

Discussion Document Marine Spark-Ignition Engine and Off-Road Recreational Vehicle Emission Regulations

under the *Canadian Environmental Protection Act, 1999*
Transportation Systems Branch
Environment Canada
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1. Introduction

This document describes the proposed content of a regulation to control emissions from

- outboard engines,
- personal watercraft engines,
- snowmobiles,
- off-highway motorcycles,
- all-terrain vehicles, and
- utility vehicles.

The intent of this document is to solicit comments from stakeholders in preparation for the formal proposal of the regulations in Part I of the *Canada Gazette*.

1.1 Policy background

In February 2001, the Minister of the Environment released the *Federal Agenda on Cleaner Vehicles, Engines and Fuels*¹ presenting a series of integrated measures to accelerate action to improve air quality. The Agenda includes the following statements:

"The Department intends to proceed with the development of emissions control programs for off-road engines, under Division 5 of CEPA 1999, aligned with the corresponding U.S. federal emissions control programs. These include...development of proposed Regulations corresponding to the U.S. Environmental Protection Agency (EPA) program for spark-ignition marine engines.... The Department will consider the development of...emissions control programs for...recreational vehicles using gasoline engines...aligned with the U.S. EPA programs once these programs are finalized in the United States. The details of future proposed Regulations, including...emissions credit systems and fleet averaging provisions, where effective and practical, will be developed through the regulatory process."

The U.S. Environmental Protection Agency (EPA) program to control exhaust emissions from marine spark-ignition engines² applies to outboard and personal watercraft engines and has been in effect in the U.S. since model year 1998 with emission standards becoming increasingly more stringent until model year 2006. The U.S. program includes a mandatory emission averaging program.

In November 2002, the EPA finalized a rule to control emissions from snowmobiles, off-highway motorcycles and all-terrain vehicles³. This rule includes full implementation of exhaust emission standards by model year 2007 with a phase-in period during model year 2006. Evaporative permeation emission standards come into effect in model year 2008. There is an optional emission credit program with separate averaging for snowmobiles, all-terrain vehicles and off-highway motorcycles.

As part of the *Federal Agenda on Cleaner Vehicles, Engines and Fuels*, Environment Canada has finalized, under the authority of Division 5 of the *Canadian Environmental Protection Act, 1999* (CEPA 1999)⁴, the *On-Road Vehicle and Engine Emission Regulations*⁵ and the *Off-Road Small Spark-Ignition Engine Emission Regulations*⁶. The *Off-Road Compression-Ignition Engine Emission Regulations* were proposed in May 2004⁷.

1.2 Marine engines and recreational vehicles in Canada

The majority of marine engines and recreational vehicles sold in Canada are imported. There is one major Canadian manufacturer⁸ active in this area. Statistics Canada data show that nine importers accounted for nearly 98% of the value of outboard engines, personal watercrafts, snowmobiles, and all-terrain vehicles imported in 2003⁹. Six of these companies imported both land-based and water-based recreational products.

Preliminary discussions with industry revealed that manufacturers consider North-America as a single market for recreational vehicles and marine engines with essentially identical products being sold on both sides of the borders. The only known case of a recreational vehicle offered for sale in Canada without it being offered for sale in the U.S. is a low-power utility snowmobile.

There exist differences in sales mix between Canada and the U.S. For example, even though the same outboard engines are offered for sale in both countries, proportionally more low-power engines are sold in Canada than in the U.S. About two-thirds of the outboard engines sold in Canada are rated below 40 kW while in the U.S. slightly less than one-third of outboards sold are in this power range.

The EPA certification database for outboard and personal watercraft engines reveals that 80 of the 161 engine families of the 2003 model year were certified above the applicable standard. About three quarters of the manufacturers are certifying at least one engine family above the standard and, therefore must rely on emission averaging to meet the requirements of the U.S. rule.

1.3 Planned regulatory program

After considering that many manufacturers are producing both marine spark-ignition engines and recreational vehicles, Environment Canada has decided to combine engine emission standards for these two applications in a single regulatory package. The planned regulations will be modeled on existing regulations under Division 5 of CEPA 1999 and will incorporate by reference the applicable U.S. EPA regulatory standards.

Environment Canada also decided to include emission averaging provisions in the planned regulations.

¹The text of the Federal agenda can be retrieved

http://www.ec.gc.ca/Ceparegistry/documents/notices/g1-13507_n1.pdf

²The text of *Control of Emissions from Marine Spark-Ignition Engines* in the *U.S. Code of Federal Regulations* can be retrieved at

http://www.access.gpo.gov/nara/cfr/waisidx_03/40cfr91_03.html

³The text of *Control of Emissions from Recreational Engines and Vehicles* in the *U.S. Code of Federal Regulations* can be retrieved at

http://www.access.gpo.gov/nara/cfr/waisidx_03/40cfr1051_03.html

⁴The text of CEPA 1999 can be retrieved at

<http://laws.justice.gc.ca/en/C-15.31/index.html>

⁵Information about the Regulations can be retrieved at

<http://www.ec.gc.ca/CEPARRegistry/regulations/DetailReg.cfm?intReg=65&x=10&y=7>

⁶Information about the Regulations can be retrieved at

<http://www.ec.gc.ca/CEPARRegistry/regulations/DetailReg.cfm?intReg=81&x=10&y=4>

⁷Information about the proposed Regulations can be retrieved at

<http://www.ec.gc.ca/CEPARRegistry/regulations/DetailReg.cfm?intReg=88&x=7&y=4>

⁸Bombardier Recreational Products manufactures snowmobiles, all-terrain vehicles and personal watercrafts in Canada and outboards in the U.S.

