CHRONIC WASTE:

Strategies to reduce waste and encourage environmentally-friendly packaging in Canada's legal cannabis industry

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McGill | MAX BELL SCHOOL of PUBLIC POLICY

July 2020

Acknowledgements

For their invaluable support and guidance, we would like to thank:

Our academic advisor, Andrew Potter, Associate Professor, Max Bell School of Public Policy

Our sponsor, Health Canada

Cannabis Council of Canada
George Smitherman, President and Chief Executive Officer

Cannasupplies
Hilary Lieberman, Executive Director
Mark Finkelstein, Vice President, Sales & Strategic Development

Canopy Growth Corporation
Dr. Mark Ware, Chief Medical Officer

McGill University
Dr. Carolyn Baglole, Associate Professor, Department of Medicine
Nathalie Duchesnay, Lecturer, Max Bell School of Public Policy
Dr. Sébastien Jodoin, Assistant Professor, Faculty of Law
Dr. Hamish Van der Ven, Assistant Professor, Department of Political Science

Others
Jameson Berkow, Founding Editor-in-Chief, *The Rise*
Michael DeVillaer, Centre for Medicinal Cannabis Research, McMaster University & St. Joseph's Healthcare Hamilton
Kathleen Ganley, Member of the Legislative Assembly of Alberta for Calgary-Mountainview
Éliane Hamel, Director (Social responsibility, health protection, education and communications), Société québécoise du cannabis (SDQC)
Darby Hoover, Senior Resource Specialist, Natural Resources Defense Council
Jo-Anne St. Godard, Executive Director of the Recycling Council of Ontario
Jordan Wellington, Vice-President (Policy), VS Strategies

Special thanks to Tom Szaky, Chief Executive Officer and founder of TerraCycle, for his book *The Future of Packaging: From Linear to Circular*, which greatly informed our work.

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Executive Summary

In 2018, Canada legalized recreational cannabis, guided by the objectives of reducing harm, protecting public safety, reducing illicit activity, and protecting young people. But this progressive social policy has come at environmental cost: nearly two years after legalization, the cannabis industry has significantly contributed to virgin plastic manufacturing, consumption, and waste. It is estimated that a standard 3.5-gram package of dried cannabis comes packaged in more than 70 grams of plastic.[1] Packaging waste and plastic pollution is an unintended consequence of legalization and a blight on the industry.

The world produces 100 million tons of plastic annually – the equivalent in weight of 2,502,556 Montréal metro cars filled with rush-hour commuters.[2] Despite 98% of Canadians having access to recycling facilities, Canadians only recycle 9% of the plastic that they consume.[3] And even when they do, 86% of the plastic that lands in recycling bins is ultimately discarded in landfills.

Reducing cannabis packaging waste and the quest to incentivize environmentally-friendly solutions are at the heart of this policy lab challenge. This report analyzes eight strategies to minimize waste while limiting risks to public health and safety. To do so, we established evaluation criteria guided by the *Cannabis Act*, and grounded in research considerations generated from dialogue with cannabis industry stakeholders, including the Government of Canada, cannabis producers, industry associations, public health experts, and environmental and national and international regulatory experts.

We recommend that Health Canada pursue the following three strategies:

1. Introduce an Extended Producer Responsibility program and a consignment and recycling system in public retail stores;
2. Standardize cannabis packaging by type of product;
3. Remove child-resistance from non-psychoactive cannabis products.

While producers and regulators have introduced initiatives to bring flexibility to packaging, this report explores the root of the problem and delivers recommendations that encourage all stakeholders to remove barriers to waste reduction.

Without coordinated action and dialogue between Health Canada and the cannabis industry, packaging waste will continue to grow. Consumers are calling out for more environmentally-friendly packaging alternatives; with the right policy instruments and grounding in public concern, the recommendations put forth in this report can heed that call and bring lasting reform to an emerging industry.

I. The Problem

POLICY CHALLENGE: What policy measures could Health Canada implement to reduce packaging waste and encourage more environmentally-friendly packaging for legal cannabis products?

GOALS: To analyze and assess the potential effectiveness of various policy options to reduce packaging waste and encourage more environmentally-friendly packaging for legal cannabis products.

A. Climate Change

Climate change is the most significant threat that impacts the planet today. In 2018, the Intergovernmental Panel on Climate Change (IPCC), an intergovernmental body of the United Nations, stated that governments must act on this transnational threat in the next 12 years to ensure that global temperatures do not rise beyond 1.5 degrees Celsius above pre-industrial levels.[4] Climate change is occurring at rates much faster than anticipated; its effects are pernicious, far-reaching, and harmful to ecosystems, societies, and economies.

B. Canada's Climate Action Plan

In 2015, Canada adopted the 2030 Agenda for Sustainable Development Goals (SDGs). Sustainable Development Goal 12 urges governments to "ensure that current material needs to not lead to the over-extraction of resources or to the degradation of environmental resources."[5]

Under the Paris Agreement, a 2015 multilateral agreement within the United Nations Framework Convention on Climate Change, Canada pledged to reduce its greenhouse gas emissions by 30% below 2005 levels by 2030.[6] In 2019, the 2005 level was estimated at 730 megatonnes of carbon dioxide equivalent.[7] The Government of Canada plans to achieve net-zero emissions by 2050.

In 2018, as part of its leadership of the G7, Canada sought to mobilize international support by launching the Oceans Plastic Charter, which outlines concrete steps to reduce plastic pollution in waterways.[8]

SINGLE-USE PLASTICS BAN:

In June 2019, Prime Minister Justin Trudeau announced his government's intention to ban harmful single-use plastics and hold companies responsible for plastic waste. Plastic waste both endangers the health of ecosystems and communities and represents a lost economic opportunity.

The government plans to work with provinces, territories, businesses, and other stakeholders to realize this goal. An ongoing initiative through the Canadian Council of Ministers of the Environment (CCME) will lead to an action plan to implement a Canada-wide Strategy on Zero Plastic Waste, which aims to keep all plastics out of the economy and their waste out of the environment.

A single-use plastics ban could be introduced in Canada as early as 2021, though the COVID-19 public health crisis may lead the government to reevaluate this timeline.

POLICY TOOLS:

- Under the *Canadian Environmental Protection Act* (1999), the government will ban some single-use plastics products, including shopping bags, cutlery, and stir sticks, and take other steps to reduce plastic waste.
- Additional regulatory actions may include mandating that newly manufactured products have a set quantity of recycled content or are easily repaired or recycled.
- The government will work with provinces and territories, through the CCME, to encourage the development of Extended Producer Responsibility (EPR) initiatives across the country, aiming to make private firms physically and or financially responsible for the management of their products and packaging throughout their life cycles.

In addition, quantifiable targets for plastics collection, recycling, and recycled content requirements will be developed with provinces, territories, and industry.

C. The Problem with Plastic

Each year, the world produces approximately 100 million tons of plastic – the equivalent weight of 2,502,556 Montréal metro cars filled with rush-hour commuters.[9]

Today, 99% of plastic is derived from fossil fuels, a significant source of greenhouse gas emissions. Low oil prices drive down the cost of virgin plastic, whose production impacted climate as much as 189 coal-fired power stations in 2019.[10] By 2050, it is predicted that plastic production will be responsible for 13% of the world's total carbon budget.

