Environment Canada Environnement Canada

Environment Canada Proposed Control Instrument

Volatile Organic Compounds in Aerosol Coatings: Considerations for the Development of a Control Instrument

Canada

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Volatile Organic Compounds in Aerosol Coatings: Considerations for the Development of a Control Instrument

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1 Introduction

Aerosol coating products were identified, through the Federal Agenda for Reduction of Emissions of Volatile Organic Compounds from Consumer and Commercial Products, as one of seven possible areas that offer opportunities for volatile organic compound (VOC) emission reductions. Environment Canada is considering the development of measures to establish VOC reactivity limits for aerosol coatings in Canada. The purpose of this document is to provide background information and supporting rationale for the categories and reactivity limits that would be the basis for possible reduction measures.

2 Background

2.1 General

Health risks to Canadians from air pollution are associated with direct exposure to ambient levels of particulate matter (PM) and ozone, the main components of smog. Smog is responsible for serious health and environmental impacts in Canada, including thousands of premature deaths, hospital admissions, emergency room visits each year and reduced crop growth.

As a gaseous precursor, VOCs contribute to the formation of PM and ground-level ozone. Up to two thirds of PM and almost all ground-level ozone is formed in the atmosphere from reaction of VOCs and nitrogen oxide in the presence of sunlight. In order to reduce PM and ground-level ozone, it is therefore necessary to control their precursors.

2.2 VOCs in Aerosol Coatings

Aerosol coatings are a source of Canadian VOC emissions. The use of aerosol coating products results in VOC emissions that originate from the propellants and solvents contained in them. Once in the air, these compounds, in the presence of sunlight, react with nitrogen oxides to form ozone. The solvents used in aerosol coatings evaporate during the application and drying processes of the paint. Typically, a solvent-blend of fast-evaporating and slow-to-medium-evaporating solvents is used in the formulation, to provide the correct drying time for the paint film. The evaporation of the solvents takes place in two stages, with the initial loss of solvent (up to 80%) being dependent on the vapour pressure of the fast-evaporating solvent component. After the initial loss of solvent, the polymer film is formed. The remaining solvent loss is caused by a slower diffusion-controlled process. The non-volatile portion of the coating remains in the cured coating film and, under normal use conditions, is not emitted to the atmosphere.

2.3 Previous and Current Activities Addressing VOCs

VOCs Declared Toxic Under the Canadian Environmental Protection Act, 1999 *(CEPA 1999)*

On July 2, 2003, an Order[1] was published in the *Canada Gazette*, Part II, adding ozone and PM precursors to Schedule 1 (List of Toxic Substances) of CEPA 1999. Along with gaseous ammonia, nitric oxide, nitrogen dioxide and sulphur dioxide, VOCs were added to Schedule 1 due to their role as precursors in the formation of ground-level ozone and PM. This listing of the precursors has given the Government of Canada the legislative authority under CEPA 1999 to control VOC emissions contributing to PM and ozone.

[1] www.gazette.gc.ca/archives/p2/2003/2003-07-02/html/sor-dors229-eng.html

Federal Agenda for Reduction of Emissions of Volatile Organic Compounds from Consumer and Commercial Products

In March 2004, the Ministers of the Environment and of Health published the Federal Agenda for Reduction of Emissions of Volatile Organic Compounds from Consumer and Commercial Products.[2] The 2004 Federal Agenda outlined the Government of Canada's plan to develop regulations under CEPA 1999 to set VOC emission standards for specific consumer and commercial products. The first step to implement the 2004 Federal Agenda was completed with the commitment to develop three sets of regulations for consumer and commercial products, as announced in the April 26, 2007, Regulatory Framework for Air Emissions.[3] This was followed by the publication in 2009 of two new regulations to limit VOCs: The *Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Products Regulations* and the *Volatile Organic Compound (VOC) Concentration Limits for Architectural Coating Products Regulations*. The *Proposed Volatile Organic Compound (VOC) Concentration Limits for Certain Products Regulations* were published in the *Canada Gazette*, Part I, on April 26, 2008.

Potential Additional Measures to Reduce Emissions of VOCs from Consumer and Commercial Products

In June 2010, Environment Canada published a discussion paper on the proposed renewal of the Federal Agenda for Reduction of Emissions of Volatile Organic Compounds from Consumer and Commercial Products.[4] The discussion paper outlines a number of possible initiatives for the Government of Canada to take in order to reduce VOC emissions from consumer and commercial products from 2010 to 2020. The Aerosol Coating category was identified as one possible area for the development of reduction measures by the Government of Canada.