⁹Importation data for off- and on-highway motorcycles cannot be separated.

2. Regulatory Framework

The planned *Marine Spark-Ignition Engine and Off-Road Recreational Vehicle Emission Regulations* (hereinafter referred to as "the planned regulations") will establish, under the authority of CEPA 1999, emission standards aligned with those of the EPA. The planned regulations will be modeled on the *Off-Road Small Spark-Ignition Engine Emission Regulations*. Throughout the discussion document, footnotes will be used to guide interested readers to the specific provisions of the *Off-Road Small Spark-Ignition Engine Emission Regulations* that will serve as a model for the planned regulations. However the discussion document can be read without consulting the model regulations.

2.1 Vehicles and Engines Subject to the Planned Regulations

The planned regulations will apply to marine spark-ignition engines and recreational vehicles manufactured in Canada and "transported within Canada" (i.e., transported between provinces and/or territories) and to marine engines and recreational vehicles imported into Canada. The definitions of the engines and vehicles to be covered by the planned regulations (given in Appendix A) will be based on those found in the *U.S. Code of Federal Regulations*¹⁰. The following vehicles or engines will not be subject to the planned regulations:

1. vehicles and engines designed exclusively for competition and with features not easily removed and with characteristics that render their use other than in competition unsafe, impractical or unlikely;
2. vehicles and engines regulated by the *On-Road Vehicle and Engine Emission Regulations*;
3. vehicles that are powered by compression-ignition engines;
4. engines that are designed to be used in military vehicles and vehicles designed for use in military combat or combat support; and
5. vehicles and engines that are being exported and that are accompanied by a written statement establishing that they will not be sold or used in Canada.

A few special cases described in section 9 of this document will be subject only to portions of the planned regulations.

The planned emission standards will apply to vehicles and engines of the 2007 and later model years. Model year is the year determined by the manufacturer to designate the period of production of a particular model of vehicle or engine. The model year can span a period of up to two calendar years less one day but can include only one January 1. The model year corresponds to the calendar year during which production occurred or during which January 1 fell. The planned regulations will come into force on January 1, 2007, except for the sections related to the national emissions mark which will come into effect on the date the planned regulations will be registered.

2.2 Persons Affected by the Planned Regulations

The planned regulations will apply mainly to "companies", as defined in CEPA 1999: "company means a **person** who

- a. is engaged in the business of manufacturing vehicles, engines or equipment in Canada;
- b. is engaged in the business of selling to other persons, for the purpose of resale by those persons, vehicles, engines or equipment obtained directly from a person described in paragraph (a) or the agent of such person; or
- c. imports any vehicle, engine or equipment into Canada for the purpose of sale."

In CEPA 1999, the term "manufacture" includes any process of assembling or altering any vehicle, engine or equipment before its sale to the first retail purchaser and the expression "to sell" includes to offer for sale or lease, have in possession for sale or lease or deliver for sale or lease.

To highlight that "company" under CEPA 1999 means only specific types of commercial entities, the word will be italicized throughout the rest of this document.

Four different types of persons are potentially affected by the regulations: the three categories listed under the definition of *company* and a person who is not a *company* importing a vehicle or engine. Table 1 provides a summary of the requirements for these four different categories of persons. Foreign vehicle or engine manufacturers are not directly subject to CEPA 1999 or to the planned regulations. However, engines imported into Canada must conform to applicable Canadian emissions standards.

¹⁰The definition of "personal watercraft" will be based on the one provided in the *Small Vessel Regulations* (<http://laws.justice.gc.ca/en/s-9/c.r.c.-c.1487/54275.html>).

3. National Emissions Mark

Companies will generally be required to apply the national emissions mark to prescribed vehicles and engines that are manufactured in Canada for sale in Canada. CEPA 1999 prohibits a *company* from transporting vehicles or engines manufactured in Canada between provinces or territories unless the vehicle or engine has a national emissions mark applied to it.

The planned regulations will include administrative provisions regarding the national emissions mark¹¹. These provisions will come into effect on the date the planned regulations are registered to allow early authorization to apply the national emissions mark to engines manufactured before January 1, 2007 that meet applicable 2007 model year standards.

Imported engines and vehicles will not require the national emissions mark as CEPA 1999 directly requires that imported engines and vehicles conform to the requirements of the planned regulations as a condition of their importation into Canada. Accordingly, the application of a national emissions mark to imported vehicles and engines will not be required to demonstrate such conformity.

