Renewal of the Federal Agenda on the Reduction of Volatile Organic Compound (VOC) Emissions from Consumer and Commercial Products for the 2021 to 2028 Period

Discussion Paper

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1. Introduction

Air pollution continues to be a problem in Canada. Data indicates that anthropogenic emissions of key air pollutants have decreased significantly; some by more than half since the mid 1990s. However, 2018 data show that emissions of volatile organic compounds (VOCs) have been rising slightly. Most of the VOC emissions came from the oil and gas industry and from the use of paints and solvents. The impacts of this pollution include a number of adverse cardio-respiratory outcomes ranging from respiratory symptoms up to and including premature mortality, increased stress on health care services, and detrimental impacts on the environment.

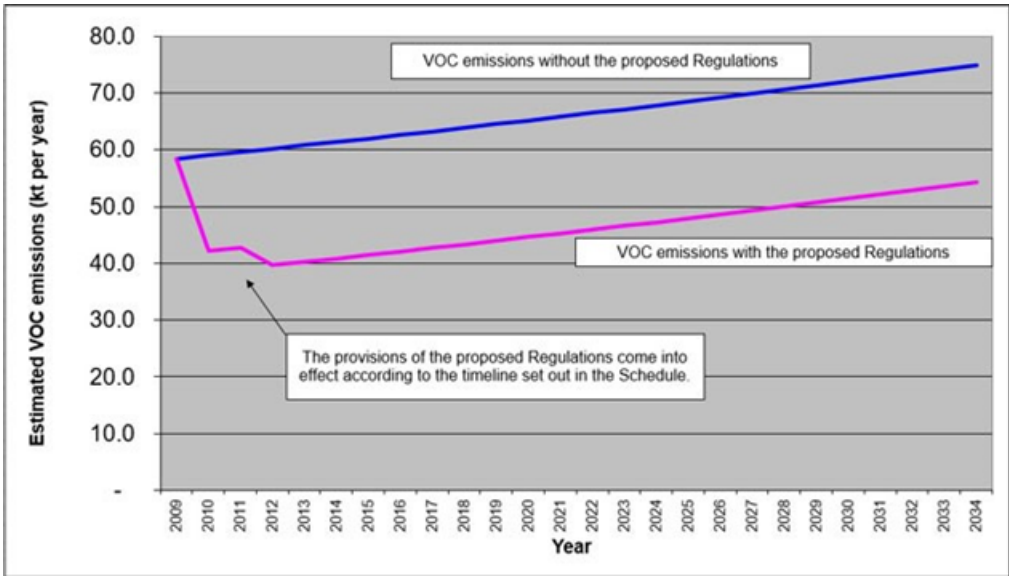
1.1 Rationale for renewing the federal agenda

The Government of Canada has committed to addressing air pollution with the aim of improving air quality under its air quality program. One aspect of the program is reducing VOC emissions, a key component of smog, from consumer and commercial products. Emissions from products have been found to be the number one source of VOCs in urban areas.

One of the challenges in controlling emissions from products is that any short term reductions in a specific sector are eroded over the longer term, as the population and the economy grows.

Figure 1 illustrates a typical sector reduction versus future growth. This points to a need to continually revisit existing limits on VOC concentrations and to consider reducing emissions from additional products.

Figure 1: total estimated VOC emissions from architectural coatings (2009 to 2034)[1]



[1]September 30, 2009, Canada Gazette, Part II, Vol. 143, No. 20: Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations - Regulatory Impact Statement.

Since the publication of the original federal agenda in 2004, a number of new opportunities to reduce VOC emissions from consumer and commercial products have been identified. For example, in the United States (U.S.), besides updating their regulations, jurisdictions have developed and implemented controls for additional products, such as gas cans. Adopting similar controls and standards would benefit Canadians and the environment by reducing VOC emissions.

This consultation paper is the first step in informing stakeholders of the federal government's plans to develop specific measures to further reduce VOC emissions from consumer and commercial products over the 2021 to 2028 time frame. The objective is to reengage existing stakeholders and those who have not been previously engaged, and also provide an overview of the need for sectors to contribute to VOC reductions.

The approach will be to align, where possible, with requirements in place in key U.S. jurisdictions, which will contribute to a level playing field, provide regulatory certainty for business, and benefit human health and the environment.

1.2 Background & context

In 2004, to manage VOC emissions from non-industrial solvents, the Ministers of Environment and Health published a notice of intent entitled *Federal Agenda on the Reduction of Emissions of Volatile Organic Compounds from Consumer and Commercial Products* in the *Canada Gazette* Part I. This document outlined a series of measures to be developed and implemented between 2004 and 2010 to control and reduce VOC emissions from consumer and commercial products.

A wide range of products used by consumers, or in institutional, industrial or commercial applications were the focus of the original 2004 federal agenda. Coatings were addressed in 2009 by publishing the *Volatile Organic Compound (VOC) Concentration limits for Architectural Coatings Regulations* and the *Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Product Regulations*.

In addition, approximately 130 categories and subcategories of consumer products will be addressed through the proposed *Volatile Organic Compound (VOC) Concentration Limits for Certain Products Regulations*. Final publication of these regulations is expected in 2021.

In 2010, Environment and Climate Change Canada (ECCC) initiated consultations on renewing the federal agenda for the 2010 to 2020 period. To facilitate stakeholder participation, the department hosted a 2-day workshop and developed a discussion document that provided background information and described proposed actions. The document was posted for a 30-day comment period. Overall, stakeholders were supportive of the renewal. Although the federal agenda was not renewed in 2010, some of the initiatives that were listed have been implemented, notably, the publication in 2017 of the *Code of Practice for the Reduction of*

Volatile Organic Compound (VOC) Emissions from Cutback and Emulsified Asphalt. There are still, however, additional opportunities to reduce VOC emissions from consumer and commercial products.

This consultation document provides updated information relative to the 2010 discussion document, identifies potential measures to be incorporated into a renewed federal agenda, and reiterates the Government of Canada's commitment to pursuing additional VOC reductions in certain key consumer and commercial products. This document also provides details on proposed measures for each targeted sector. All comments received during the 2010 consultations were reviewed and taken into consideration in developing this document.

