



Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from Cutback and Emulsified Asphalt

Prepared by:

Products Division
Industrial Sectors, Chemicals and Waste Directorate
Environment and Climate Change Canada
351 St. Joseph Boulevard, 9th Floor
Gatineau, Quebec
K1A 0H3

February 2017

This page intentionally left blank.

Table of Contents

Preface	1
Asphalt use in Canada and VOC emissions.....	1
Air quality issues.....	2
Objective.....	2
1 Interpretation	3
1.1 Applicability.....	3
1.2 Definitions.....	3
2 Recommended Practices	5
2.1 Cutback asphalt.....	5
2.1.1 <i>Practices regarding cutback asphalt during the ozone season</i>	5
2.1.2 <i>Practices regarding cutback asphalt outside of the ozone season</i>	5
2.2 Emulsified asphalt.....	5
2.2.1 <i>Practices regarding emulsified asphalt during the ozone season</i>	5
2.2.2 <i>Practices regarding emulsified asphalt outside of the ozone season</i>	5
2.3 Low-emitting VOC product alternatives	6
2.4 Labelling	6
2.5 Contracting.....	6
2.6 Conditions of use and training of staff	6
3 Record Keeping	6
3.1 Manufacturers	6
3.2 Procurement enablers of paving projects	7
3.3 End-users (paving companies)	7
4 Reporting	7
5 Review of Progress	7
6 Coming into Effect	7
7 Contact Information	8
 Appendix:	
Report Form	A-1

This page intentionally left blank

Preface

Asphalt use in Canada and VOC emissions

In Canada, there are more than 1 million kilometers of roads and highways, almost half of which are paved. There are also large areas taken up by parking lots and private driveways. Asphalt is the material of choice for paving roads and parking lots, and is used for maintenance and repairs as well as construction. Given the use of asphalt for many large surface areas, asphalt manufacturing, distribution, supply and use represent one of Canada's most important industry sectors.

Emulsified asphalt and cutback asphalt are products used in various road construction, maintenance and repair materials activities, such as:

- plant mix;
- road mix;
- surface treatment;
- asphalt applications including prime and tack coat, dust palliative, crack filler;
- maintenance mix;
- cold in-place recycling; and
- full-depth reclamation.

These products are prepared by mixing asphalt cement with either a petroleum solvent to produce cutback asphalt, or with emulsifiers and water (and sometimes a small amount of petroleum solvent) to produce emulsified asphalt. Once the liquefied asphalt cement is applied to the road surface, the petroleum solvent or the water evaporates, leaving the asphalt cement behind. This evaporation causes VOC emissions which contribute to the creation of ground-level ozone and particulate matter, two major components of smog.

As of 2016, many jurisdictions in Canada and the United States have adopted practices to reduce VOC emissions from this sector. In each case, this involves either restrictions on the use of cutback asphalt during the ozone season (typically the summer months), or a prohibition of the use of cutback asphalt throughout the year. In addition, many jurisdictions restrict VOC content in the manufacturing of cutback and emulsified asphalt.

VOC emission levels depend on a number of factors, including the type of asphalt used and the ambient temperature. However, new formulations of asphalt are being developed — and becoming more available — which produce lower VOC emissions. These formulations use bio-products instead of petroleum solvents, and harden through the polymerization of the bio-diluent instead of through the evaporation of solvents.

The majority of liquefied asphalt used in Canada is emulsified. According to a 2010 study conducted for Environment and Climate Change Canada¹ 301 kilotonnes (kt) of liquefied asphalt were used in Canada in 2009, which produced approximately 8.8 kt of VOC emissions. Although cutback asphalt represented only 15% of liquefied asphalt use, it was responsible for 59% of the VOC emissions (5.2 kt). The same study estimated that, without an environmental framework in place, VOC emissions from asphalt use in Canada could reach 10.8 kt by 2020.