Table 1
Summary of Regulatory Requirements

	Canadian vehicle or engine manufacturer	Distributor of Canadian vehicles or engines	Vehicle or engine importer	
			For sale	For other purposes
Company under CEPA 1999?	yes	yes	yes	no
Apply the national emissions mark	X	X		
Supply vehicles or engines that comply with standards	X	X	X	(1)
Submit an end of model year emission averaging report	X	X	X	
Provide evidence of conformity upon request	X	X	X	(1)
Submit an importation declaration			X	X
Prescribed label is affixed to an imported vehicle or engine				X
Provide maintenance instructions	X	X	X	
Cause notice of defect to be given, if necessary	X	X	X	

(1) The presence of the prescribed label on the vehicle or engine and a statement given at importation that the vehicle or engine conforms to applicable standards will be considered evidence that the vehicle or engine conforms to the prescribed or equivalent emission standards when it is imported for purposes other than sale.

¹¹ These provisions will be very similar to sections 6 to 8 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

4. Emission Standards

The planned regulations will require that the vehicle or engine to conform to the applicable standards. These standards will be aligned with applicable EPA rules.

4.1 Emission control system, defeat device¹² and adjustable parameters¹³

Under the planned regulations, no vehicle or engine can be equipped with a defeat device. In addition, an emission control system shall not release a substance that causes air pollution and that would not have been released if the system were not installed. The emission control system shall not make the vehicle unsafe or endanger persons or property near the engine or machine. Vehicles and engines with adjustable parameters will have to comply with the applicable standards regardless of the setting of these parameters.

4.2 Exhaust, crankcase and evaporative emission standards

The planned emission standards will be aligned with those of the EPA and the planned regulations will incorporate by reference sections of the applicable parts of the U.S. *Code of Federal Regulations* (**Table 2**). An engine must conform to the emission standards throughout its "useful life" and the useful life period is incorporated by reference from the U.S. *Code of Federal Regulations*.

	Reference (Title and Part)	Section in reference			
		Exhaust	Crankcase	Evapo- rative	Useful life
Outboard and personal watercraft	40 CFR 91	104	109	n/a	105
Snowmobile	40 CFR 1051	103 (a) & (b)	115(a)	110	103(c)
Off-highway motorcycle	40 CFR 1051	105 (a) & (b)	115(a)	110	105(c)
ATV and utility vehicle	40 CFR 1051	107 (a) & (b)	115(a)	110	107(c)

4.3 Vehicle and engine covered by an EPA certificate of conformity and sold concurrently in Canada and the U.S.¹⁴

Under the planned regulations, a vehicle or engine covered by an EPA certificate of conformity and sold concurrently in Canada and the U.S. will be deemed to conform to the emission standards if this vehicle or engine meets all requirements set out in the EPA certificate of conformity. All other requirements of the planned regulations (such as evidence of conformity, importation documents, notice of defect, etc.) will have to be met.

Under the planned regulations, vehicles or engines expected to have similar emission characteristics throughout their useful life periods can be grouped in an "engine family"¹⁵. The criteria to be met to allow groupings into engine families in the planned regulations are aligned with those set out in the U.S. *Code of Federal Regulations*.

¹² The provisions regarding emission control system and defeat device will be very similar to section 9 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

¹³The provisions regarding adjustable parameters will be very similar to section 12 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

¹⁴This provision will be very similar to section 14 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

¹⁵ Following the usage established in the U.S. *Code of Federal Regulations*, the expression "engine family" is used equally for a group of engines or a group of vehicles.

5. Averaging Requirements

The planned regulations will establish fleet average emission requirements with the objective of creating a regulatory framework that will achieve a Canadian fleet emission performance comparable with the U.S.

Under the planned regulations, the term "fleet" will refer to vehicles and engines of a specific model year that a *company* manufactures in Canada and/or imports into Canada for sale in Canada. There will be separate fleets for each type of recreational vehicle and for marine engines and emission credits cannot be exchanged between a *company's* fleets. Therefore emission credits from a *company's* fleet of snowmobiles cannot be used to offset an emission deficit from the same *company's* fleet of outboard and personal watercraft engines. Section 5.2 will describe how a *company* can offset an emission deficit.

The methods of calculating fleet average values and emission credits will be consistent with those set out in the *U.S. Code of Federal Regulations*. However these equations have been modified to be consistent with the planned regulatory framework which will be similar to the one developed for the *On-Road Vehicle and Engine Emission Regulations*.

The U.S. rule for marine spark-ignition engines includes only a single equation for calculating emission credits. This equation was simplified by curve fitting and adapted to the planned regulatory framework requiring equations for the fleet average emission value and the fleet average standard. The resulting equations are in a form consistent with the averaging equations for recreational vehicles that are also intended to be included in the planned regulations.

The variables (described in section 5.1) are given single-letter names to make the equations easier to incorporate into a bilingual text. Appendix B describes the modifications and demonstrates that the equations in the *U.S. Code of Federal Regulations* and the modified version of those equations for the planned regulations are equivalent.