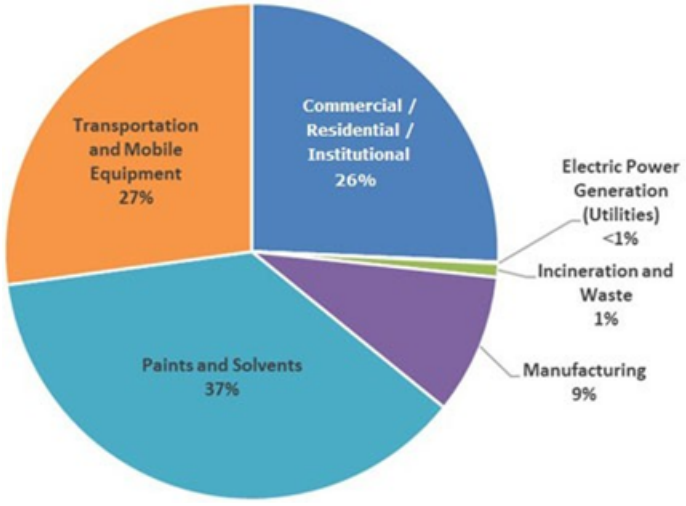
Following consultations on this document, the Government of Canada intends to publish, in the *Canada Gazette*, Part I, a notice of intent identifying and describing proposed additional control measures to further reduce VOC emissions from consumer and commercial products. These measures would be developed and implemented by 2028.

1.3 Sources of VOCs

Emissions of VOCs originate from both biogenic (natural) and anthropogenic (human-made) sources. Anthropogenic sources of VOCs include fuel combustion and evaporation processes associated with transportation, certain industries such as paint booths at auto plants and steel processing plants, and general solvent use. VOCs that are released through anthropogenic activities tend to be found wherever people live and work.

Figure 2 below illustrates the key sources of anthropogenic VOC emissions that affect mainly urban areas, where the use of consumer and commercial products tend to be concentrated.

Figure 2: Figure 2: total anthropogenic VOC emissions in Canadian urban areas (2018)[2]



[2] ECCC, Pollution Data Division, Canada's Air Pollutant Emissions Inventory Report 2020.

The paints and solvents category is comprised of a wide array of disparate sectors and sources. These include commercial processes, such as printing and degreasing, and consumer and commercial products. The transportation and mobile equipment category was formerly the largest VOC emission category in urban areas in Canada, however, with the advancement of vehicle emission reduction technologies, the paints and solvents category has since become the largest source.

1.4 VOCs in consumer and commercial products

Consumer and commercial products are products that are used in households, and by institutional and commercial consumers. This includes cleaning products, paints, inks and adhesives and does not include fuels, fuel additives, motor vehicles, non-road vehicles and non-road engines. The main VOC sources from products and their respective emission contributions are listed below in table 1.

Table 1: VOC emissions from consumer and commercial products (2018)[3]

Source	VOC emissions (kt)	VOC emissions (%)
Personal care products	6.2	1.3
Household products	41.3	8.6
Windshield washer	78.4	16.3
Dry cleaning	0.2	0.04
Pesticides	24.3	5.0
Surface coatings - architectural	19.1	4.0
Surface coatings - automotive refinishing	4.0	0.8
Surface coatings - others	59.0	12.2
Portable fuel containers*	70.0	14.5
Printing	19.1	4.0
Degreasing	20.3	4.2
Industrial - general cleaning	51.8	10.7
Industrial - adhesives and sealants	10.0	2.1
Industrial - aerosols	9.0	1.9
Industrial - asphalt cutback	14.8	3.1
Other commercial and industrial	54.6	11.3
Total	**482.0**	**100.0**

* 2008 value, 2018 value not available.

[3] ECCC, Pollution Data Division, Canada's Air Pollutant Emissions Inventory Report 2020, supplemented with 2008 PFC data from the Technical and Economical Study on VOC Emissions from Portable Fuel Containers, prepared for ECCC, Cheminfo Services, December 2008.

Windshield washer fluid, although a large source of VOCs from the consumer and commercial products sector, is not included in this discussion paper. After consulting stakeholders, and conducting an analysis of windshield washer fluid use and weather data in Canada, the department determined that achieving significant reductions in VOC emissions from windshield washer fluid would require setting a national limit on its use that would not be appropriate for the Canadian climate, due to the lack of alternatives and safety concerns.

1.5 VOCs and air quality

VOCs contribute to the formation of both particulate matter (PM) and ground-level ozone, which are the 2 main components of smog. PM can be emitted directly (primary PM) or formed in the atmosphere (secondary PM) by complex chemical reactions involving VOCs, sulphur dioxide (SO_2), nitrogen oxides (NO_x) and ammonia. Ground-level ozone is formed through complex reactions between VOCs and NO_x in the atmosphere, when exposed to sunlight.

1.5.1 Health effects

There are various health effects associated with PM and ozone.

PM

PM is a mixture of solid particles and liquid droplets found in the air that includes:

- PM_{10}: inhalable particles, with diameters that are 10 micrometers and smaller
- $PM_{2.5}$: fine inhalable particles, with diameters that are 2.5 micrometers and smaller
- $PM_{2.5}$, pose the greatest risk to health as they can penetrate deep into the lungs and some may even enter the bloodstream.

In 2013, Health Canada published an extensive review of the literature on the health effects of $PM_{2.5}$. The analysis concluded that $PM_{2.5}$ was causally associated with a number of adverse cardio-respiratory outcomes ranging from respiratory symptoms up to and including premature mortality and that there were distinguishable effects for both short- and long-term exposures (Health Canada, 2013)[4]. The evidence included epidemiological studies of associations in Canadian (and other) populations for premature mortality and hospital admissions, supported by evidence from controlled exposure studies using both animal models and human participants that provide a clear causal chain at Canadian exposure levels. Additionally, the evidence points to adverse effects that are indicative of non-threshold relationships at the population level. Health Canada continues to review the health science related to different particulate matter sizes, focussing especially on $PM_{2.5}$, since the 2013 review has found evidence supporting

[4] Health Canada, Canadian Smog Science Assessment: Volume 2: health Effects, July 2013.

previous conclusions but also an indication that the effects likely extend beyond cardio-respiratory health.

There is evidence implicating a number of groups as being especially sensitive to the effects of $PM_{2.5}$. Those with pre-existing respiratory and cardiac conditions are more at-risk from higher exposure. More importantly, long-term exposure to $PM_{2.5}$ increases the risk of various adverse health outcomes, such as cardiovascular morbidity and mortality. As such, the size of the "susceptible" population is likely to be substantial. In addition, individuals who engage in greater levels of outdoor activity are more likely to be exposed to higher levels of ambient $PM_{2.5}$, and are therefore more vulnerable to its effects.