Plastic production, consumption, and waste also clog landfills, threaten oceans and marine life, and affect human health. At least 8 million tonnes of discarded plastic – the equivalent of 200,204 Montréal metro cars[11] – enter the world's oceans each year. Plastic pollution in our oceans is projected to double by 2030.

In the United States, 94% of tap water samples tested positive for microplastics – tiny shards of plastic that are less than 5 millimetres in length[12] – that come from the breakdown of plastic products. In Canada, researchers at McGill University tested a sampling of leading brands of bottled water;[13] microplastics were found in each.

According to a study from the United Nations Food and Agriculture Organization, these particles, and the additives they contain, can affect human health.[14] The 170 fracking chemicals to create the feedstock for plastics can also cause toxicity and cancers in humans.[15]

WHAT IS RECYCLING?

Industrial Revolution
Before formal recycling programs, high material costs and limited supply made recycling and reuse sensible. Periods of war inspired more systematized methods of collecting materials for reuse and recycling. Patriotic citizens gathered materials to support war efforts.

World War II
Recycling quotas planted the seeds of many recycling programs that exist today.

Post-war
Consumerism became a form of patriotism that supplanted thrift. Economic prosperity led to increasing waste.

1960s and 1970s
Waste reduction and environmental protection gained widespread support.

The Government of Canada created the first Department of Environment; provinces developed environmental regulations and dedicated bureaucracies; and municipalities started to recycle.

RECYCLABILITY

Technically, any material is recyclable if cost is not a concern. In practice, recycling is a function of practical feasibility and the demand for secondary recycled materials. Packaging is recyclable if it can be collected, sorted, reprocessed, and ultimately reused in manufacturing. Initiatives such as removing plastic windows from cardboard packaging, reducing plastic coatings, and making packaging out of single materials significantly increase the likelihood that products may be usefully and cost-effectively recycled.

D. Recycling in Canada

In Canada, provinces and territories are responsible for the licensing and permitting of waste management;[16] this includes recycling centres, hazardous waste facilities, and landfills. Municipalities are responsible for facilities and set intake standards.

Cost-sharing for recycling varies significantly across Canada. For instance, the City of Toronto splits recycling costs with the Government of Ontario, while cities in Saskatchewan incur 80% of recycling costs.[17] The first blue box curbside recycling program, now a staple in cities across Canada, was launched in Kitchener, Ontario in 1981.[18] Today, it is estimated that 98% of Canadians have access to some form of local recycling.[19]

Despite widespread access, only 9% of the 3.2 million tonnes of plastic waste generated annually in Canada is recycled.[20] Approximately 86% of plastic waste is diverted to landfills and 1% is leaked into the environment.[21] The rest is incinerated to generate energy.

Each percentage of plastic waste represents 29,000 metric tonnes of litter, equivalent to 725 Montréal metro cars packed with commuters.[22]

Deloitte suggests that a robust recycling industry, with a 90% uptake rate, could lower greenhouse gas emissions and boost the economy, creating 17,000 direct jobs and 25,000 indirect jobs in Canada.[23] Without significant changes, plastic waste sent to landfills would represent a lost value of $11.1 billion by 2030.

E. Legal Cannabis and Packaging

The *Cannabis Act*, which regulates the cannabis industry in Canada, sets stringent packaging and labelling requirements, but does little to address the reality of excessive packaging waste. Cannabis products are required to display large standardized labels and be sealed by excise stamps specific to each jurisdiction. Producers are also prohibited from all forms of advertising to limit appeal to young people.

Cannabis regulations – grounded in concern for public health and public safety – have led producers to package products in larger and more resource-intensive containers than necessary. Excessive packaging is a result of designs that must accommodate large standardized labels and excise stamps, regardless of the packaged contents' volume.

Nearly two years after legalization, the cannabis industry is undergoing a period of financial upheaval, consolidation, and shaky investor confidence. The industry is extremely cost-sensitive, with many producers actively shedding expenses. Like the Canadian tobacco and alcohol industries, the cannabis industry is prohibited from engaging in traditional marketing, limiting their ability to differentiate themselves in the marketplace.

With no way to communicate to customers whether their packaging is environmentally-friendly, some producers may find it difficult to justify moving away from inexpensive virgin plastic. Taken together, cannabis producers are risk-averse and have few incentives to explore innovative packaging solutions.

Complicating matters, the *Cannabis Act* and associated regulations do not permit Health Canada to review packaging options for issues unrelated to health and safety. As a result, producers are informed of packaging non-compliance by way of costly recalls. Without packaging pre-approval, producers are unlikely to take on the cost and risk of innovating.

The current regulatory regime is partially responsible for the growing problem of packaging and plastic waste in the cannabis industry. High volumes of waste have caused the industry, and to a lesser extent, Health Canada, significant reputational damage.[24] The regulatory burdens that reduce incentives to innovate contribute to environmental degradation and hinder the legal industry's ability to compete with the illicit market.

To meet Health Canada's goal of reducing waste and encouraging more environmentally-friendly cannabis packaging, policy solutions must balance regulatory imperatives and financial burdens, while ensuring that the market is competitive and free to innovate.

II. The Landscape

A. Historical Landscape

Planting the Seeds

In 1923, cannabis was first made illegal when Prime Minister William Lyon Mackenzie King's Liberal government introduced the *Act to Prohibit The Improper Use of Opium and Other Drugs,* which added "cannabis indica (Indian Hemp) or hasheesh" to the list of prohibited drugs alongside heroin and codeine.[25]

Criminalization did not reflect a social problem.[26] Police did not seize cannabis until 1932;[27] the first possession offences occurred in 1937.[28]

In 1961, Canada signed the United Nations Single Convention on Narcotic Drugs, which outlawed cannabis production and supply.[29] In the following years, cannabis grew in popularity, spurred by young people's consumption and the hippie counterculture.[30] By the mid-1960s, the law imposed a maximum penalty of six months in prison and a $1,000 fine ($8,149.70 in 2020 dollars[31]) for a first offence of cannabis possession.[32]

In 1969, the federal government launched the *Royal Commission of Inquiry in the Non-Medical Use of Drugs,* known as the Le Dain Commission. In 1973, the Commission recommended that cannabis possession be decriminalized but not legalized.[33]

Cannabis possession arrests nevertheless continued to climb, reaching a peak of over 65,000 arrests in 1981. The years 1980 and 1981 also saw the highest levels of drug offences in Canadian history, at 303 per 100,000 people.[34] After a significant decline between the late 1980s and early 1990s, drug arrests started to increase again.[35]

The Frontier of the 21st Century

In 2000, the Ontario Court of Appeal ruled that cannabis prohibition was unconstitutional because it did not allow for medical use.[36] In response, the federal government enacted the *Marihuana for Medical Access Regulations* (MMAR) in 2001,[37] permitting licensed patients to grow or access cannabis for medical purposes.[38]