5.1 Equations used in averaging calculations.

The following equations will be part of the regulatory framework for averaging:

$$A = \frac{\sum_{i=1}^{TOT} W_i \times Y_i \times Z_i}{\sum_{i=1}^{TOT} Y_i \times Z_i} \quad [1]$$

$$B = \frac{\sum_{i=1}^{TOT} X_i \times Y_i \times Z_i}{\sum_{i=1}^{TOT} Y_i \times Z_i} \quad [2]$$

$$credits = (A - B) \times \left(\sum_{i=1}^{TOT} Y_i \times Z_i \right) \quad [3]$$

where

A represents the sales-weighted fleet average standard¹⁶;

B represents the sales-weighted fleet average emission value;

W_i represents the applicable emission standards to the i^{th} engine family in the fleet;

X_i represents the family emission limit¹⁷ for the i^{th} vehicle or engine;

Y_i represents the number of vehicles or engines in the i^{th} engine family in the fleet;

$$Z_i = \begin{cases} 136.6 \times P_i^{0.86} & \text{if } i^{th} \text{ engine family is a group of outboard engines} \\ 114 \times P_i & \text{if } i^{th} \text{ engine family is a group of personal watercraft engines}^{18} \\ UL_i & \text{if } i^{th} \text{ engine family is a group of recreational vehicles} \end{cases}$$

P_i represents the power of the i^{th} engine in kW;

UL_i represents the useful life of the i^{th} engine family in hr or km; and

TOT represents the number of engine families in the fleet.

5.2 Framework for averaging

As shown in **Table 3**, all engines or vehicles in a given fleet can be arranged into one of six categories (identified as A to F in the table) according to the answer to each of the following questions:

- is the vehicle or engine covered by an EPA certificate and sold concurrently in the U.S.?
- are the vehicle or engine emissions below the applicable standards?
- is the quantity of vehicles or engines of the same model sold in Canada less than in the U.S.?

Table 3
Categories of engines and vehicles for averaging purposes

	Is the vehicle or engine covered by an EPA certificate and sold concurrently in the U.S.?	Are the vehicle or engine emissions below the applicable standards?	Is the quantity of vehicles or engines of the same model sold in Canada less than in the U.S.?
A	yes	yes	yes
B	yes	yes	no
C	yes	no	yes
D	yes	no	no
E	no	yes	n/a
F	no	no	n/a

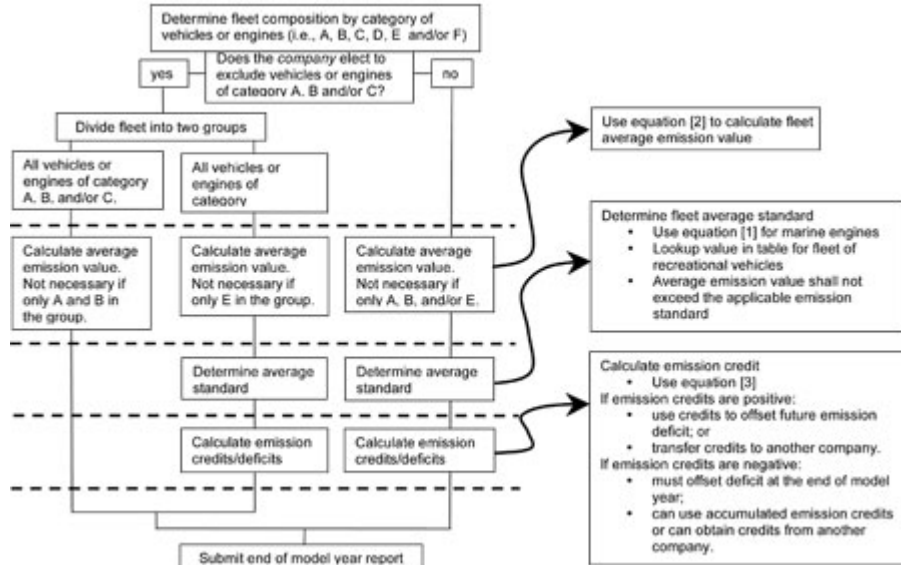
When calculating values required to meet the averaging requirements, the planned regulations will allow a company

- to consider all vehicle or engine categories (i.e., A to F) or
- to consider only vehicle or engine categories D, E and F by allowing the exclusion of vehicles or engines that are covered by an EPA certificate if: they are certified below the applicable standards (i.e., categories A and B); or the vehicles or engines are certified above the applicable standards but fewer of the same model are sold in Canada than the U.S. (i.e., category C).

Figure 1 illustrates the framework for averaging. Based on its vehicles and engines sales, a *company* will determine its sales-weighted "fleet average standard" and calculate its sales-weighted "fleet average emission value" for each applicable emission (HC, HC+NO_x, CO, and evaporative permeation, as the case may be). Based on these two values, the emission credits for the fleet will then be calculated.

Positive emission credits obtained in a specific model year may be used by the *company* to offset a future deficit or may be transferred to another *company*. Negative emission credits (or deficits) must be off-set by using previously accumulated credits or by obtaining credits from another *company*. Emission credits (or deficits) are obtained by applicable emissions from a given fleet. The planned regulations will require companies to report their fleet averages and emission credits at the end of each model year.

Figure 1: Framework for averaging.



Click to enlarge

¹⁶ The value A does not need to be calculated for a fleet of snowmobiles, off-highway motorcycles or all-terrain vehicles as the emission standard is obtained directly from the emission standard table applicable to the model year and the type of vehicle in the fleet.