¹ Environmental Health Strategies Inc. *Technical and Economic Study on VOC (Volatile Organic Compound) Emissions from Emulsified and Cutback Asphalt Use in Canada*. October 2010. Prepared for Environment and Climate Change Canada.

Air quality issues

Smog is an air quality issue that poses serious health and environmental concerns in Canada. Particulate matter and ground-level ozone are the two principal components of smog and can be transported by prevailing winds over long distances, making them not only a local urban issue but one that extends regionally in Canada into many smaller communities and rural areas.

Ozone is formed by complex reactions between nitrogen oxides (NO_x) and VOCs, in the presence of sunlight. Particulate matter is released directly into the air by industrial activity, and can also be formed in the atmosphere via complex chemical reactions involving emissions of smog precursors, including sulphur dioxide (SO₂), NO_x, VOCs and ammonia (NH₃). In order to reduce smog levels and improve air quality, it is necessary to control and reduce particulate matter and emissions of its precursors.

On July 2, 2003, an Order added ozone, its precursors and precursors to particulate matter less than or equal to 10 microns (PM₁₀) to the List of Toxic Substances in Schedule 1 of the *Canadian Environmental Protection Act, 1999* (CEPA). Along with gaseous ammonia, nitric oxide, nitrogen dioxide and SO₂, VOCs were added to Schedule 1 due to their role as precursors in the formation of ground-level ozone and particulate matter. This listing enables the Government of Canada to regulate VOC emissions contributing to PM and ozone under CEPA 1999.

The 2012 Canadian Smog Science Assessment (co-authored by Environment and Climate Change Canada and Health Canada) concluded that both particulate matter and ground-level ozone must be treated as having no safe level.

Objective

The main objective of this Code of Practice (the Code) is to protect the environment and the health of Canadians while maintaining road safety by recommending best practices that encourage, when suitable, the use of low VOC emitting asphalt. Specifically, the Code aims to reduce VOC emissions from the asphalt sector by at least 40% over a 6-year period. The Code seeks to fulfil this objective by providing guidance to the manufacturers, importers, sellers and users of asphalt. In particular, it recommends ways to help reduce VOC emissions from the use of cutback asphalt and emulsified asphalt.

General compliance with this code would result in yearly VOC emissions from the use of asphalt being reduced by between 3 to 5 kilotonnes.

Measurement of this target will be determined by comparing the correlation between VOC emissions of the total quantities of asphalt manufactured during the 6-year period with the VOC emissions from the initial quantity of asphalt manufactured at the time of publication of this Code. This assessment will help determine whether it is necessary to amend the Code or develop another control instrument to better manage VOC emissions from the asphalt sector.

By applying the standards and best practices outlined in the Code, it is expected that the following benefits may be achieved:

- reducing VOC emissions and generating environmental and health benefits from reducing the intensity and frequency of smog events;

- improving air quality at the sites where asphalt is applied, thereby reducing the potential impact on the health of workers and local (especially urban) communities;
- fostering consistency and alignment with similar measures in other jurisdictions in North America.

1-Interpretation

1.1-Applicability

The Code applies to any person involved in the manufacture, import, offer for sale, sale or use of cutback asphalt or emulsified asphalt. This includes:

1. Manufacturers and distributors;
2. Procurement enablers; and
3. End-users (paving companies).

All recommended practices included in the Code relate to paving material for paving, construction and maintenance operations of roads, streets, highways, parking lots or driveways.

1.2-Definitions

The following definitions apply to this Code:

Asphalt cement: A dark brown to black cement-like residuum obtained from the distillation of suitable crude oils. The distillation process may involve one or more of the following: atmospheric distillation, vacuum distillation, steam distillation. Further processing of distilled residuum may be needed to yield a material whose physical properties are suitable for commercial applications. The additional processes can involve air oxidation, solvent stripping or blending of residua of different stiffness characteristics.

ASTM: American Society of Testing and Materials.