2.4 The Science of Volatile Organic Compound Photochemical Reactivity

The photochemical reactivity of a VOC is a measure of its potential to impact ozone levels. Individual VOCs vary in the amount of ozone potentially formed once emitted in the air; this is called "reactivity." Distinguishing between more reactive and less reactive VOCs will further or more efficiently decrease ozone concentrations than by controlling all VOCs equally.

VOCs vary in their ability to contribute to ozone formation because they react at different rates and via different chemical mechanisms. In other words, the difference in the chemistry of each VOC, or its reactivity, determines its impact on ozone formation. These differences can be quantified and used in approaches to control emissions of VOCs. To account for the differences in the VOCs' abilities to form ozone, a method is needed to quantify the impact of each VOC in ozone formation.

[2] www.ec.gc.ca/cov-voc/default.asp?lang=En&n=424DFC9B-1
[3] www.ec.gc.ca/doc/media/m_124/toc_eng.htm
[4] www.ec.gc.ca/cov-voc/default.asp?lang=En&n=424DFC9B-1

One tool that allows such measurements is the development of reactivity-based scales.

Reactivity-based scales, such as the Maximum Incremental Reactivity (MIR) scale,[5] will compare the reactivity of one VOC to the reactivity of another, and these differences can be used to develop control approaches that target reductions from VOCs that have a higher potential to form ozone. A list of MIR values of reactive organic compounds (in units of gram O_3 per gram organic compound) has been compiled. These MIR values combined with emission data can be used to determine the ozone contribution of an individual chemical. To do this, each ingredient in an aerosol coating formulation would be assigned its corresponding MIR value (non-reactive organic compounds are assigned MIR values of zero). The weight fraction of each ingredient is multiplied by the MIR value to determine the "weighted reactivity" of an ingredient. The weighted relativities of all ingredients are summed to determine the product's weighted MIR (in grams of ozone/gram product). The "product-weighted reactivity" MIR would then be compared to the reactivity limit.

[5] www.arb.ca.gov/regact/2009/mir2009/mirfinfro.pdf

3 Background Information for Aerosol Coating

3.1 Industry Background

An "aerosol coating product" is a pressurized coating product containing pigments or resins that dispense product ingredients by means of a propellant, and that is packaged in a disposable can for hand-held application. A controlled amount of propellant in the product vaporizes as it leaves the container, creating the aerosol spray. The combination of product and propellant is finely tuned to produce the correct concentration and spray pattern for an effective product. Aerosol coatings are used for a number of applications, including small domestic coating jobs, marking of parking lots, athletic fields, construction sites marking, and touch-up of marks and scratches in paintwork of automobiles, appliances and machinery. Additional applications include arts and crafts.

Aerosol coatings are used by professional and do-it-yourself (DIY) consumers. The DIY segment accounts for approximately 80% of all sales. The remainder of aerosol coatings are sold for industrial maintenance (15%) and original equipment manufacturer use (5%).[6]

The aerosol coatings industry includes the formulators and manufacturers of the concentrated product. These manufacturers may package the product or they may use toll fillers. These toll fillers may work not only with the large manufacturers, but also for other coating manufacturers who do not have the specialized equipment necessary to fill aerosol containers. The fillers may then supply the product to coating dealers, home supply stores, distributors, company-owned stores and industrial customers.[7]

Based on industry information, it is estimated that approximately 7043 tonnes[8] of aerosol coatings were sold in Canada in 2008. This is the equivalent of approximately 20.7 million aerosol cans filled and sold each year. Approximately 40% of these coatings were manufactured in Canada. Approximately 60% of the total volume was imported, primarily from the United States.

Opportunities to achieve feasible reductions in industrial applications of aerosol coating products will be explored through information to be gathered by the Government of Canada. Various coatings categories are contained in aerosol packaging, including clear coatings, flat paint products, fluorescent coatings,

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[6] Cheminfo Services Inc. *Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products in Canada*. Markham, Ontario, March 25, 2010, p. 17.
[7] National Archives and Records Administration, *Federal Register-Part III-Environmental Protection Agency, 40 CFR Parts 51 and 59 National Volatile Organic Compounds Emission Standards for Aerosol Coatings; Final Rule*, Monday, March 24, 2008.
[8] Cheminfo Services Inc. *Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products in Canada*. Markham, Ontario, March 25, 2010, p. 4.

metallic coatings, non-flat paints, primer coatings, ground traffic/marking paints and specialty coatings including automotive aerosol coatings.[9]

3.2 VOC Emissions from Aerosol Coatings

Questionnaire responses received from aerosol coating manufacturers supplying Canada identified a total domestic market for all coatings of 7043 tonnes in 2008, with these products containing 3821 tonnes of VOCs. A total of 3208 unique aerosol coating products were identified among the responses received during the study. Of these products, 3107 were already compliant with the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (U.S. EPA) ozone reactivity limits, while 101 products were not compliant. Compliant products contained 3643 tonnes of VOCs while non-compliant products contained 178 tonnes of VOCs.