¹⁷ Family emission limit represents an emission level that is declared by the manufacturer for certification purposes for a given engine family.

¹⁸ For vehicles that have standards in g/kW-hr and a useful life in km, the useful life is converted to kW-hr based on the maximum power output and an assumed vehicle speed of 30 km/hr

$$UL_i (kW - hr) = UL_i (km) \times \frac{\text{maximum power (kW)}}{30 \text{ km/hr}}$$

For evaporative permeation standards expressed in g/m²/day, the useful life expressed in years is multiplied by 365.24 days.

6. Evidence of Conformity¹⁹

The planned regulations will identify the records respecting the evidence of conformity that must be provided upon request.

For a vehicle or engine that is covered by an EPA certificate of conformity and that is sold concurrently in Canada and in the U.S., the evidence of conformity will be

1. a copy of the EPA certificate of conformity;
2. a document demonstrating that the vehicle or engine is sold in the U.S. during the model year;
3. a copy of the records submitted to the EPA when applying to obtain a certificate of conformity; and
4. the U.S. EPA engine information label affixed to the vehicle or engine.

For a vehicle or engine that is not covered by an EPA certificate of conformity or that is not sold concurrently in Canada and in the U.S., the evidence of conformity shall be obtained and produced in a form and manner that is satisfactory to the Minister. This evidence will be expected to be comparable to that specified under items (3) and (4) of the previous paragraph.

A *company* will be required to provide the evidence of conformity in respect of any vehicle or engine only upon request from the Minister. This request can apply to vehicles or engines manufactured in the eight years preceding the request and evidence of conformity must be provided in either official language within 40 days after the request is delivered. If the evidence of conformity must be translated from a language other than French or English, the *company* has 60 days to provide the evidence.

While the planned regulations will not oblige a *company* to maintain these records in Canada, there is an obligation to make them available on request. Accordingly, *companies* will have to ensure that the necessary arrangements are in place to fulfill this obligation.

¹⁹ The requirements regarding evidence of conformity will be similar to sections 16 to 18 of *Off-Road Small Spark-Ignition Engine Emission Regulations*.

7. Importing a Vehicle or Engine

Only vehicles and engines that comply with the planned regulations will be eligible for importation. Any person importing a vehicle or engine will have to submit a declaration at a customs office. For a *company* importing a vehicle or engine, the information to be provided will be similar to that given in section 19(1) of the *Off-Road Small Spark-Ignition Engine Emission Regulations*. For a *person who is not a company* importing a vehicle or engine, the information to be provided will also be similar to that given to section 19(1) of the *Off-Road Small Spark-Ignition Engine Emission Regulations*, except for a statement that the engine bears a national emissions mark, either an EPA emissions label or California Air Resources Board label indicating that the engine conformed to the applicable emissions standards at the time of its manufacture, or a statement from the manufacturer that the vehicle or engine conformed to the applicable Canadian standards at the time of its manufacture.

Any *company* that imports 500 or more prescribed vehicles or engines in a calendar year may provide the information required via a bulk declaration rather than a declaration at a customs office.

8. Other Obligations

8.1 To provide maintenance instructions²⁰

Under the planned regulations, a *company* will have to ensure that written instructions for emission-related maintenance are provided to the first retail purchaser of every engine or vehicle. The instructions must be provided in English, French or both official languages, as requested by the purchaser.

8.2 To label every snowmobile, off-highway motorcycle, and all-terrain vehicle with removable hangtag

A bilingual removable hangtag shall be affixed to every recreational vehicle. This hangtag will show the emission characteristics of the vehicle relative to other models in accordance with subsection 1051.135(g) of *Control of Emissions from Recreational Engines and Vehicles* in the *U.S. Code of Federal Regulations*.

8.3 To affix an identification number

A unique, legible identification number shall be affixed on every engine or vehicle.

8.4 To give a notice of defect²¹

A *company* shall, on becoming aware of a defect in the design, construction or functioning of the vehicle or engine that affects or is likely to affect its compliance with a prescribed standard, cause notice of defect to be given to the Minister, to each person who has obtained such vehicle or engine from the *company* and to each current owner of such vehicle or engine.

The planned regulations will describe the information that must be provided in the notice of defect. The notice must be given to the Minister, to each person who has obtained such vehicle or engine from the *company* and to each current owner of such vehicle or engine.

Given the nature of the recreational vehicle and engine market, CEPA 1999 provides flexibility regarding issuing notice to current owners. The Minister may order that the notice be provided by publication in daily newspapers or in an alternative medium or, if the circumstances warrant, order that the current owners need not be notified. The notice of defect provided to the Minister requires a description of the means available to the *company* to contact the current owner of each affected vehicle or engine.

Within 60 days after a notice of defect has been given, the *company* must submit to the Minister an initial report²². Unless the Minister directs otherwise, the *company* must also provide a report respecting the defect and its correction not later than 12 months after giving a notice of defect for a defect affecting an outboard or personal watercraft engine and no later than 6 months and every 6 months thereafter for a defect affecting a recreational vehicle.