Ozone

Ozone has been conclusively determined to exert a range of adverse effects on human health at concentrations commonly found in Canada (Health Canada, 2013). Although ozone deposits in the respiratory tract and the majority of epidemiological studies available report associations with respiratory outcomes, there is a growing body of evidence showing that ozone can also have adverse effects on the cardiovascular system.

Ozone is regarded by Health Canada as a substance without a threshold for effects at the population level. The 2013 Health Canada review of the literature on the health effects of ground-level ozone concluded that acute ozone exposure had a causal relationship with respiratory outcomes (for example, increases in respiratory symptoms, airway injury, respiratory-related hospitalization), a likely causal relationship with total non-accidental and cardiopulmonary mortality, and was suggestive of a causal relationship with cardiovascular health outcomes. It was further concluded that while there were some indications of effects from long-term exposures, the weight of evidence remains small and questions remain about the role of other factors in the reported associations. The evidence included epidemiological studies of associations in the Canadian (and other) populations for hospital admissions and premature mortality, supported by evidence from controlled exposure studies using both animal and human participants.

Overall, the weight of evidence indicates that ozone is associated with acute-exposure mortality and a range of (largely respiratory) human health endpoints, such as reduced pulmonary function, increased asthma exacerbation and respiratory symptoms leading to emergency room and hospitalizations (Health Canada, 2013). Those with pre-existing respiratory conditions are more at-risk from exposure as well as those engaged in greater levels of outdoor activity as they are more likely to be exposed to higher levels of ozone and are therefore more vulnerable to the effects of ozone exposure.

1.5.2 Environmental effects

Ozone and $PM_{2.5}$ also have detrimental impacts on the environment. Ozone can damage leaves, reduce photosynthesis, impair reproduction of plants and decrease agricultural crop yields,

which can reduce the variety of plants in an ecosystem. $PM_{2.5}$ is the main cause of reduced visibility (haze) and can be carried over long distances by wind and then settle on the ground or water. The effects of this settling may include acidification of lakes and streams, depletion of nutrients in soil, damage to forests and farm crops, negative affects on the diversity of ecosystems and contribute to the production of acid rain.

1.5.3 Air quality management

In 2000, federal, provincial and territorial Ministers of the Environment endorsed the Canada-wide Standards (CWS) for $PM_{2.5}$ and ozone; ambient targets that were intended to provide a certain degree of protection from the harmful effects of $PM_{2.5}$ and ozone. In 2012, building on the CWS, the federal, provincial and territorial Ministers of the Environment adopted the Air Quality Management System (AQMS) as a collaborative approach to protect the health of Canadians and the environment by improving air quality in Canada.

Included in the AQMS are Canadian Ambient Air Quality Standards (CAAQS) for $PM_{2.5}$ and ozone, which are the drivers for continuous improvement to air quality and replaces the 2000 Canada-wide Standards.

The CAAQS for $PM_{2.5}$ has applied since 2015 and is currently under review. The recently updated CAAQS for ozone builds upon targets previously set under the AQMS. The updated standard could reduce Canadians' exposure to ambient ground-level ozone by as much as 10% by 2025, leading to improvements in air quality across the country. The updated ozone CAAQS were published as environmental objectives in the *Canada Gazette*, Part I in June 2019. The $PM_{2.5}$ and ozone CAAQS are presented in table 2. The year in the CAAQS table is the year in which the standard becomes effective.

Table 2: CAAQS for $PM_{2.5}$ and ozone

Pollutant	Averaging time	Numerical value (2015)	Numerical value (2020)	Numerical value (2025)	Statistical form
$PM_{2.5}$	24-hour	28 µg/m^3	27 µg/m^3	TBD	The 3-year average of the annual 98th percentile of the daily 24-hour average concentrations
$PM_{2.5}$	Annual	10.0 µg/m^3	8.8 µg/m^3	TBD	The 3-year average of the annual average of all 1-hour concentrations
O_3	8-hour	63 ppb	62 ppb	60 ppb	The 3-year average of the annual 4th highest of the daily maximum 8-hour average ozone concentrations

1.5.4 International engagement

Canada works with international partners to address air pollutants that cross borders and affect Canada's air quality. Canada and the U.S. signed the Canada-U.S. Air Quality Agreement in 1991 to reduce pollutants that cause acid rain. In 2000, the ozone annex, which commits both countries to reduce their emissions of VOCs and NO_x, was added to the agreement. Under the ozone annex, both Canada and the U.S. committed to reduce emissions of NO_x and VOCs, the precursors to ozone. Canadian commitments to reduce VOCs include the development of measures to reduce VOC emissions from solvents, paints and consumer products using a mix of instruments.

In 2017, Canada ratified the Gothenburg Protocol under the Convention on Long-Range Transboundary Air Pollution. The Gothenburg Protocol was established to address pollutants that cause acidification and ground-level ozone and sets limits on emissions of air pollutants, including VOCs, SO_2, NO_x and PM. Under the protocol, Canada committed to:

- an emission ceiling for VOCs of 2100 kilotonnes (kt) to be met by 2010 (this commitment was met and has been maintained)
- a 20% emission reduction for VOCs from 2005 levels by 2020 (Canada's 2018 report on air pollutant emissions projections indicated that Canada was on track to meet this commitment)

1.6 Past Government of Canada actions targeting VOCs

Since 2000, the Government of Canada has put in place various measures to reduce VOC emissions from transportation, consumer and commercial sources.

In February 2001, the Minister of the Environment published the *Federal Agenda on Cleaner Vehicles, Engines and Fuels*. The agenda sets out a series of regulatory and non-regulatory measures to protect the health of Canadians and the environment by reducing emissions from vehicles, engines and fuels. The following regulations that reduce VOC emissions by targeting the tailpipe release of hydrocarbons, were developed under this policy:

- *On-Road Vehicle and Engine Emission Regulations* (SOR/2003-2)
- *Off-Road Small Spark-Ignition Engine Emission Regulations* (SOR/2003-355)
- *Off-Road Compression-Ignition Engine Emission Regulations* (SOR/2005-32)
- *Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* (SOR/2010-201)
- *Marine Spark-Ignition Engine, Vessel and Off-road Recreational Vehicle Emission Regulations* (SOR/2011-10)
- *Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations* (SOR/2013-24)
- *Off-road Compression-Ignition (Mobile and Stationary) and Large Spark-Ignition Engine Emission Regulations* (SOR/2020-258)

On June 12, 2003, an order added ozone and VOCs to Schedule 1 (List of Toxic Substances) of the *Canadian Environmental Protection Act, 1999* (CEPA). Along with gaseous ammonia, nitric oxide, NO_x and sulphur dioxide, VOCs were added to Schedule 1 due to their role as precursors in the formation of ground-level ozone and PM_{10}. The addition of the precursors enables the Government of Canada to regulate VOC emissions under CEPA.