The first effort to decriminalize non-medical marijuana came in 2003 under Prime Minister Jean Chrétien's Liberal government, which sought to reduce possession of 15 grams or less to a fineable offense.[39] Chrétien's successor, Paul Martin, attempted to introduce an identical decriminalization measure in 2004, but the bill was defeated when his minority government lost reelection.[40]

Cannabis prohibition reached its apex when mandatory minimum prison sentences were imposed on illegal producers and dealers,[41] as part of Conservative Prime Minister Stephen Harper's 2012 omnibus bill, the *Safe Streets and Communities Act*.[42]

In 2013, however, the Conservative government introduced the *Marihuana for Medical Purposes* (MMPR) framework, which laid down the foundation for a commercially licensed medical cannabis industry.[43] This new framework replaced the MMAR framework, whose restrictions on possession and production were judged to be constitutionally invalid.[44]

In 2015, the Supreme Court ruled that it was unconstitutional to restrict medical cannabis to flower only and made it legal for producers to offer cannabis oils and extracts, as well as infused foods and drinks.[45]

Final Steps to Legalization

In 2015, Liberal Prime Minister Justin Trudeau announced that his government would legalize recreational cannabis.[46] The following year, the *Task Force on Marijuana Regulation and Legalization* concluded that cannabis prohibition did not protect youth and left many Canadians with damaging criminal records for simple possession charges.[47] The task force outlined that legalization should aim to protect youth, eliminate the illicit market, and reduce the burden on the criminal justice system.[48] Decriminalization alone was deemed insufficient to counter the illicit market and organized crime.[49]

In April 2017, Bill C-45, the *Cannabis Act*, was introduced. The bill received Royal Assent in June 2018. Coupled with its companion legislation, Bill C-46, *An Act to Amend the Criminal Code*, it legalized the possession, use, cultivation, and purchase of cannabis for recreational purposes by adults in Canada, and placed cannabis regulation in federal jurisdiction.[50] On October 17, 2018, when the new laws came into force, Canada became the second country in the world, after Uruguay, to legalize recreational cannabis.[51]

B. Regulatory Landscape

1. Overview of Canadian Laws and Frameworks

Document	Governing authority	Amendment process
Cannabis Act	Parliament	Amending Act of Parliament
Cannabis Regulations	Health Canada and Treasury Board	Governor in Council order
Packaging Guidelines	Health Canada	Department directive

Cannabis Act

Effective as of October 17, 2018, the *Cannabis Act*, which lays out the framework for legalization and can only be amended by Parliament, states as its purpose to protect public health and safety, and in particular to:

a) protect the health of young persons by restricting their access to cannabis;
b) protect young persons and others from inducements to use cannabis;
c) provide for the licit production of cannabis to reduce illicit activities in relation to cannabis;
d) deter illicit activities in relation to cannabis through appropriate sanctions and enforcement measures;
e) reduce the burden on the criminal justice system in relation to cannabis;
f) provide access to a quality-controlled supply of cannabis; and
g) enhance public awareness of the health risks associated with cannabis use.[52]

The *Cannabis Act* allows for the authorized sale of the following products, by class:[53]

- Dried cannabis;
- Fresh cannabis;
- Cannabis plants;
- Cannabis seeds;
- Edible cannabis;
- Cannabis extracts (as of October 17, 2019, this includes cannabis oil[54]) and
- Cannabis topicals.

Cannabis Regulations

In accordance with the *Cannabis Act*, the Cannabis Regulations outline the rules around recreational cannabis licensing, permits, security, production, promotion, testing, packaging, and labelling.

According to Section 139 of the *Act*, the regulations may be amended by order of the Governor in Council. This requires collaboration between Health Canada and the Treasury Board, and bypasses the necessity for an Act of Parliament, as long as the amendments comply with the *Act*.

2. Packaging and Labelling Guidelines

The Cannabis Regulations set out cannabis packaging and labelling requirements to be met before sale or distribution:[55]

- Plain packaging and labelling for all cannabis products with restrictions on logos, colours, and branding;
- Child-resistant container;
- Standardized labelling with the cannabis symbol;
- Mandatory health warning message; and
- Specific product information (e.g., brand name of the cannabis product, class of cannabis, delta-9-tetrahydrocannabinol (THC), cannabidiol (CBD) information, and licence holder information).

These measures are designed to:

- Reduce the appeal of cannabis products, especially to young persons;
- Make the standardized cannabis symbol and health warning messages more prominent and noticeable to avoid accidental consumption and overconsumption; and
- Provide consumers with accurate information about the content and use of the product.

Licence holders are responsible for complying with the *Act*, Regulations, and other legislation that may apply to them or their activities, effectively shifting the onus of compliance onto producers.

Labels for all classes of cannabis products must include:[56]

- Contact information of the licence holder;
- Class of cannabis;
- Lot number;
- Recommended storage conditions;
- Packaging date;
- Net weight of the cannabis;
- Warning statement in upper case font; and
- Number of discrete units (if applicable).