Under CEPA 1999, a *company* is not required to cause notice of defect to be given if a relevant notice has already been given in Canada by another person (e.g., the vehicle or engine manufacturer) for the same defect.

8.5 To provide a vehicle or engine²³

Upon request from the Minister, a *company* shall make available for testing any vehicle or engine that was used in tests conducted in order to establish information submitted as evidence of conformity or an equivalent vehicle or engine. The Minister will defray the transportation cost and pay the rental rate that will be set in the planned regulations. The planned annual rental rate is 12% of the manufacturer's suggested retail price of the vehicle or engine, prorated on a daily basis for each day the vehicle or engine is made available.

²⁰ This provision will be very similar to section 15 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

²¹ This provision will be very similar to section 15 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

²² The information to be provided in this report will be similar to the one required under subsection 25(2) of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

²³ This provision will be very similar to section 23 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*

9. Special Cases

9.1 Vehicles and engines imported in Canada solely for purposes of exhibition, demonstration, evaluation or testing²⁴

Under CEPA 1999, a vehicle or engine imported into Canada solely for purposes of exhibition, demonstration, evaluation or testing does not have to meet with the requirements of the planned regulations if a declaration signed by the person importing the vehicle or engine or their duly authorized representative is submitted at a customs office.

9.2 Incomplete vehicle or engine²⁵

Under the planned regulations, an incomplete vehicle or engine can be imported by a *company* if a declaration is submitted at a customs office. The declaration will have to be signed by a duly authorized representative of the *company* and will contain a statement from the vehicle or engine manufacturer that the engine will, when completed in accordance to the instructions provided by the manufacturer, conform to the prescribed standards and a statement from the *company* that the vehicle or engine will be completed in accordance to the manufacturer's instructions.

9.3 Replacement engine²⁶

A replacement engine will be "an engine designed exclusively to replace an engine in a vehicle for which no current model year engine with the physical or performance characteristics necessary for the operation of the vehicle exists". A replacement engine may conform to standards different from those prescribed in the planned regulations, but at least as stringent as the standards applicable to the original engine.

9.4 Engine or vehicle for which the Governor-in-Council has granted an exemption²⁷

A *company* may apply to the Governor in Council to be granted an exemption from any standards set under the planned regulations. An exemption will be granted only if, in the opinion of the Governor in Council, conformity with that standard would

- a. create substantial financial hardship for the company;
- b. impede the development of new features for safety, emission monitoring or emission control that are equivalent or superior to those that conform to prescribed standards; or
- c. impede with the development of new kinds of engines or engine components.

CEPA 1999 does not authorize an exemption for financial hardship if the annual world production of vehicles or engines manufactured by the *company* or by the manufacturer of the vehicle or engine that is the subject of the application for exemption exceeded 10,000 vehicles or engines or if the annual total number of vehicles or engines manufactured for, or imported into, the Canadian market exceeded 1,000 vehicles or engines.

²⁴ This provision will be very similar to section 20 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

²⁵ This provision will be very similar to section 22 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

²⁶ This provision will be very similar to section 13 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

²⁷ This provision will be very similar to sections 24-25 of the *Off-Road Small Spark-Ignition Engine Emission Regulations*.

10. Next steps

The goal of this document is to solicit comments from stakeholders prior to publishing a formal proposal in Part I of the *Canada Gazette*. Stakeholders may comment on any aspect of the planned regulations. Environment Canada would appreciate comments specifically on the following aspects

- the general approach of the planned regulations including combining two U.S. rules into a single Canadian regulatory package;
- the planned approach with regard to emission averaging;
- the existence or likelihood of vehicles or engines **not** sold in the U.S. being (a) imported into Canada or (b) manufactured in Canada;
- information regarding the estimated market for "competition" vehicles and engines, the exemption of such products from the planned regulation and if exempted, whether such products should be labelled as "competition" vehicles or engines.

Comments will be considered in developing a formal written proposal in the *Canada Gazette* Part I. Please provide your written comments by regular mail or by e-mail to:

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Appendix A - Definitions of Vehicles and Engines to be Covered by the Planned Regulations

The definitions of vehicles and engines to be covered by the planned regulations, with the exception of personal watercraft, are based on those set out in the applicable *U.S. Code of Federal Regulations*. The definition of "personal watercraft" stems from the *Small Vessel Regulations* under the *Canada Shipping Act*.

"All-terrain vehicle" means a land-based or amphibious off-road vehicle, other than an utility vehicle, that

- a. is designed to travel on four low-pressure tires, having a seat designed to be straddled by the operator and handlebars for steering controls and intended for use by a single operator and no other passengers; or
- b. has three or more wheels, that has more than one seat, is designed for operation over rough terrain, and is intended primarily for transportation.

"Off-highway motorcycle" means a two-wheeled vehicle with an off-road engine and a seat.

"Outboard engine" means an engine that, when mounted on a vessel in the position to operate, houses the engine and drive unit external to the hull of the vessel.

"Personal watercraft" means a water-jet driven vessel with an enclosed hull and no cockpit and a maximum length of 4 m, that is designed to be used by one or more persons.

"Snowmobile" means a vehicle, including a snowmobile conversion vehicle, designed primarily for travel on snow with a maximum width of 1.5 meters or less.