Under the previous federal agenda that covered the period of 2004 to 2010, the following regulations were developed:

- *Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Products Regulations* (SOR/2009-197)
- *Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations* (SOR/2009-264)
- Proposed *Volatile Organic Compound (VOC) Concentration Limits for Certain Products Regulations* (published in the *Canada Gazette*, Part I in 2008 and in 2019, with revisions. Work on this instrument is ongoing and publication in the *Canada Gazette* Part II is expected in 2021.)

In June 2016, in an Order amending Schedule 1 to the *Canadian Environmental Protection Act*, the definition of VOCs was amended to add 16 exempted substances.

On February 25, 2017, a notice of the issuance and publication of the *Code of Practice for the Reduction of Volatile Organic Compound (VOC) Emissions from Cutback and Emulsified Asphalt* was published in the *Canada Gazette*, Part I. The main objective of this code of practice is to recommend best practices that encourage the use of low VOC emitting asphalt products.

In April 2018 the *Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector)* (SOR/2018-66) were published in the *Canada Gazette*, Part II. These regulations are designed to promote innovation and provide flexibility for oil and gas industries to choose the most cost-effective compliance options and promote sound industry practices such as gas capture, clean combustion, and leak detection and repair to reduce emissions.

In October 2020, the *Reduction in the Release of Volatile Organic Compounds Regulations (Petroleum Sector)* (SOR/2020-231) were published in the *Canada Gazette*, Part II. These regulations require the implementation of comprehensive leak detection and repair programs at Canadian petroleum refineries, upgraders and certain petrochemical facilities. The operators of these facilities are also required to modify certain equipment components to prevent leaks and to monitor the level of certain VOCs at facility perimeters.

2. Rationale for implementing additional measures targeting consumer and commercial products

Unlike large industrial sources of VOC emissions, individual consumer and commercial product VOC emissions are small but widely distributed across many sectors (for example, personal care and household maintenance products, coatings, lubricants and inks) and tend to concentrate in densely populated areas where smog is an issue.

While individual products emit only small amounts of VOCs, collectively they contribute significantly to overall VOC emissions. In fact, over the last few years, consumer and commercial products have replaced the transportation sector as the largest contributors to VOC emissions in urban areas.

Measures put in place by the Government of Canada, such as regulations controlling tailpipe emissions and the VOC content of paints and coatings, have contributed to significant reductions in VOC emissions in Canada. These reductions, however, are being slowly eroded by increased product use caused by population growth and associated consumer demand. As such, more needs to be done to further reduce emissions.

3. Approach to selecting proposed measures

Proposed measures to include in a renewed federal agenda were identified taking into consideration the following 4 principles:

1. fulfilling the Government of Canada's commitments to improve air quality
2. taking action where there are opportunities for significant and cost-effective improvements
3. aligning standards within the North American market wherever possible to keep Canadian businesses competitive
4. setting a level playing field for businesses in Canada

These principles are further discussed below.

3.1 Fulfilling the Government of Canada's commitments to improve air quality

Despite improvements in air quality over the past 2 decades, the burden of air pollution on the health of Canadians continues to be significant. Almost one quarter of Canadians live in communities that exceed at least one of the CAAQS. Health Canada estimates that air pollution from industry, transportation and other human activities results in more than 14 600 premature deaths every year in Canada.

The Government of Canada's Air Quality Program aims to ensure that Canadians have clean air and the environment is protected. This initiative includes activities to address sources of domestic and international air pollution, including reducing VOC emissions from consumer and

commercial products. Further reductions in VOC emissions will not only help to protect the health of Canadians and the environment, but will contribute to reducing transboundary air pollution.

3.2 Taking action where there is opportunity for significant and cost-effective improvements

The Government of Canada is looking to develop VOC emission reduction measures that provide benefits across Canada (in other words, that are not regional and that will benefit from a national approach). Although some measures are already in place to reduce VOC emissions in certain sectors, there are more opportunities that, although more expensive to implement, remain cost-effective.

3.3 Aligning standards within the North American market wherever possible

One of the goals of the federal agenda is to align Canada's consumer and commercial product requirements with those in the U.S. Alignment is desirable, because:

- clean air is a transboundary issue (measures are required on both sides of the border to manage the release of smog precursors such as VOCs)
- the North American consumer and commercial products market is highly integrated (aligning Canadian measures with those in the U.S. ensures consistency in product requirements in the North American market)
- the U.S. has a long history of regulating consumer and commercial products and Canada can benefit from the U.S. experience

A number of states and regional air authorities have developed regulatory product standards. The California Air Resource Board (CARB) has a long history in developing air standards, which have been emulated by other states. The Ozone Transport Commission (OTC) is a multi-state organization created under the *Federal Clean Air Act*. The OTC represents 13 northeastern states and is responsible for implementing regional solutions to ground-level ozone. Model rules adopted by OTC are often based on CARB regulations, which are the most stringent in the U.S.

OTC states, when combined with California, account for about 35% of the US population. This represents a significant portion of the US marketplace and greatly influences North America. By aligning with OTC and/or CARB, the Government of Canada ensures that Canadian standards are representative of standards driving the North American marketplace.

3.4 Setting a level playing field for businesses in Canada

One goal for a renewed federal agenda is to develop measures that address both importers and Canada's domestic production. A national approach will avoid a provincial patchwork of measures and set a level playing field for businesses across Canada.

4. Proposed measures for 2021 to 2028

The Government of Canada has identified the following measures as the focus of the federal agenda renewal. All measures will be subject to the standard instrument development process prior to their implementation, including appropriate data gathering, cost-benefit analysis and stakeholder consultations.