3. Standard Cannabis Label Overview

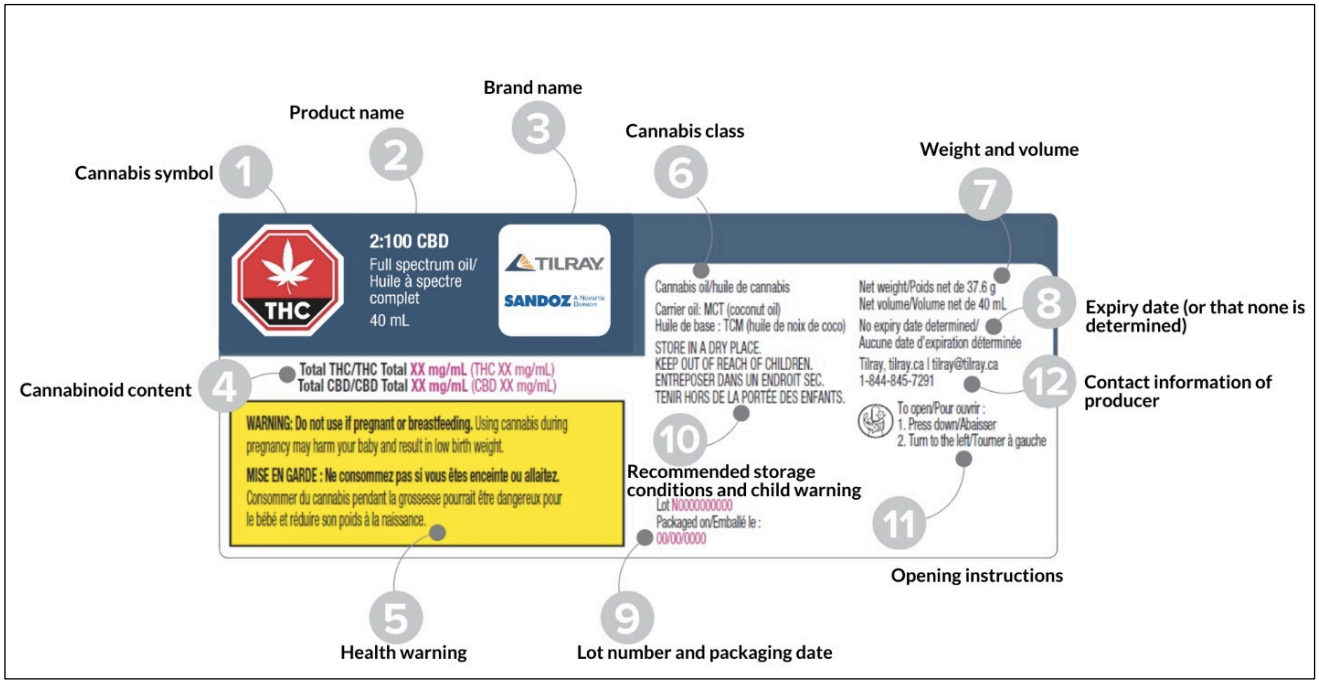

Figure 1. An example of topical cannabis product label.
Source: Fryer, Melissa. "New Product Labels." Tilray, April 10, 2019. https://www.tilray.ca/en/blog/post/new-product-labels.)

Health Canada does not review or pre-approve packages or labels, and instead applies a risk-based approach to compliance and enforcement.[57] It uses ministerial orders to provide information, tests, studies, and recalls to address issues of non-compliance that could impact public health or public safety.

4. Provincial and Territorial Retail Models

Provinces and territories are responsible for determining how cannabis is distributed and sold within their jurisdictions.[58] They set rules regarding:

- How cannabis can be sold;
- Where stores may be located;
- How stores must be operated; and
- Who is allowed to sell cannabis.

Provinces and territories also have the flexibility to set added restrictions, including:

- Lowering possession limits;
- Increasing the minimum age;
- Restricting where cannabis may be used in public; and
- Setting added requirements on personal cultivation.

Frameworks for retail cannabis sales vary widely. Health Canada licenses and regulates cannabis producers under Canada's federal model of governance, while provinces and territories develop retail and distribution models. Retail structure, sales revenues, and the vitality of the illicit market vary significantly by region. Federalism presents opportunities for dialogue centered on how varied legal frameworks realize the mandate of the *Cannabis Act*. This dynamic could foster inter-jurisdictional policy learning.

Each subnational government can choose to have cannabis products sold by public entities, private companies, or a hybrid of the two. The following describes the model chosen by each provincial and territorial government:[59]

Subnational Jurisdiction	Retail Stores	Online Retail	Wholesale and Distribution
Alberta	Private	Public	Public
British Columbia	Hybrid	Public	Public
Manitoba	Private	Private	Public
New Brunswick	Public	Public	Public
Newfoundland and Labrador	Private	Public	Public
Northwest Territories	Public	Public	Public
Nova Scotia	Public	Public	Public
Nunavut	Hybrid (expected)	Private	Public
Ontario	Private	Public	Public
Prince Edward Island	Public	Public	Public
Québec	Public	Public	Public
Saskatchewan	Private	Private	Private
Yukon	Hybrid	Public	Public

5. Ecosystem

The following shows the various actors involved in the legal cannabis ecosystem, and their relationship to each other:

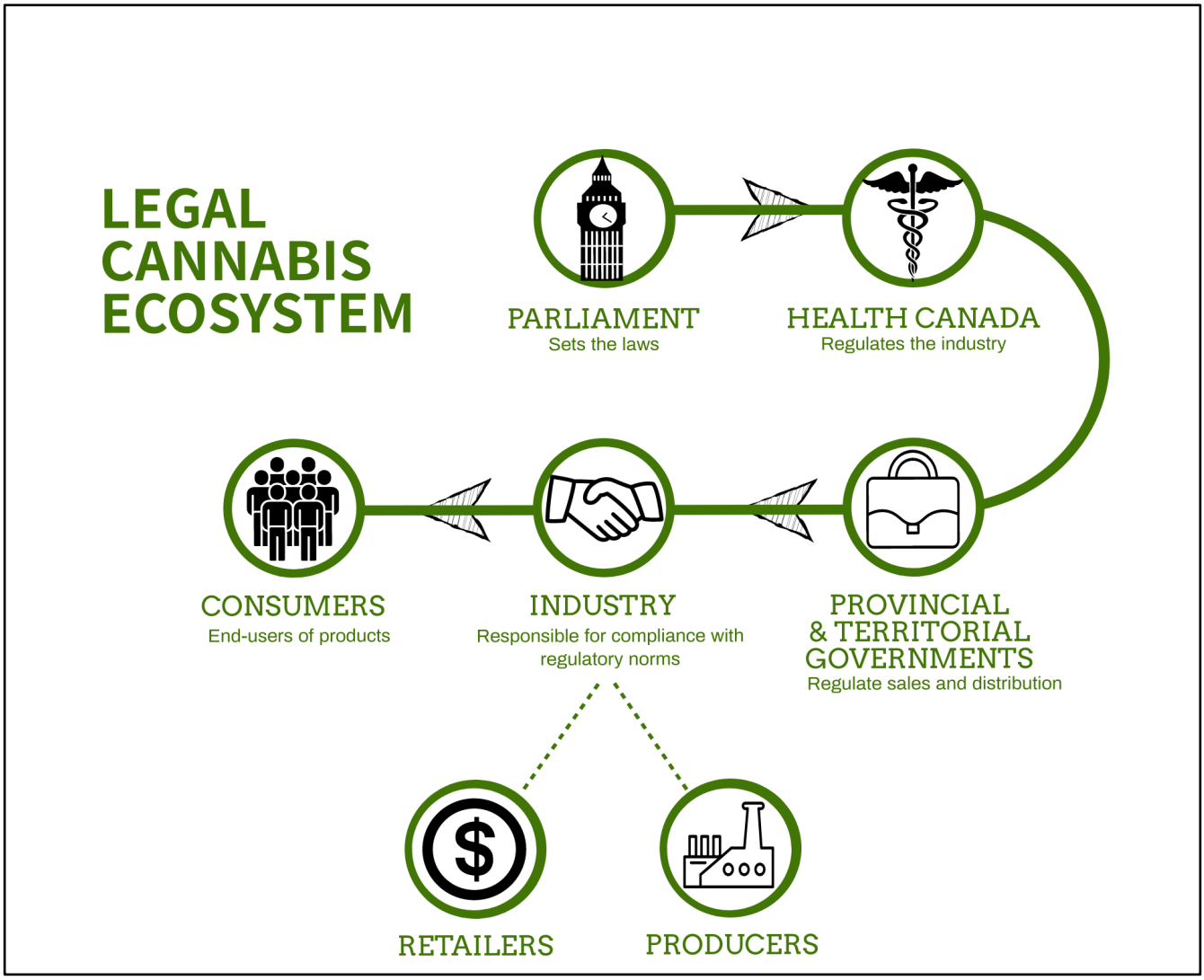

Figure 2. The Canadian legal cannabis ecosystem.