Crude oil: Unrefined petroleum product composed of hydrocarbon deposits. Any use of crude oil in an asphalt application falls within the scope of this Code.

Cutback asphalt: Asphalt cement whose viscosity has been reduced by the addition of a cutback solvent derived from petroleum. There are three major types of cutback asphalt based on the relative rate of evaporation of the solvent:

- Rapid-curing: Asphalt cement combined with a light petroleum diluent of high volatility, generally with a boiling point similar to gasoline or naphtha and as further defined by ASTM D2028 / D2028M “Standard Specification for Cutback Asphalt (Rapid-Curing Type)”.
- Medium-curing: Asphalt cement combined with a petroleum diluent of intermediate volatility, generally with a boiling point similar to kerosene and as further defined by

ASTM D2027 / D2027M “Standard Specification for Cutback Asphalt (Medium-Curing Type)”.

- Slow-curing: Asphalt cement combined with a petroleum diluent of low volatility, generally with a boiling point similar to fuel oil and as further defined by ASTM D2026 / D2026M “Standard Specification for Cutback Asphalt (Slow-Curing Type)”.

Cutback asphalts can be used with cold aggregates requiring little or no heat. They are most commonly used in road mixing operations, stockpile mixes and spray applications such as prime, tack and seal coats. For the purpose of this Code, cutback asphalts also include any crude petroleum oils and road oils used for road construction and maintenance.

Emulsified asphalt: A mixture of asphalt cement, water and an emulsifying agent. There are two major categories of emulsified asphalt: cationic and anionic. Anionic emulsions have negatively charged asphalt droplets and cationic emulsions have positively charged asphalt droplets. Certain grades of emulsified asphalt contain added petroleum diluent which permits a thicker film to adhere to the aggregate and promotes stronger bonding of the asphalt to the aggregate.

Several types and grades of emulsified asphalts are produced to serve specific applications:

- “RS”, “MS”, “SS” and “QS” designations refer to the emulsion setting rate of rapid-setting, medium-setting, slow-setting and quick-setting, respectively.
- A “C” preceding some of the emulsified asphalt grades designates a cationic asphalt emulsion.
- An “h” following certain grades designates a harder base asphalt in the product.
- An “HF” preceding some of the grades indicates a high-float product as measured by a float test as defined by ASTM D139 “Standard Test Method for Float Test for Bituminous Materials”. High-float products generally contain added petroleum diluent such as fuel oil, which permits a thicker film to adhere to the aggregate and promotes stronger bonding of the asphalt to the aggregate. HF products are often used with dusty or dense graded aggregate.

Emulsified asphalt products are used for road construction and for many specialty applications. RS and CRS products are generally used in spray applications such as aggregate (chip) seals and other surface treatment methods. The medium-setting grades are more commonly used for mixing with coarse aggregate for plant or road mix. The slow-setting grades are designed for maximum mixing stability and are used with dense-graded aggregate containing high fines which are used in soil stabilization, asphalt surface mixes, slurry seal applications, and tack and prime coat applications. Quick-setting grades are specialized emulsions used for quick-set slurry applications.

Governments: All orders of government, such as municipal, regional, provincial, territorial, federal and Indigenous authorities.

The Minister: The Minister of the Environment.

Ozone season: The ground-level ozone season occurs during the warm-season months, when the days are warmer and longer. The period of May 1 through September 30 is considered the

ground-level ozone season in Canada, as defined in the *Ozone Annex (2000)* of the *Canada-United States Air Quality Agreement (1991)*.

Person: Includes individuals, companies, organizations or governments.

Road oils: Use of crude oil in an asphalt application.

Volatile organic compounds (VOCs): Substances set out in Item 65 on the List of Toxic Substances in Schedule 1 of the *Canadian Environmental Protection Act, 1999*.