"Utility vehicle"²⁸ means a vehicle that has four or more wheels, seating for two or more persons, is designed for operation over rough terrain and has either a rear payload 350 pounds (159 kg) or more or seating for six or more passengers.

²⁸ The planned regulations will apply to utility vehicles with engine displacement not exceeding 1000 cubic centimeters, engine brake power not exceeding 30 kW and maximum vehicle speed exceeding 40 km/hr. Utility vehicles will be subject to the standards for all-terrain vehicles (please refer to **Table 2**).

Appendix B - Developing CFR Averaging Equations to Fit the Canadian Regulatory Framework

This appendix presents the equations intended for use in the averaging provisions of the planned regulations. The averaging calculations in the planned Regulations are intended to be the same as those found in the *U.S. Code of Federal Regulations (CFR)*. However it was necessary to modify some of the U.S. equations to be consistent with the Canadian regulatory framework which is modeled on the one developed for the *On-Road Vehicle and Engine Emission Regulations*²⁹. An approximation of some terms used in the U.S. averaging provisions for outboard and personal watercraft engines was introduced to simplify the equations. Section 720 of Part 1051 of the CFR³⁰ presents the calculation of average emission level and emission credits for a company's fleet of snowmobiles, off-highway motorcycles, or all-terrain vehicles as

$$\text{emission level} = \frac{\sum_i^{TOT} FEL_i \times \text{sales}_i \times UL_i}{\sum_i^{TOT} \text{sales}_i \times UL_i} \quad [1]$$

$$\text{credit} = \left(\text{average standard} - \text{emission level} \right) \times \sum_i^{TOT} \text{sales}_i \times UL_i \quad [2]$$

where

TOT represents the number of models of vehicles in the fleet;
FEL_i represents the family emission limit for the *ith* vehicle model (for HC, HC+NOx, CO or evaporative permeation, as the case may be) in g/kW-hr, g/km, or g/m²/day;
sales_i represents the number of vehicles of model *i* in the fleet;
UL_i represents the useful life of the *ith* model of vehicle in hr or km;
average standard represents the applicable emission standard (for HC, HC+NOx, CO or evaporative permeation, as the case may be) in g/kW-hr, g/km, or g/m²/day.

In **equation [2]**, the applicable emission standard is obtained by looking up in the emission standard table applicable to the model year and the type of vehicle in the fleet (i.e., snowmobile, off-highway motorcycle or all-terrain vehicle). For vehicles that have standards in g/kW-hr and a useful life in km, the useful life is converted to kW-hr based on the maximum power output and an assumed vehicle speed of 30 km/hr

$$UL_i (kW - hr) = UL_i (km) \times \frac{\text{maximum power (kW)}}{30 \text{ km/hr}} \quad [3]$$

For evaporative permeation standards expressed in g/m²/day, the useful life expressed in years is multiplied by 365.24 days.

Section 207 of Part 91 of the CFR³¹ presents the calculation of emission credits of the *ith* model of outboard or personal watercraft engines in a company's fleet as

$$\text{credits}_i = \sum_{t=1}^{2\mu_{\text{life},i}} \frac{S_i(t) \times \text{sales}_i \times (STD_i - FEL_i) \times P_i \times 0.207 \times \mu_{\text{use},i}}{1.03^t} \quad [4]$$

where

t represents time in model years;

S_i(t) represents the cumulative fraction of the *ith* engine that is still in use at time *t*

$$S_i(t) = e^{-(0.906 \times t / \mu_{\text{life}})} \quad [5]$$

sales_i represents the number of *ith* engines in the fleet;

STD_i represents the applicable HC+NOx emission standards for the *ith* engine in g/kW-hr;

FEL_i represents the engine family limit for the *ith* engine in g/kW-hr;

P_i represents the power of the *ith* engine in kW;

μ_{use,i} represents the annual mean use and is 34.8 hours if the *ith* engine is an outboard or 77.3 hours if it is a personal watercraft;

μ_{life,i} represents the average actual life and is $41.27 \text{ years} \times kW^{0.204} \times (P_i/0.746)^{-0.204}$

if the i^{th} engine is an outboard or 10 years if the i^{th} engine is a personal watercraft

Equation [4] can be rearranged by removing from the summation some of the variables that are independent of t to yield

$$credits_i = (STD_i - FEL_i) \times sales_i \times \sum_{t=1}^{2\mu_{life}} \frac{\mu_{use,i} \times S_i(t) \times 0.207 \times P_i}{1.03^t} \quad [6]$$