Parliament created the *Cannabis Act* and can pass amending legislation as necessary. **Health Canada** is the federal government's regulating body for the cannabis industry, responsible for enforcement of the *Cannabis Act* and associated regulations. **Provincial and territorial governments** are responsible for setting up distribution and retail models, while deferring to municipalities on local consumption bylaws. **Industry** consists of both producers and retailers. Depending on the jurisdiction, consumers may purchase products directly from a producer (e.g., Tweed in Ontario) or a retailer (e.g., the Société québécoise du cannabis (SQDC) in Québec). **Consumers** are the end-users of recreational cannabis products.

CANNABIS CONSUMPTION IN CANADA:
In the first year following legalization, legal cannabis sales online and in retail stores reached $908 million, equivalent to **$24 of legal cannabis per capita**.[60]

Data made publicly available indicates that as of the April 2020 reporting period:

- 7,592,177 packaged units of cannabis were sold across Canada for medical and non-medical purposes:[61]
    - Dried cannabis represented 73% of sales;
    - Cannabis extracts represented 14% of sales; and
    - Edible cannabis represented 12% of sales.

C. Industry Challenges

Cannabis sales expectations were sky-high before legalization. Legal cannabis was anticipated to account for two-thirds of all recreational cannabis sales and total $4.34 billion in sales in 2019.[62] Multiple supply chain bottlenecks, limited storefronts in populated areas, and low demand have meant that forecasts fell short. In the first year following cannabis legalization, Canadians spent $908 million on legal cannabis,[63] well below expectations.[64]

As of June 2020, there are over 700 legal cannabis retail locations across Canada. Ontario and Québec, Canada's two most populous provinces, have 58 and 40 storefronts, respectively,[65] catering to a population of 23 million people.[66] The slow rollout of licensed retail stores has limited the reach of the legal cannabis market. As of July 2019, 45% of Canadians lived within 10 kilometers of a licensed cannabis retailer;[67] this should continue to rise as more licences are issued, stores opened, and supply chains streamlined.

A lack of physical retail options drives some consumers to the illicit market, where cannabis is readily available at more affordable prices.[68] Statistics Canada data shows that the illicit market still accounted for between 70 and 80% of all cannabis sales in 2019.[69]

The average cost of legal cannabis has increased to $10.30 per gram, while that of illegal cannabis has fallen to $5.73 per gram.[70] Price continues to be a critical factor for consumers. If the *Cannabis Act* is to achieve its goal of eliminating the illicit market, this stark price differential must be addressed.[71]

Despite initial hurdles, the cannabis industry is maturing and expanding product offerings. Often referred to as "Cannabis 2.0" products, new releases such as edible cannabis and infused beverages reached the market in late 2019. The industry expects 500 food and beverage items to be available to consumers by the end of 2020.[72]

The legal cannabis industry is evolving.[73] In light of frequent senior management changes, a lack of cash liquidity,[74] and limited profitability,[75] the industry is consolidating and will continue to see mergers, acquisitions, and in some cases, bankruptcies.[76] Recently, firms have laid off hundreds of employees,[77] sold facilities,[78] and restructured to cut costs.[79] Investor confidence has dropped in light of these mounting losses. In some cases, investors have even accused producers of misleading them or failing to disclose financial difficulties, and filed class-action lawsuits.[80]

> If Canada wishes to achieve policy objectives outlined in the *Cannabis Act*, regulations must foster an environment in which industry can flourish and provide consumers greater availability and accessible price points to compete with the illicit market.

III. Methodology & Evaluation Criteria

Methodology

Five methods informed this policy analysis: (1) literature reviews, (2) interviews with government policy experts, medical researchers, cannabis industry leaders, and recycling and environmental policy experts, (3) case studies of regional and international policy interventions, (4) analysis using data made publicly available by the federal, provincial, and territorial governments, and (5) site visits.

Literature Review

This analysis incorporates research based on publicly available policy documents and legislation from Canadian federal, territorial, and provincial governments, as well as internal documents provided by Health Canada. Industry white papers, health policy research publications, and analysis conducted by non-governmental organizations and academics were reviewed.

Interviews

Interviews were conducted with a broad range of cannabis industry stakeholders, including government officials, academics and researchers, representatives of non-governmental organizations, media, and private sector actors. The following is a list of organizations consulted:

Government officials

- Health Canada, Controlled Substances and Cannabis Branch
- California Bureau of Cannabis Control
- Société québécoise du cannabis (SQDC)

Academics and researchers

- McGill University:
  - Department of Political Science
  - Faculty of Law
  - Max Bell School of Public Policy
  - Research Centre for Cannabis
- McMaster University, Centre for Medicinal Cannabis Research

Non-governmental organizations

- Natural Resources Defense Council
- Recycling Council of Ontario

Media

- *The Rise*

Private sector

- Cannabis Council of Canada
- CannaComply
- Cannasupplies
- Canopy Growth Corporation
- VS Strategies

Case studies

In addition to Canadian case studies, sources from the U.S. states of California, Nevada, Colorado, Oregon, and New York, and the country of Uruguay informed our research.

Data analysis

Data made publicly available by Statistics Canada and published in the Canada Gazette was used to inform this analysis. The Cannabis Tracking System and National Cannabis Survey were central to our research.

Site visits

Our understanding of the cannabis cultivation process was greatly informed by touring Canopy Growth Corporation's Tweed facility in Smiths Falls, Ontario.

Evaluation of Strategies

This report outlines a series of policy options that Health Canada can consider to address packaging waste and incentivize more environmentally-friendly packaging. Each option was evaluated by a set of standardized criteria, detailed below and in the following Section. In accordance with the policy challenge, waste reduction impacts and alignment with the mandate of the *Cannabis Act* were prioritized. A cost-benefit analysis and the Government of Canada Regulatory Impact Analysis Statement (RIAS) framework also featured in this analysis.

Evaluation criteria	Questions for consideration
Waste reduction impacts	➢ Will this strategy reduce cannabis packaging and waste and encourage more environmentally-friendly packaging? ➢ Will this strategy encourage packaging with post-consumer use or greater recyclability? ➢ Will this strategy reduce plastic waste and pollution? ➢ Is there a market for post-consumer materials created by this strategy? ➢ Is there a need for government intervention to reduce waste?
Alignment with *Cannabis Act* mandate	➢ Does this strategy align with Health Canada's mandate to uphold public health and public safety? ➢ Will this strategy protect the health of young persons by restricting their access to cannabis? ➢ Will this strategy protect young persons and others from inducement to use cannabis? ➢ Will this strategy deter illicit activities related to cannabis? ➢ Will this strategy reduce the burden on the criminal justice system in relation to cannabis? ➢ Will this strategy alter consumer's access to a quality-controlled supply of cannabis? ➢ Will this strategy enhance public awareness of the health risks associated with cannabis use?