2- Recommended Practices

2.1-Cutback asphalt

2.1.1-Practices regarding cutback asphalt during the ozone season

During the ozone season, it is recommended that cutback asphalt manufactured, imported, offered for sale, sold or used in paving material for paving, construction or maintenance operations, have a VOC content equal to or less than 0.5% by volume which evaporates at 260°C (500°F) or less, as determined by the oil portion of the distillate collected when analyzed in accordance with ASTM D402 /D402M “Standard Test Method for Distillation of Cutback Asphalt”.

2.1.2-Practices regarding cutback asphalt outside of the ozone season

Outside of the ozone season, it is recommended that cutback asphalt manufactured, imported, offered for sale, sold or used in paving material for paving, construction or maintenance operations, have a VOC content equal to or less than 5% by volume which evaporates at 260°C (500°F) or less, as determined by the oil portion of the distillate collected when analyzed in accordance with ASTM D402 /D402M “Standard Test Method for Distillation of Cutback Asphalt”.

2.2-Emulsified asphalt

2.2.1-Practices regarding emulsified asphalt during the ozone season

During the ozone season, it is recommended that emulsified asphalt manufactured, imported, offered for sale, sold or used in paving material for paving, construction or maintenance operations, have a VOC content equal to or less than 3% by volume which evaporates at 260°C (500°F) or less, as determined by the oil portion of distillate collected when analyzed in accordance with ASTM D6997 “Standard Test Method for Distillation of Emulsified Asphalt”.

2.2.2-Practices regarding emulsified asphalt outside of the ozone season

Outside of the ozone season, any emulsified asphalt can be manufactured, imported, offered for sale, sold or used for paving material for paving material for paving, construction or maintenance operations.

2.3- Low-emitting VOC product alternatives

It is recommended to consider manufacturing, importing, selling or using low-emitting VOC product alternatives instead of cutback asphalt with petroleum solvent formulations.

2.4- Labelling

Anyone who manufactures, imports, offers for sale or sells cutback asphalt or emulsified asphalt should have a product technical specification sheet available that accompanies the product and includes seasonal recommendations on product use in Canada, in accordance with sections 2.1 and 2.2 of this Code. A reference to the Code should also be provided.

2.5- Contracting

It is recommended that a commitment to follow the Code be included in contracts that are issued for paving or maintenance operations in Canada.

Manufacturers, sellers and procurement enablers should promote the use of alternative formulations of asphalt containing low VOC-emitting products during contracting discussions, when appropriate.

This subsection does not apply to individuals having their residential driveways paved.

2.6- Conditions of use and training of staff

Any person conducting paving or maintenance operations using cutback asphalt or emulsified asphalt should conduct their activities in accordance with the Code.

Any such person should provide their employees with appropriate training on the requirements of the Code. Such training should include, as a minimum, knowledge of the type of asphalt product that should be used during and outside the ozone season, the recommended use for various types of asphalt throughout the year, the operational changes associated with the use of emulsified asphalt compared with the use of cutback asphalt containing higher concentrations of petroleum solvents, and record keeping procedures.

3- Record Keeping

3.1- Manufacturers

A person who manufactures cutback asphalt or emulsified asphalt should keep records of the quantity and grade of all asphalt manufactured and sold for that year. These records should be kept for a minimum of six years.

3.2- Procurement enablers of paving projects

A person who enters into a contractual agreement with a paving company for paving or maintenance operations with cutback asphalt or emulsified asphalt should keep a copy of such contracts for a minimum of six years.

This subsection does not apply to individuals having their residential driveways paved.

3.3-End-users (paving companies)

A person who uses cutback asphalt or emulsified asphalt for paving or maintenance operations should keep records of the quantity and type of asphalt product used for each year. These records should be kept for a minimum of six years.

4-Reporting

A person who meets the conditions of section 3.1 should send reports to the Minister. The first report should be sent by March 31, 2018 and should cover the previous calendar year's activities (2017). Subsequent reports should be sent every two years by March 31 of those years and should cover activities relevant to the previous calendar year.