When focusing on the summation in **equation [6]**,

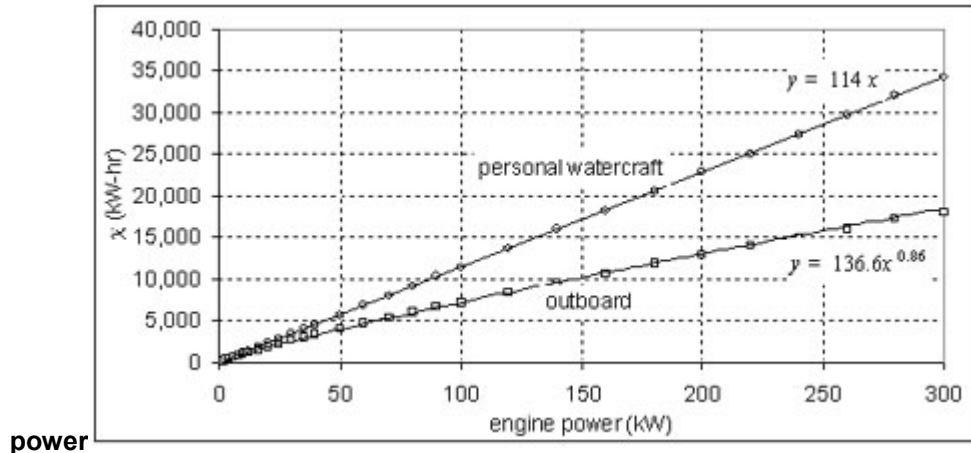
$$X_i = \sum_{t=1}^{2\mu_{life}} \frac{\mu_{use,i} \times S_i(t) \times 0.207 \times P_i}{1.03^t} \quad [7]$$

it can be observed that the value X_i depends only on the type (outboard or personal watercraft) and power of the i^{th} engine model. The values of all other variables in **equation [4]** are set by these two values. **Figure B-1** shows a plot of the value of X as a function of engine power for outboards and personal watercrafts. The data points represents the values calculated using **equation [7]** and the lines shows a curve fitting equation that can be used to approximate **equation [7]**:

$$X_i \approx K_i \times P_i^{n_i} \quad [8]$$

where K_i and n_i are 136.6 hours-kW^{0.14} and 0.86 if the i^{th} engine model is an outboard and 114 hours and 1.0 if it is a personal watercraft.

Figure B-1: Calculation of equation [7] for various engine



Substituting **equation [8]** into **[6]** yields

$$credits_i = (STD_i - FEL_i) \times sales_i \times K_i \times P_i^{n_i} \quad [9]$$

which can be applied to the *company's* entire fleet using a summation

$$credits = \sum_{i=1}^{TOT} (STD_i - FEL_i) \times sales_i \times K_i \times P_i^{n_i} \quad [10]$$

where TOT represents the number of different engine models in the fleet.

Equation [10] now needs to be further modified to be consistent with the regulatory framework based on the *On-Road Vehicle and Engine Emission Regulations*. The averaging equations for outboard and personal watercrafts and for recreational vehicles will also be manipulated to have the same format. The names of the variables will be changed to a one-letter format to make it easier to incorporate the equations in a bilingual text.

The planned regulatory framework requires the fleet average standard and the fleet average emission values. **Equation [1]** gives the fleet average emission value for a fleet of snowmobiles, all-terrain vehicles or off-highway motorcycles. By inspection, **equation [1]** can be generalized to all forms of vehicles and engines covered by the planned regulations

$$B = \sum_{i=1}^{TOT} X_i \times Y_i \times Z_i / \sum_{i=1}^{TOT} Y_i \times Z_i \quad [11]$$

where

B represents the sales-weighted fleet average emission value;
 X_i represents the family emission limit for the i^{th} vehicle or engine in g/kW-hr;
 Y_i represents the number of i vehicles or engines in the fleet; and

$$Z_i = \begin{cases} 136.6 \times P_i^{0.86} & \text{if } i^{th} \text{ vehicle or engine model is an outboard} \\ 114 \times P_i & \text{if } i^{th} \text{ vehicle or engine model is a personal watercraft} \\ UL_i & \text{if } i^{th} \text{ vehicle or engine model is a recreational vehicle} \end{cases} \quad [12]$$

The fleet average standard value required by the planned regulatory framework can be obtained by simply looking up a value in the appropriate table for a fleet of snowmobiles, off-highway motorcycles and all-terrain vehicles. However, the fleet average standard for a fleet of outboard and personal watercraft engines requires a calculation as the emission standard varies with the power of the engine models in the fleet. This value can be calculated in a manner similar to **equation [11]**

$$A = \frac{\sum_{i=1}^{TOT} W_i \times Y_i \times Z_i}{\sum_{i=1}^{TOT} Y_i \times Z_i} \quad [13]$$

where

A represents the sales-weighted fleet average standard;
 W_i represents the applicable emission standards to the i^{th} engine model in the fleet in g/kW-hr;
and
the other variables are as previously defined.

The last requirement of the planned regulatory framework is the calculations of each fleet emission credits which can be obtained by modifying **equation [2]** as

$$credits = (A - B) \times \left(\sum_{i=1}^{TOT} Y_i \times Z_i \right) \quad [14]$$

where A is calculated using **equation [13]** for a fleet of outboards and personal watercraft or is obtained by lookup in the appropriate standard table.

²⁹ http://www.ec.gc.ca/ceparegistry/documents/regulations/g2-13701_r1.pdf

³⁰ U.S. Code of Federal Regulations, Title 40, Part 1051, *Control of Emissions from Recreational Engines and Vehicles*.

³¹ U.S. Code of Federal Regulations, Title 40, Part 91, *Control of Emissions from Marine Spark-Ignition Engines and Vehicles*.