Ease of implementation	➢ Does Health Canada have the existing jurisdiction and authority to implement this strategy? ➢ Can this strategy be implemented by regulation, guideline, or directive without amending the *Cannabis Act*? ➢ Can this strategy be scaled? What would its impact be on Canada's varied provincial and territorial legalization schemes? ➢ What resources are necessary to implement this strategy? ➢ Will this strategy incur enforcement costs? ➢ How will this strategy be communicated to producers and consumers?
Political feasibility	➢ Will this strategy require the approval of Parliament? What is the likelihood of its approval? ➢ Will this strategy be met with resistance from stakeholders, including provincial and territorial governments and consumers?
Viability for the cannabis industry	➢ Will this strategy impact access to legal cannabis? ➢ Will this strategy increase cost to producers? What is the likelihood that costs will be shifted to consumers? ➢ Will this strategy meet resistance from the industry?
Cost-benefit analysis	➢ What impact will this strategy have on taxpayers, industry, consumers, and the Government of Canada? ➢ What are the potential positive and negative economic, environmental, and social impacts on Canadians, businesses, and the Government of Canada? ➢ Does this strategy increase the end-market value of the packaging material by making it more valuable for reuse or more recyclable?
Regulatory Impact Analysis Statement considerations[81]	➢ What kind of consultation would this strategy require? ➢ Does this strategy impact Canada's modern treaty obligations? ➢ Does this strategy minimize the burden on business? ➢ How does a gender-based analysis plus (GBA+) impact the proposed strategy? ➢ Does this strategy carry international implications?

IV. Potential Strategies for Waste Reduction

Target	Strategy
A. Producers	1. Mandate all white plastic 2. Packaging standardization 3. Extended Producer Responsibility 4. Hemp Plastic Innovation Fund
B. Consumers	5. In-store consignment and recycling
C. Regulatory Norms	6. Remove child-resistance from non-psychoactive THCA products 7. Harmonize excise stamps 8. Bulk cannabis sales

A. Target Producers:

1. Mandate all white plastic

Overview

Recyclability can differ greatly depending on material, shape, size, and colour. A significant challenge for traditional recycling facilities is black and dark plastics, which cannot be easily or economically sorted and separated from other waste using optical scanning technology.[82] Recycling facilities sort plastics by bouncing light beams onto bales of waste materials; since black plastic absorbs light, it cannot be identified using standard technology. The presence of black plastic in recycling streams also makes it more challenging to recycle other colours and types of plastic. Most black plastic is ultimately landfilled or incinerated.

In Canada, recycling facilities rarely process dark plastics. Almost all Ontario municipalities reject black plastic, including the City of Toronto.[83]

Major cannabis producers, including Aurora Cannabis, Canopy Growth, Redecan, and 7ACRES, currently use black plastic packaging.[84] Black plastic satisfies the *Cannabis Act* requirements that containers be opaque and include a matte finish. Black plastic is also an affordable option for producers because it can be made by mixing scrap plastic of different colours or waste recycled from electronic products. Approximately 40% of black plastic contains heavy metals from electronic waste, such as cadmium, mercury, and lead, which can adversely affect health.[85]

To increase the recyclability of plastic used in the cannabis industry, Health Canada may explore mandating the use of all-white plastic containers.

Opportunity
As an interim step before single-use plastics are phased out from the cannabis industry, mandating the use of white plastic would allow the industry to move away from harmful black plastic, a material that is rarely recycled and can be detrimental to human health and the environment. Switching to plastic that is easier to recycle could lead to higher recycling rates and increase the useful life of post-consumer plastics.

Challenges
This strategy would require amendments to the Cannabis Regulation, to mandate the use of white plastics in cannabis packaging. This strategy may not significantly reduce packaging waste or incentivize environmentally-friendly packaging, but it will make cannabis containers more easily and economically recyclable.

Producers would have to plan for necessary supply chain and equipment modifications, or work with new suppliers, which may result in increased costs. Packaging colour is a key brand indicator for cannabis producers; shifting to a uniform colour may be met with resistance from the industry.

2. Packaging standardization

Overview
Both Health Canada and cannabis producers have voiced support for more environmentally-friendly cannabis packaging. Cannabis regulations have had the unintended consequence of leading producers to package products in larger and more resource-intensive containers than otherwise necessary. In striving to comply with public health and public safety regulations, producers often resort to multi-material packaging, which reduces recyclability. Recycling packaging made of multiple materials can require manual separation, which is logistically and or economically unfeasible in most recycling facilities.

To enhance reusability of post-consumer packaging industry-wide, Health Canada should standardize cannabis packaging by regulating the material, shape, and size of all packaging by type of product. This strategy could significantly reduce plastic waste and pollution and increase recyclability by third party companies and or municipalities.

Opportunities
By introducing regulations, this policy would increase the reusability of packaging, significantly reduce waste, and increase recyclability of packaging in the cannabis industry.

Fully harmonizing packaging across all cannabis producers would allow third party recyclers and or municipalities to sort and clean post-consumer packaging more easily and economically. Post-consumer packaging could be both reused by any individual firm in the industry and recycled in a closed-loop mechanism to ensure a feedstock of material with known and desired properties for firms industry-wide. This strategy would significantly reduce plastic waste while evening out the varying economic capacities between individual firms and enabling smaller companies to benefit from a return on their investment.

In designing the packaging standardization regulations, Health Canada could require non-fossil fuel materials that are easily and economically recyclable, mandate a set quantity of recycled content, and aim to reduce the overall carbon footprint of packaging throughout its life cycle. Regulations should be developed in consultation with firms that are already bringing innovative packaging options to the market. Health Canada may wish to coordinate with Innovation, Science and Economic Development Canada to encourage the use of materials sourced and produced in Canada, such as zero-carbon aluminum, which may also foster job creation.

SUSTAINABILITY CHECKLIST FOR PACKAGING:
Designed by PAC Packaging Consortium, a Canadian non-profit[86]

- What are the packaging materials and from where are they sourced?
- Can the materials be eliminated or reduced? Are there systems in place to reuse the packaging?
- Can the packaging be collected, separated, and recovered in existing programs?
- Do the materials meet the requirements for composting?
- Are consumers receiving proper information on how to dispose of packaging?

Challenges

Low acceptability by producers is the biggest challenge to this option. Some producers may resist standardization on the grounds that packaging material, shape, size, and colour are crucial to differentiating their brand from competitors', given the prohibition on other forms of marketing.

This strategy would require amendments to the Cannabis Regulations to detail new packaging requirements by type of cannabis product.

To comply with the new regulations, firms may have to make significant upfront economic investments in the necessary supply chain and equipment modifications, which may be passed onto consumers in the form of increased product cost. However, it is noteworthy that many firms may see some level of return on their investment in the form of recouped post-consumer packaging optimized for reuse and recycled materials for manufacturing purposes.

Health Canada may seek to offer some financial incentives to firms in the transitional process, which would increase the cost of this policy option to taxpayers.

3. Extended Producer Responsibility

Overview

Extended Producer Responsibility (EPR) initiatives give producers the physical and financial responsibility to manage the entire life cycle of their products in an environmentally sound manner, including addressing the disposal and treatment of post-consumer packaging. Introducing an EPR initiative in the legal cannabis industry could increase recycling rates and directly and indirectly decrease plastic waste and pollution.