The U.S. EPA along with CARB have adopted the VOC reactivity limits for aerosol coatings to replace the traditional mass-based limits. Should Environment Canada align to the CARB / U.S. EPA reactivity limits, 42 tonnes of equivalent annual VOC emission reductions would be realized in Canada.[10] This estimate of expected VOC emission reductions is much lower than previously anticipated due to the high proportion of products that are already meeting CARB / U.S. EPA limits.

[9] Federal Agenda, a Discussion Paper for the 2010 to 2020 Period.
[10] Cheminfo Services Inc. *Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products in Canada*. Markham, Ontario, March 25, 2010, p. 5.

4 Actions in Other Jurisdictions

California Air Resources Board (CARB)

CARB was the first jurisdiction to enact a control instrument (in their case, regulations) for VOC content limits for aerosol coatings as a result of the substantial ozone non-attainment problems in the state. In 1995, it adopted its first mass-based regulation to reduce VOC emissions from aerosol coatings. In 1998, a revised version of the mass-based regulation established VOC content limits more stringent than the existing 1995 limits. This aerosol coatings regulation limited the VOC content for 36 products of aerosol paints (see Annex). At the time, industry voiced concerns that the proposed mass-based limits reductions were not practically achievable.

In 2002, CARB subsequently developed a reactivity-based rule. To provide time for the industry to reformulate to meet the 2002 reactivity-based limits, CARB extended the compliance date for the general coating category to June 1, 2002, and the compliance date for the specialty coating categories to January 1, 2003.[11] In September 2005, the U.S. EPA published a Final Rule that approved the California State Implementation Plan (SIP), including the reactivity-based equivalent emissions reductions, and made other administrative and definitional changes that cleared the way for the CARB rule.[12]

United States Environmental Protection Agency (U.S. EPA)

The U.S. EPA has implemented a national rule to reduce the ozone-forming potential of VOC emissions from aerosol coatings use. The national rule, which became effective on March 24, 2008, establishes reactivity limits for 36 different aerosol coating categories. The categories and the limits are the same as those developed and implemented by CARB in its California state-wide rule on aerosol coatings, which was implemented in 2002. The U.S. EPA's national rule builds largely upon CARB's effort to regulate aerosol coatings using the relative reactivity approach. Both the CARB and U.S. EPA rules apply to all spray paint products, including those used in consumer, institutional, industrial and commercial settings.[13]

Europe

Certain aerosol paints are regulated in Europe in terms of their VOC content. Specifically, aerosol paint used in vehicle refinishing is regulated for its VOC content in Europe. No other aerosol paint applications in Europe are regulated for their VOC content at this time (including the application of paint in the manufacture of

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[11] Cheminfo Services Inc. *Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products in Canada*. Markham, Ontario, March 25, 2010, pp. 272.
[12] U.S Environmental Protection Agency, *National Volatile Organic Emission Standards for Aerosol Coatings, History of California's Aerosol Coatings Rule*, 2006.
[13] National Paints and Coatings Association, *Letter to the U.S. EPA – Comments on the Proposed Aerosol Coatings Rule, Docket ID No. EPA-HQ-OAR-2006-0971*, August 15, 2007.

new automobiles). Outside of the European Commission, there are no countries in the European Union that have established their own regulations to limit the VOC content of aerosol paint. This has been left up to the European Commission to implement, in order to prevent distortion in the internal European Union market.

Australia

The Australian Government through the Council of Australian Governments (COAG) Standing Council on Environment and Water is assessing the merits and options of reformulating surface coatings (architectural and decorative paints and enamels, wood care products, and automotive refinishing coatings) to contain lower levels of VOCs. The process is to determine whether regulations are required for part of this assessment; at this stage, no final decision has been proposed or endorsed by COAG.

5 Benefits and Costs

5.1 VOC Reductions

The potential reduction in VOC emissions is estimated at 42 tonnes of total VOC emissions from aerosol coatings if all products in Canada met CARB / U.S. EPA limits. Environment Canada will continue to monitor VOC emission and will consider further measures if necessary in order to achieve its target for VOC emissions reductions.

5.2 Costs

Environment Canada is conducting a socio-economic study to estimate the costs associated with implementing a control instrument. The information gathered through the Socio-Economic Study for Aerosol Coatings containing Volatile Organic Compounds (VOCs) in Canada, the Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products in Canada, along with the limits set by U.S. EPA and CARB referenced as a baseline will be used to assist in VOC reactivity limits and in assessing associated economic impacts for future control measures employed to address the environmental and health impacts of VOCs in consumer and commercial products. The study is expected to be completed by the summer of 2012.