4.1 Portable fuel containers (PFC)

PFCs have a nominal capacity of 40 litres or less, and are designed for receiving, transporting, storing, and dispensing fuel or kerosene. PFCs are used to fill a variety of equipment including lawnmowers, automobiles, all-terrain vehicles and recreational watercraft. Emissions from PFCs are primarily of 3 types: evaporative losses from unsealed or open containers; permeation emissions from fuel passing through plastic container walls; and evaporative emissions from spillage during use. In 2018, PFCs are estimated to emit about 14.5% of all VOCs released by consumer and commercial products in Canada (table 1).

4.1.1 Current North American measures

PFC VOC emissions are not currently controlled in Canada. The Canadian General Standards Board (CGSB), at the request of Environment and Climate Change Canada (ECCC), is currently developing a National Standard of Canada to control the emissions of VOCs from PFCs. This National Standard should become available in 2021. The standard will be voluntary, but is expected to drive the Canadian market toward lower VOC-emitting PFCs.

PFCs are regulated throughout the U.S. The U.S. EPA published the *Control of Evaporative Emissions from New and In-Use Portable Fuel Containers Regulations* in 2007. These regulations are based on the CARB *Portable Fuel Container Regulation*, which were initially adopted in 2000 and were last amended in 2017.

4.1.2 Proposed measure

CEPA does not currently have the authority to regulate the design of PFCs to minimize VOCs released during use. ECCC will monitor the state of implementation of the voluntary CGSB standard. If the standard is not widely adopted in Canada, and if the required CEPA authorities become available, ECCC may develop regulations that reference the existing CGSB standard, and/or include requirements that are equivalent to the U.S. EPA national standard and CARB regulations.

4.1.3 Potential reductions

According to a study prepared for ECCC entitled *Technical and Economical Study on VOC Emissions from Portable Fuel Containers* (Cheminfo, 2008)[5], PFCs emitted about 70 kt of VOCs in Canada in 2007. This study estimated that VOC emissions from PFCs would be reduced by 88% if all PFCs in Canada were compliant with U.S. requirements. This would represent a 62 kt reduction from 2007 levels. The study estimated that, in 2008, it would cost $656 per tonne of VOCs to achieve these reductions (Cheminfo, 2008).

ECCC does not currently have an updated estimate of VOC emissions from PFCs, nor information on potential reductions and cost effectiveness. Updated values will be generated prior to making any additional decisions to reduce VOC emissions from PFCs.

4.2 Architectural coatings

Architectural coatings include paints, stains and varnishes that are applied to a wide variety of stationary structures in residential, commercial, institutional and industrial settings. Emissions occur when the solvents contained in these products evaporate, following product application onto a surface. This document addresses VOC emissions from aerosol coatings separately, in section 5.2. In 2018, architectural coatings were estimated to emit about 19 kt, or 4% of all VOC released by consumer and commercial products in Canada (table 1).

4.2.1 Current North American measures

The Government of Canada published the *Volatile Organic Compound (VOC) Concentration limits for Architectural Coatings Regulations* in 2009. The regulations set mandatory VOC concentration limits for 53 categories of architectural coatings, including traffic marking coatings. Concentration limits vary between 100 g/L and 800 g/L depending on the category and are set out in the schedules to the regulations . The traffic marking coatings category is the only one subject to an annual use prohibition during the period of May 1 to October 15. During this period, a person must not use traffic marking coatings with VOC concentrations exceeding 150 g/L.

These regulations were based on the OTC *Model Rule 2001- Architectural & Industrial Maintenance (AIM) Coatings Phase I* adopted in 2001. This OTC model rule was updated in 2011 and includes requirements that are more stringent than what is found in the current ECCC regulations. Other relevant instruments in the U.S. include the CARB *Suggested Control Measures (SCM) for architectural coatings*, which were last updated in 2020. The SCM, which is more stringent than the current ECCC regulations, is a model rule developed by CARB that local air districts can use to develop their own rules. The South Coast Air Quality management District

[5] Cheminfo Services, Technical and Economical Study on VOC Emissions from Portable Fuel Containers: Final Report, prepared for ECCC, December 8, 2008.

(SCAQMD) *Rule 1113 - Architectural Coatings*, which were last amended in 2016, goes beyond CARB's SCM and includes the most stringent VOC concentration limits of all U.S. jurisdictions.

Many products in the Canadian market have significantly lower VOC concentrations limits than what is required by ECCC regulations. A 2020 technical study entitled *Potential Additional Emission Reductions from the Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations* (Cheminfo, 2020)[6] included a survey of products sold on the Canadian market, which showed that the percentage of reported products compliant with current OTC, CARB and SCAQMD limits were respectively 85.9%, 69.0% and 68.0%.

4.2.2 Proposed measure

ECCC is proposing to amend the *Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations* to achieve additional VOC reductions and reflect the current North American technology and architectural coating market. ECCC is proposing to adopt the current VOC concentration limits for coatings included in CARB's SCM for architectural coatings. Differences between Canada and California, in terms of climate, will be considered prior to adoption of stricter concentration limits. ECCC is not proposing the adoption of the CARB SCM limits for colorants, for which the estimated cost effectiveness is $42,586 per tonne reduced, with a modest reduction of 0.3 kt per year (Cheminfo, 2020).

These regulations are also being assessed under the ECCC regulatory stock review. This review stems from the 2018 *Treasury Board Secretariat Cabinet Directive on Regulation*, which lays out the rules and requirements for developing and implementing regulations. This review's goal is to ensure that the regulations continue to be appropriate and effective, and achieve their intended policy objectives. Information gathered during the review will be used to inform the regulatory amendment process.

4.2.3 Potential reductions

Adopting CARB's current SCM VOC concentration limits would yield further reductions of about 7 kt per year. This represents a VOC emission reduction of about 58% from current regulated levels. It is estimated that the cost effectiveness of this measure will be in the range of -$590 to $2,544 per tonne of VOC reduced (Cheminfo, 2020).

4.3 Automotive refinishing products

Automotive refinishing is the repair or maintenance of the worn or damaged coatings of automobiles, trucks, and other mobile equipment. VOC emissions from automotive refinishing are the result of the use of solvents in both cleaning and coating products. The solvents are released to the atmosphere by evaporation following product application. VOC emissions from

[6] Cheminfo Services, Potential Additional Emission Reductions from the Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations: Final report, prepared for ECCC, February 6, 2020.

aerosol coatings are addressed separately, in section 5.2. In 2018, automotive refinishing products were estimated to emit about 4 kt, or 0.8% of all VOC released by consumer and commercial products in Canada (table 1).