EPR initiatives work by quantifying and adding the environmental costs associated with a product throughout its life cycle to its market price. EPR initiatives, therefore, shift the responsibility of product treatment and disposal from municipalities and taxpayers to producers and consumers. As a result, they also incentivize producers to create more environmentally-friendly and recyclable packaging, which reduces their financial burden. EPR differs from product stewardship, which shares the responsibility for a product among all the actors involved in its life span.

Opportunity

An EPR initiative will significantly increase the recovery rate of cannabis packaging, reduce waste, and encourage more environmentally-friendly packaging, while reducing recycling costs to taxpayers.

An EPR will incentivize manufacturers to reduce waste, which would otherwise represent a lost economic opportunity, and to design more environmentally-friendly packaging to improve future recyclability. EPR initiatives are among the most effective means of incorporating environmental standards in product design and reducing waste.

EPR initiatives have been successfully operating in the automotive tire industry in European countries since 1995 and in Canada since 2007. In European countries, they allow **100% of tires to be reused, retread, and recycled** – all stockpiles have been eliminated and a circular economy introduced.

In Canada, EPR programs recover between **84 and 100% of tires**, while fostering job creation.[87]

While an EPR program may increase the price of some cannabis products, it will also shift the financial burden of post-consumer waste management upstream to producers, away from public institutions and taxpayers. This would create significant savings for municipalities and taxpayers and has the potential to change consumer behaviour.

The introduction of a country-wide EPR initiative in the legal cannabis industry is consistent with the Government of Canada's plan to reduce plastic waste.

Challenges

EPR programs are typically made mandatory through legislation, though they can also be adopted voluntarily or following negotiated agreements between governments and industry. Health Canada may choose to introduce an EPR program in one of two ways:

- Through the mechanisms of the Canadian Council of Ministers of the Environment and the Federal-Provincial-Territorial Senior Working Groups, where EPR programs could be negotiated, designed, and managed; or
- By amending the Cannabis Regulations, which could require EPR as a condition for licensing and point to best practices for environmentally-sound disposal and treatment of post-consumer products.

Implementation and scalability are the biggest challenges to this option. The introduction of an EPR program would, by definition, exclusively target the legal cannabis industry, leaving public retailers unburdened with new environmental rules and resulting in patchy implementation across jurisdictions. Health Canada should ensure that the private sector can adequately coordinate with public retailers, in relevant provinces and territories, without placing an undue burden on the industry.

To comply with the new regulations, firms may have to make some upfront investments, which may be passed onto consumers in the form of increased product cost.

4. Hemp Plastic Innovation Fund

Overview

A natural derivative of the cannabis cultivation process is fibrous stalks and stems that can be transformed into biodegradable hemp plastic.[88] Manufacturing hemp plastic requires 22 to 45% less energy than plastics made from non-renewable energy sources. Hemp plastic cultivation requires further study and testing, but could reinforce circular practices within the cannabis industry that result in producers growing both cannabis products and packaging.

Health Canada should introduce a hemp plastic innovation fund to encourage licensed cannabis producers to explore the ways in which hemp by-products from the cannabis cultivation process can be repurposed into innovative and biodegradable plastic packaging solutions.

Opportunities

Hemp is a natural derivative of the cannabis cultivation process. Hemp plastic is 2.5 times stiffer than traditional fossil fuel-derived plastics, non-toxic and flexible enough to be moulded into durable forms.[89] The opportunity to create a circular economy for cannabis and hemp cultivation could reduce virgin plastic and low-recyclability packaging waste, while reducing current disposal costs and fostering job creation in the legal cannabis industry.

Cultivating hemp plastic is generally more expensive than traditional fossil fuel-derived polymers and can result in a heavier product that could impact transportation costs and overall carbon footprint. With further study and financial backing to support partnerships between industry and manufacturers, cultivating and processing in-house hemp plastic can greatly increase the volume of biodegradable packaging from renewable sources used in cannabis products. Funding to explore transforming material that would otherwise go to waste into a useful product would support cost-sensitive producers and encourage diversification in cannabis offerings.

Challenges

This strategy may require amendments to the Industrial Hemp Regulations. Licensed cannabis producers do not currently use hemp by-products for packaging; introducing this process will come with technological challenges. Encouraging hemp plastic cultivation may require financial incentives and regulatory changes regarding hemp waste. Although hemp plastic is versatile and flexible for moulding, cultivating hemp plastic and packaging, such as jars and cans, may be outside licensed producers' current scope.

It may be challenging to establish partnerships or evaluate the long-term value-added of producing hemp plastic. Generally, hemp plastic is heavier than traditional plastics and could incur higher transportation costs, which would somewhat mitigate the reduction in the carbon footprint of packaging throughout its life cycle.

B. Target Consumers:

5. Consignment and Recycling System

Overview

Despite widespread access to recycling bins, only 9% of the 3.2 million tonnes of plastic waste generated annually in Canada is recycled.[90] This is estimated to represent a lost economic opportunity of $11 billion by 2030 for Canada.

According to an internal report commissioned by Innovation, Science and Economic Development Canada in 2020, a significant contributor to Canadians' poor recycling behaviour is the confusion surrounding what products and materials are recyclable; this leads to low recycling rates and significant contamination at recycling facilities.

Health Canada can increase recycling rates for cannabis product packaging by working with provinces and territories to introduce a free-to-user, in-store consignment and recycling system in all public retail stores, similar to beverage container buy-backs with which Canadians are familiar.

This strategy will ensure that a more substantial and increasing portion of post-consumer packaging is consigned and recycled. Waste materials may then be reused and recycled for the industry in an open- or closed-loop approach that ensures a feedstock with known and desired properties.

Opportunity

Online sales from cannabis retailers significantly declined between legalization in October 2018 and the following year, from 43.4% to 5.9% of sales, due to the increase in the number of physical cannabis retailers.[91] This trend is expected to continue as more retailers come on the market, both public and private. A significant portion of cannabis sales are done in physical stores, most of which currently lack consumer-facing consignment and recycling options.

By making bins easily accessible and recognizable in-store with financial incentives to users, Health Canada would see a significant increase in recovery and recycling rates, diverting waste from nature and landfills. A simple targeted public awareness campaign about recycling cannabis packaging should accompany this policy.

This option could create economic opportunities for the cannabis industry. The industry may be encouraged to develop public-private partnerships with provincial and territorial governments, through which open- or closed-loop recycling schemes could be developed. The Société québécoise du cannabis (SQDC) and Canopy Growth are currently developing a partnership, alongside the third party recycler TerraCycle. Through this partnership, SQDC retailers will provide free-to-user, in-store consignment bins, the contents of which are recycled by TerraCycle and recouped by Canopy Growth. In this configuration, consignment and recycling initiatives also reduce costs to municipalities and taxpayers by shifting them onto industry. The industry benefits financially from reduced packaging material costs.