The report should contain the product name, type of asphalt, quantity manufactured (tonnes), quantity sold (tonnes), and VOCs contained in the asphalt (% by volume and % by weight). The report should also specify whether the product was manufactured and/or sold during the ozone season. An example report form is provided in the Appendix of the Code.

This information will be used to evaluate and determine whether the objective of the Code was achieved in reducing the emissions of VOC from the asphalt sector.

5-Review of Progress

The Minister will review the implementation of the Code six years after its publication to determine the level of implementation of the recommended best management practices. The information collected through reporting will help determine whether the Code has met its objective of reducing the VOC emissions from this sector or if amendments to the Code or the development of another control instrument is required.

6-Coming into Effect

The Code will come into effect on the day that the Notice announcing the availability of the final Code is published in the *Canada Gazette*, Part I.

7-Contact Information

Mail: Products Division
Environment and Climate Change Canada
351 St-Joseph Boulevard, 9th floor
Gatineau, Quebec
K1A 0H3

Telephone: 819-938-4483 or 1-888-391-3426
Fax: 819-938-4480 or 1-888-391-3695
Email: ec.produits-products.ec@canada.ca
Website: www.ec.gc.ca/cov-voc

Appendix:

Report Form

(Calendar year: _____)

Section 1 – General information on the manufacturer

Name of the organization: _____

Head Office - Civic address: _____

Phone number: _____

Email address: _____

Head Office - Postal address (if it differs from the civic address):

Section 2 – Facility Information

List the number of facilities / locations your company owns or operates in each province/territory as well as the percentage of cutback asphalt and emulsified asphalt produced during the calendar year at each facility with respect to the company total production

Province/Territory	Number of Facilities	% Cutback Asphalt produced during the calendar year	% Emulsified Asphalt produced during the calendar year
Nova Scotia			
New Brunswick			
Newfoundland and Labrador			
Prince Edward Island			
Quebec			
Ontario			
Manitoba			
Saskatchewan			
Alberta			
British Columbia			
Northwest Territories			
Yukon			
Nunavut			

Section 3 – Information with respect to the asphalt products manufactured and sold

For each asphalt product manufactured and sold during the calendar year, provide the name of the product, the type of asphalt (cutback asphalt – CA, or emulsified asphalt –EA), specify whether the asphalt product was manufactured or sold during the ozone season (Yes –Y, or No –N), the quantity manufactured (in tonnes), the quantity sold (in tonnes), and/or the VOCs contained in the asphalt (percentage by volume and by weight).

Product Name	Type of Asphalt (CA or EA)	Ozone Season (Y/N)	Quantity Manufactured (tonnes)	Quantity Sold (tonnes)	VOC Content (% by volume)	VOC Content (% by weight)

Section 4 – Confidentiality

In accordance with section 313 of the *Canadian Environmental Protection Act, 1999*, an applicant who submits a request that information contained in the application be treated as confidential, must include with the request, the identification of the following:

- a) any information that constitutes a trade secret;

- b) any information the disclosure of which would likely cause material financial loss to, or prejudice the competitive position of, the applicant;

- c) any information the disclosure of which would likely interfere with contractual or other negotiations being conducted by the applicant; and

- d) any financial, commercial, scientific or technical information that is confidential and is treated consistently in a confidential manner by the applicant.

Section 5 – Submission of report

Contact information on the manufacturer’s representative

Name: _____ Telephone number: _____

Job title: _____

Email address: _____

Address (if different from section 1): _____

I hereby certify that I am the manufacturer’s representative and I certify that the information provided in this report is accurate and complete.

Name

Date

Signature

Submit completed form before March 31 to:

Products Division – VOC Asphalt Report
Environment and Climate Change Canada

By Mail: 351 St-Joseph Boulevard, 9th floor
Gatineau, Quebec
K1A 0H3

By Fax: 819-938-4480 or 1-888-391-3695

By Email: ec.produits-products.ec@canada.ca