4.3.1 Current North American measures

ECCC published the *Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Products Regulations* in 2009. These regulations control the import, manufacture and sale of automotive refinishing products. These regulations establish concentration limits for VOCs in 14 categories of automotive refinishing products including pre-treatment wash primers, primer surfacers, primer sealers, colour coatings, clear coats, truck bed liner coatings, and surface cleaners.

The VOC concentration limits in the *Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Products Regulations* were based on the *2005 CARB Suggested Control Measure for Automotive Coatings*. In 2011, the OTC Model Rule for Mobile Equipment Repair and Refinishing (MERR), first published in 2001, was updated to reflect the 2005 CARB limits, but with some small differences. As such, the updated OTC rule is equivalent in terms of stringency to ECCC's regulations, except for 3 product categories for which it is more stringent: adhesion promoter, truck bed liner coating and single-stage coating.

4.3.2 Proposed measure

ECCC is considering amendments to the Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Products Regulations to address administrative and compliance issues. During the amendment process, ECCC will consider aligning our VOC concentration limits with the OTC 2011 MERR limits.

4.3.3 Potential reductions

The potential reductions in VOC emissions from amending these regulations are unknown but are expected to be small. A study quantifying the potential reductions and the cost to industry associated with these reductions will be carried-out prior to implementing regulatory amendments. The results of this study will inform any decision to modify the current VOC regulations.

4.4 Industrial and commercial adhesives and sealants

Adhesives, also referred to as "glues", are substances that allow the joining or bonding of two materials together. Sealants are materials with adhesive properties that are formulated primarily to fill, seal, waterproof or weatherproof gaps or joints between 2 surfaces. Sealants include sealant primers and caulks. VOCs are emitted as the adhesive or sealant products dry during their use. In this section the focus is on adhesive and sealants used in the industrial and manufacturing sectors such as, but not limited to, automotive, aeronautics, building and civil engineering projects, electronics, packaging, wood, furniture, metals, plastics and composites, textiles, and

footwear. In 2018, industrial and commercial adhesives and sealants were estimated to emit about 10 kt, or 2.1% of all VOC released by consumer and commercial products in Canada (table 1).

4.4.1 Current North American measures

Canada currently has no instruments in place to reduce VOC emissions from industrial and commercial adhesives and sealants. The proposed *Volatile Organic Compound (VOC) Concentration Limits for Certain Products Regulations* address some adhesives and sealants that are imported or manufactured in Canada. For instance, the regulations would apply to certain product categories used for consumer as well as commercial applications such as sealants and caulks, structural waterproof adhesives, aerosol adhesives, and non-aerosol adhesives. However, these regulations would not apply to products that are designed to be used solely in a manufacturing or processing activity.

In the U.S. there is no federal standard for industrial adhesive applications. The U.S. EPA developed the *Control Techniques Guidelines for Miscellaneous Industrial Adhesives* to assist states and local air pollution control authorities in developing approaches for controlling VOC emissions from miscellaneous industrial adhesive application processes. The OTC has a 2006 *Model Rule for Adhesives and Sealants* that limits VOC emissions from industrial and commercial adhesives, sealants and primers that 12 OTC member states have implemented. There is no CARB SCM for industrial adhesives and sealants. However, some districts, such as the SCAQMD have implemented rules to limit the VOC content of adhesives and sealants (*Rule 1168 - Adhesive and Sealant Applications* last amended in 2017).

4.4.2 Proposed measure

The proposed measure is to establish regulations targeting industrial and commercial adhesives and sealants, based on the OTC *Model Rule for Adhesives and Sealants and/or SCAQMD Rule 1168 Adhesive and Sealant Applications*. The plan is to collect information on the amount of VOCs emitted by industrial and commercial adhesives and sealants and the potential reductions that could be achieved by meeting the OTC or SCAQMD standards. This information will validate the need for regulations and determine which of the OTC or SCAQMD requirements would be the most relevant based on current technologies, state of the Canadian market and other unique Canadian circumstances, such as climate.

4.4.3 Potential reductions

The 2009 report entitled *Technical and Economical Study on Volatile Organic Compounds in Industrial and Commercial Adhesives* (Cheminfo, 2009)[7] provides an analysis of VOC emissions

[7] Cheminfo Services, Technical and Economical Study on Volatile Organic Compounds in Industrial and Commercial Adhesives: Final Report, Prepared for ECCC, March 27, 2009.

from 58 types of adhesives. According to this study, adhesives and sealants were the source of an estimated 12 kt of VOC emissions in 2005.

The study showed that a high percentage of the industrial/commercial adhesive and sealant product volume supplied to the Canadian market was compliant with the OTC and SCAQMD VOC content limits (82% compliance with OTC limits and just under 77% compliance with SCAQMD limits). Nevertheless, an additional 3 to 4 kt of VOC emission reductions could be achieved by adopting OTC VOC content limits in Canada. If the SCAQMD VOC content limits were adopted, VOC emission reductions could range from 4 to 5 kt. Cost to industry per tonne reduced was estimated to range from $390 to $3,100 if either the OTC or the SCAQMD limits are adopted.

4.5 Printing

There are 4 basic processes used in the printing industry: web offset lithography, web letterpress, rotogravure, flexography and in recent years, digital printing has become more prevalent. In addition, the use of low or zero VOC inks is increasing. Printing may be performed on coated or uncoated paper and on other surfaces such as plastic, metal and fabric. VOC emissions from printing vary depending on the printing process, ink formulation and coverage, press size and speed, and operating time. In 2018, printing was estimated to emit about 19.1 kt, or 4.0% of all VOC released by consumer and commercial products in Canada (table 1).

4.5.1 Current North American measures

The Canadian Council of Ministers of the Environment (CCME) published an *Environmental Code of Practice for Volatile Organic Compound Emissions from Commercial/Industrial Printing Industry* in 1999. The code is intended to provide a basis for implementing consistent and uniform control measures and operating standards for commercial and industrial printing facilities across Canada. The code provides guidance on minimizing VOC emissions from commercial and industrial printing in which flexography, rotogravure, lithography or letterpress printing processes are involved.

ECCC entered into an *Environmental Performance Agreement (EPA) with the Screen Printing and Graphic Imaging Association International* in 2004. The target was a 20% reduction in VOCs by 2008 from 2000 levels. The agreement expired in 2008 and there is currently no federal instrument in place. This EPA did not lead to expected reductions, and as such, there is a need to further explore control options for this sector.