5.3 Benefits

Reductions in emissions resulting from measures taken generate environmental and health benefits that could be translated into economic terms. For example, health benefits could be translated into avoided costs to the health care system as well as improved individual well-being. The reactivity-based approach adopted relies primarily on VOC substitution rather than VOC reduction, yet still preserves the ozone reduction benefits of the previously adopted mass-based VOC limits. Since the limits are based on reactivity of VOCs rather than mass of VOCs, it offers industry significantly more flexibility in achieving environmental benefits at lower cost.

6 Path Forward

6.1 Consultation Meeting

On March 7, 2012, Environment Canada held a consultation meeting concerning the proposed approaches on VOC emission reductions in aerosol coatings in Canada. The purpose of the meeting was to assess the possibilities for introducing measures for establishing VOC reactivity limits in aerosol coatings, by:

1. presenting and clarifying background information gathered to support a possible control measure;
2. obtaining feedback on elements of possible control strategies; and
3. clarifying the next steps in the process.

Stakeholders in the consultation process include Canadian manufacturers, importers and sellers of aerosol coatings, associations representing manufacturers, importers, sellers and applicators of coatings (including the Canadian Paint and Coatings Association, American Coatings Association, National Aerosol Association, and Canadian Vehicle Manufacturers' Association). Other stakeholders include government departments and environmental non-governmental organizations.

During the consultation session, a number of questions were raised and stakeholders were encouraged to provide feedback and comments.

Questions addressed during the session included:

- Was the background information presented accurate?
- Was there any new or additional information?
- Are there any concerns with the information presented?

Various control measures are available to manage the risk associated with aerosol coating products. The following risk management tools were considered and discussed during the consultation:

- Performance standard (regulation or environmental guideline)
    - An Environment Canada regulation or environmental guideline to set VOC reactivity limits in certain categories of aerosol coating products
- Pollution Prevention (P2) Plan with manufacturers and importers of aerosol coatings to reduce VOC emissions from aerosol coating products
- Environmental performance agreement (EPA)
    - An EPA with product manufacturers to reduce VOC emission from aerosol coatings and to report on reductions

In view of the high proportion of products already meeting CARB / U.S. EPA limits, an additional option of taking no further action was discussed.

Feedback on the possibilities:

- What are the "pros" or strengths of each approach?
- What are the "cons" or weaknesses?
- Is there a preferred option?

Next steps:

- Need for, and how to continue, the dialogue
- Need a mechanism to coordinate?

Stakeholders were encouraged to provide written comments following the consultation. In consideration of the information and feedback received, the Department will evaluate the options, with the aim of determining the most efficient approach to meet environmental objectives.

Contact Information

For further information on this discussion document, or to learn how to participate in the public consultation activities for the proposed control measures, please contact:

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10 Wellington Street, 23rd Floor
Gatineau QC K1A 0H3
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Fax: 819-994-1412
TTY: 819-994-0736

enviroinfo@ec.gc.ca

Annex: Proposed VOC Reactivity Limits (g O_3/g product)

Coating Category	Reactivity Limit
Clear Coatings	1.50
Flat Coatings	1.20
Fluorescent Coatings	1.75
Metallic Coatings	1.90
Non-Flat Coatings	1.40
Primers	1.20
Ground Traffic/Marking	1.20
Art Fixatives or Sealants	1.80
Auto Body Primers	1.55
Automotive Bumper and Trim Products	1.75
Aviation or Marine Primers	2.00
Aviation Propeller Coatings	2.50
Corrosion Resistant Brass, Bronze or Copper Coatings	1.80
Exact Match Finish-Engine Enamel	1.70
Exact Match Finish-Automotive	1.50
Exact Match Finish-Industrial	2.05
Floral Sprays	1.70
Glass Coatings	1.40
High Temperature Coatings	1.85
Hobby/Model/Craft Coatings, Enamel	1.45
Hobby/Model/Craft Coatings, Lacquer	2.70
Hobby/Model/Craft Coatings, Clear or Metallic	1.60
Marine Spar Varnishes	0.90
Photograph Coatings	1.00
Pleasure Craft Primers, Surfaces or Undercoaters	1.05
Pleasure Craft Topcoats	0.60
Polyolefin Adhesion Promoters	2.50
Shellac Sealers, Clear	1.00
Shellac Sealers, Pigmented	0.95
Slip-Resistant Coatings	2.45
Spatter/Multi-colour Coatings	1.05
Vinyl/Fabric/Leather/Polycarbonate Coatings	1.55
Webbing/Veiling Coatings	0.85
Weld-through Primers	1.00
Wood Stains	1.40
Wood Touch-up/Repair or Restoration Coatings	1.50

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