The U.S. EPA promulgated the *New Source Standards of Performance for the Graphic Arts Industry: Publication Rotogravure Printing 40 CFR 60, Subpart QQ* which was first adopted 1982 and last amended in 2004. Currently, there are no CARB SCMs in place, although some California districts regulate printing activities. For example, the SCAQMD enacted:

- *Rule 1130 - Graphic Arts Printing Operations* (enacted in 1980, and last amendment in 2014)

- *Rule 1130.1. Screen Printing Operations* (enacted in 1991 and last amended in 1996)

These SCAQMD rules specify VOC limits for graphic arts printing materials and for screen printing materials, and include requirements for operational practices and approved emission control measures for the use of non-compliant materials.

4.5.2 Proposed measure

The 2019 report entitled *VOC Emission Estimations and Cost-Benefit Analysis of VOC Emissions from the Canadian Printing Industry* (ToxEcology, 2019)[8] states that the printing industry in Canada has been declining over the last decade as demand from printed media has plummeted. This baseline trend has impacted VOC emissions, resulting in a 52% decline over the 2007 to 2017 period. Offshoring and Canadian consumers' shift to digital media are expected to continue to constrain overall printing industry demand and as such, further reductions are expected over the next decade (ToxEcology, 2019).

However, printing on plastic packaging is one segment of the printing industry that continues to be a major source of VOC emissions. ECCC is proposing to develop a risk management instrument targeting this industry segment. Targeting printing on plastic packaging would focus the proposed measure where it will have the most impact.

Based on data reported to the National Pollutant Inventory (NPRI) for 2017, 14 of the 21 facilities that would be targeted by this measure are located in Ontario. The other 7 facilities are distributed among Quebec, Manitoba, Nova Scotia and British Columbia.

Ink reformulation or water-based inks are not considered viable options for printing on plastic materials because printing on a plastic substrate requires a high solvent ink, which evaporates quickly, to prevent smearing and ensure adhesion.

ECCC is working towards a vision of zero plastic waste, where all plastics are kept in the economy and out of landfills and the environment. As part of its comprehensive zero plastic waste agenda, the department is developing an integrated management approach to plastics, which would seek to eliminate sources of plastic pollution, create viable domestic secondary end markets for plastics, and improve value recovery of plastic products and packaging. Some of these measures may lead to a reduce demand for plastic packaging material. ECCC will monitor the impact of the zero plastic waste agenda on VOC emissions from printing on plastic packaging and consider its impacts prior to moving forward with the development of a risk management instrument targeting this activity.

[8] ToxEcology, VOC Emission Estimations and Cost-Benefit Analysis of VOC Emissions from the Canadian Printing Industry: Final Report, prepared for ECCC, March 18, 2019.

4.5.3 Potential reductions

Total annual VOC emissions from printing were estimated to represent 15 kt in 2017. Of these emissions, 70% are associated with printing on plastics. The majority (21) of the 24 largest emitting facilities that report to the NPRI print on plastic packaging and do not currently have add on controls to reduce VOC emissions. Installing Regenerative Thermal Oxidizers (RTO) to control the VOC releases from these facilities would generate a reduction of about 6 kt (40%) from 2017 levels. The associated annualized cost per tonne of VOC reduced would range from $673 to $733 (ToxEcology, 2019).

5. Other activities

In addition to implementing the proposed measures, ECCC is recommending other activities to support the federal agenda and prepare for the development of measures post 2028. These activities are described below.

5.1 Excluded VOCs

VOCs are a family of organic compounds that contain one or more carbon atoms and have high vapour pressures so that they evaporate readily into the atmosphere. While there are thousands of compounds that meet this definition, ECCC is concerned with the VOCs that participate in atmospheric photochemical reactions and are therefore harmful to human health and the environment. These VOCs are defined under Schedule 1 (item 65) of CEPA. The VOC definition specifically excludes a list of photo-chemically low-reactive compounds such as methane, ethane and the chlorofluorocarbons (CFCs).

Proposed activity

ECCC will update, on an as needed basis, the VOC definition to mirror the list of excluded compounds included in the U.S. EPA VOC definition. This measure will allow further alignment with U.S. regulations and will provide greater flexibility to industry, allowing them to utilize additional excluded compounds in their formulations that do not contribute to smog formation.

5.2 Aerosol coatings

An aerosol coating product consists of pressurized pigments or resins dispensed by means of a propellant.[9] Various types of coatings are contained in aerosol packaging, including clear coatings, flat paint, fluorescent paint, metallic coatings, non-flat paint, primers, ground traffic/marking paint and specialty coatings, including automotive coatings. The use of aerosol coating products results in VOC emissions that originate from the propellants and solvents

[9] Definition taken from the California Air Resources Board's Regulation for Reducing the Ozone formed from Aerosol Coating Product Emissions.

contained in the product. The solvents used in aerosol coatings evaporate during the coating application and drying processes.

There are several aerosol coating products for which there are currently no measures in place in Canada to reduce VOC emissions. These products are specifically excluded from the *Volatile Organic Compound (VOC) Concentration limits for Architectural Coatings Regulations* and the *Volatile Organic Compound (VOC) Concentration Limits for Automotive Refinishing Products Regulations*.

There are federal and state measures in place in the U.S. CARB's *Regulation for Reducing the Ozone Formed from Aerosol Coating Products Emissions* came into force in 2002. The regulation provides reactivity-based requirements instead of the traditional grams per litre for VOC content limit. This regulation served as the model for the U.S. EPA's 2007 *Aerosol Coatings: National Volatile Organic Compound Emission Standards*. This U.S. EPA National Standard was last amended in 2012. The CARB and U.S. EPA measures apply to aerosol products used in consumer, institutional, industrial and commercial settings.

Proposed activity

A study contracted by ECCC entitled *Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products*[10] was completed in 2010. The study's results showed that 7043 tonnes (t) of aerosol coating were supplied to the Canadian domestic market in 2008 and that these products contained 4 kt of VOCs. A total of 3208 unique aerosol coating products were identified by study respondents. Of these products, 96.9% were compliant with the CARB and U.S. EPA ozone reactivity limits. It was estimated that harmonizing with the CARB/U.S. EPA reactivity limits would yield a total of 42 t of annual VOC emission reductions in Canada.

As the available data is dated and shows that no significant reductions would be achieved from controlling this type of product, ECCC will conduct a new study to evaluate the current situation and re-assess the potential emission reductions associated with the current U.S. measures and associated costs. This information will be used to re-assess if a measure targeting this sector is required.

5.3 Cars, vans, light trucks assembly & auto parts coatings

This category targets products used in assembly line coating operations conducted during the manufacturing of new motor vehicles or new motor vehicle parts. In 2018, 8 kt of VOCs were emitted from vehicle manufacturing (engines, parts, assembly, painting).[11] Of these emissions,

[10] Cheminfo Services, Technical Study on Volatile Organic Compounds/Challenge Substances in Aerosol Coating Products: Final Report, prepared for ECCC, March 25, 2010.

[11] ECCC, Pollution Data Division. Canada's Air Pollutant Emissions Inventory Report: chapter 2.4, 2020.

3 kt were associated parts coatings.[12] Vehicle manufacturing is located exclusively in Ontario while the majority of parts manufacturing takes place in Ontario and Québec.

There is no federal instrument targeting this sector. There are however, *Recommended CCME Standards and Guidelines for the Reduction of VOC Emissions from Canadian Automotive Parts Coatings Operations* that were published in 2002. The extent to which these standards and guidelines have been adopted by provinces is unknown. The U.S EPA published the *Control Techniques Guidelines for Automobile and Light-Duty Truck Assembly Coatings* in 2008. The only U.S. mandatory requirement identified is the California SCAQMD *Rule for Motor Vehicle Assembly Line Coating Operations (Rule 1115)*. This rule was adopted in 1979 and was last amended in 1995.

Proposed activity

ECCC will gather information on the current state of provincial requirements to control VOC emissions from motor vehicle assembly lines or parts manufacturing coating operations. ECCC will then identify potential reductions in VOC emissions achievable by controlling this source of emissions and the cost and feasibility of applying such measures in Canada. As these sources are typically regulated by provincial jurisdictions, we will engage them about the need to develop further measures. This information will be used to determine if there is an opportunity to achieve significant VOC reductions.

5.4 Plastic, rubber, leather and glass coatings

This category targets products used to coat plastic, rubber, leather and glass parts and accessories manufactured to be used, for example, in recreational vehicles, businesses, laboratories and medical equipment. In 2016, 2 kt of VOCs were emitted from plastic parts coatings.[13] Emissions from rubber, leather and glass product coatings are unknown.

The only relevant North American instrument identified is California SCAQMD *Rule 1145 - Plastic, Rubber, Leather and Glass Coatings*. This rule was published in 1983 and was last modified in 2009.

Proposed activity

ECCC will gather information on the current state of provincial requirements to control VOC emissions from plastic, rubber, leather and glass product coatings. ECCC will then identify potential VOC emissions that could be achieved by controlling this source of emissions and the cost and feasibility of applying such measures in Canada. As these sources are typically regulated by provincial jurisdictions, we will also engage in discussions with provincial authorities to gauge

[12] ECCC, Pollution Data Division, Canada's Air Pollutant Emissions Inventory for 2016.

[13] ECCC, Pollution Data Division. Canada's Air Pollutant Emissions Inventory; Solvent Use Model Data for 2016, 2018.

the need and interest in developing a federal measure targeting this sector. This information will be used to determine if a measure targeting this sector will achieve significant VOC reductions.

5.5 Solvent degreasing

Solvent degreasing can be defined as a physical process that uses solvents to remove soils from a substrate by dissolving or dispersing the soils. The use of solvents in degreasing processes results in VOC emissions.

Canada currently has *Solvent Degreasing Regulations* in place, but these only cover 2 specific toxic substances listed in CEPA, Schedule 1: tetrachloroethylene (PERC) and trichloroethylene. In the United States, some standards also apply to VOCs. If a similar approach is adopted in Canada, this could lead to potential additional reductions beyond the existing regulations.

Proposed activity

ECCC will conduct a study to identify potential VOC emission reductions that could be achieved by implementing measures to cover all VOC-containing solvent that are used in solvent degreasing operations. This information will be used to determine if additional measures targeting this sector are required.

5.6 Pesticides

Pesticides are used to control pests such as insects, rodents, weeds and fungi. These products can be used, for example, to protect agricultural crops, or in consumer/commercial settings. Some of these pesticides contain VOC solvents in their formulations to make the active ingredients more efficient in their application. These products release VOCs when applied.

The Pest Management Regulatory Agency administers the *Pest Control Products Act* (PCPA) for the federal Minister of Health. The PCPA regulates the use of substances that have a pest control use. The Act also regulates other substances, such as formulants, adjuvants and contaminants that are contained in pest control products. The Act is supplemented by the *Pest Control Products Regulations*.

Proposed activity

In order to better understand the contribution to the overall VOC emissions and their possible impacts on the environment, the Government of Canada will conduct a study to validate current pesticide VOC emissions estimates, allocate emissions to specific products and activities, and assess potential approaches for emission reductions. This study will help determine if any additional measures targeting pesticides are required.

6. Summary & timelines

Table 3 below provides a summary of the proposed measures and their associated timelines.

Table 3: summary of proposed measures and associated timelines for the 2021 to 2028 period

Products/sector	Proposed measure	Potential reductions (kt VOC/yr)	Timelines (work begins/final publication)
Architectural coatings	Amending regulations to align with current OTC or CARB requirements.	7	2020/2022
Automotive refinishing products	Amending regulations to resolve administrative and other issues; may revise some VOC concentration limits to align with current OTC requirements.	Unknown	2021/2023
Industrial and commercial adhesives and sealants	Regulations based on the OTC Model Rule and/or SCAQMD Rule.	4 to 5	2021/2025
Portable fuel containers	Regulations based on CGSB standard and/or U.S. requirements.	60+	2020/2027*
Printing	Risk management instrument targeting the activity of printing on plastic packaging.	6	2025/2028

* If an evaluation of the effectiveness of the voluntary standard warrants further action, regulations may be developed.

7. Next steps

Stakeholders have until April 8, 2021 to provide comments on this consultation document. Comments received during the consultation period will be reviewed and considered for the elaboration of the final renewal of the *Federal Agenda on the Reduction of Volatile Organic Compound (VOC) Emissions from Consumer and Commercial Products (2021-2028)*. The federal agenda will be published as a formal Notice of Intent (NOI) in Part I of the *Canada Gazette*. The NOI will lay out an agenda of planned measures and future activities to be undertaken by 2028 to reduce VOC emissions from consumer and commercial products.

Instrument development under the federal agenda will follow standard processes, including appropriate consultations with stakeholders.