Challenges

Before implementing a simple consignment and recycling system mandatory in all retailers, Health Canada may seek to engage in public and private consultations to develop a pilot project and test out the system's effectiveness. It should specifically encourage and work with the relevant provincial and territorial governments to deploy post-consumer recovery systems in all public cannabis product retailers.

The tools and mechanisms of the Canadian Council of Ministers of the Environment (CCME) and the Federal-Provincial-Territorial Senior Working Groups may serve to launch and maintain an ongoing dialogue on this issue with partner governments.

This strategy may incur some costs on provincial and territorial governments, as they deploy the consignment and recycling system and encourage its use by consumers. They may, however, be encouraged by Health Canada to engage in mutually beneficial public-private partnerships to reduce these costs.

C. Target Regulatory Norms:

6. Remove child resistance from non-psychoactive THCA products

Overview

As of April 2020, 73% of cannabis products sold in Canada contain inactive tetrahydrocannabinolic acid (THCA), such as dried flower or pre-rolled joints.[92] Inactive THCA confers no euphoric or therapeutic benefit when consumed raw. When THCA is heated or vaporized – a process called decarboxylation – it is converted into delta-9-tetrahydrocannabinol (THC), which can have psychoactive effects when consumed.[93]

Regulations under the *Cannabis Act* currently require all cannabis products to be sold in child-resistant packages. Child resistance aims to reduce the risk of accidental consumption and overconsumption, reduce the appeal of cannabis products to young persons, and provide consumers with the information they need to make informed decisions before using cannabis.

Child resistance on oral prescriptions and aspirin-containing products have been associated with reductions in child mortality.[94] It is justified for products that have toxic or poisonous effects, and has been shown to reduce toxicant exposure in children. The rationale for child resistance weakens when the product it conceals does not confer poisonous or harmful effects when consumed.

Health Canada could divide products based on whether they include psychoactive THC or inactive THCA. Creating a product division based on the biological activity and potential for harm eliminates the need for child-resistant packaging on inactive THCA products (dried flower and pre-rolls) that confer no effects when consumed raw. Removing child resistance from inactive THCA products is grounded in biomedical evidence that Health Canada outlines in its Information for Health Care Professionals: Cannabis (marihuana, marijuana) and the cannabinoids, which outlines that THCA must go through the decarboxylation – or heating – process to be converted to active THC.[95]

Strong evidence supports child-resistant packaging on products containing high concentrations of psychoactive THC such as edibles, oils, and beverages.[96] Child resistance requirements should not be removed from high concentrate THC products.

Removing child resistance from inactive THCA products will greatly increase the range of packaging materials available to producers and reduce overall packaging waste and costs. Producers could package dried cannabis using resealable, single-source materials such as compostable bags and uncoated cardboard containers.

Opportunities

Dividing cannabis products based on whether or not they include active THC content could permit the vast majority of cannabis products to be sold without child-resistant packaging. Child-resistant packaging is generally heavier, which increases packaging and transportation costs, as well as the overall carbon footprint of the product throughout its life cycle. The most cost-effective packaging material is virgin plastic, only about 9% of which is currently recycled in Canada. This strategy would result in high waste reduction.

Child-resistant packaging is generally made of multiple materials, which hinders recyclability. Moving away from child-resistance allows for packaging to still be resealable and clearly labeled. Selling inactive THCA products in uncoated cardboard similar to tobacco product packaging would reduce waste and increase recyclability, while maintaining stringent quality controls and labelling standards. A new inactive THCA content warning should be added to all cannabis packaging principal display panels.

Tobacco product packaging provides a precedent for policymakers. Although consuming raw tobacco can induce nicotine poisoning, dried tobacco products are sold without child-resistance. For many producers and consumers, the inconsistency between child-resistance requirements for tobacco products and cannabis products resists explanation and appears grounded in an abundance of caution, rather than science.

The *Cannabis Act* advocates for greater public awareness of the health risks associated with cannabis use. Creating this product division presents the opportunity to educate the public about the risk associated with consuming psychoactive THC products and could complement Health Canada's "Start Low and Go Slow" public campaign.[97] Changing perceptions around child-resistance to reduce packaging sizes and plastic waste would demonstrate that Health Canada welcomes stakeholder feedback and aims to introduce evidence- and science-based policy.

Challenges

Political capital will need to be expended to realize this strategy. Public perceptions of cannabis, and the dangers surrounding cannabis use, continue to take form. The scientific basis for packaging inactive THCA products without child-resistance will need to be communicated, alongside the significant waste reduction potential and the fact that this strategy is grounded in science.

This strategy would require changes to the *Cannabis Act* and accompanying regulations to create a division between psychoactive THC and inactive THCA products and remove child resistance requirements.

Producers may need time to redesign packaging, modify production lines, purchase new packaging equipment, and or develop new supply chains. The cost-cutting benefits of moving away from child-resistant packaging would vary; cost will be incurred to introduce new packaging paradigms. To smooth the implementation period, Health Canada should consider that some producers may not switch to new packaging styles immediately and encourage dialogue between all parties to address feasibility.

Communicating the health dangers associated with psychoactive THC content will require public awareness campaigns and targeted messaging. It is possible that removing child-resistance could signal that cannabis is generally less risky, which would be an undesirable outcome. To reduce the appeal of cannabis to young persons, Health Canada may consider pairing this strategy with increased public awareness campaigns and encouraging provincial counterparts to adopt a similar strategy.

7. Harmonize Excise Stamps

Overview

Under the Excise Duty Framework for Cannabis, the federal government requires all legal cannabis products ready for purchase to carry excise stamps as proof of duty payment by the licensed producer – similar to that of tobacco.[98] Excise stamps also serve as tamper-proof seals (see Appendix A for an example). The federal excise duty is payable by a licensed cannabis producer when they deliver their products to the retailer and or consumer.

The current system of 13 distinct provincial and territorial specific stamps has been cited as an area of concern by cannabis producers. When inventory needs to be reallocated according to demand across the country, products must be shipped back to a production facility, stripped of their stamps, and re-stamped with the applicable jurisdictional stamps before they can be sold.

Such logistical burdens make it more expensive and time-consuming for legal producers to deliver products, and could reduce access to legal cannabis. Supply shortages can drive consumers to the illicit market because of producers' inability to respond to real-time shifts in demand. Preventable product shortages are costly to both consumers and governments, and hinders the industry's capacity to displace the illegal market.[99]

Opportunities

Given that the *Cannabis Act* aims to counter the illicit market, regulators must support legal producers and ensure that administrative and logistical burdens are not so onerous as to drive up expenses, which would be a disservice to consumers.

Excise stamps serve as an integral component of the Canadian regulatory regime, but the best way to mitigate the shortcomings of provincial and territorial specific stamps would be to introduce a federal excise stamp. A federal stamp would limit friction in the legal cannabis supply chain and increase logistical efficiency.

Producers note that there is a precedent in the Canadian alcohol industry, which moved away from province- and territory-specific excise stamps after delivering a regulatory impact analysis and successfully arguing for the benefits of an alternative approach.[100]

If the government is committed to eliminating the illicit market, it must acknowledge that the current system creates barriers for business. A single federal stamp would alleviate many friction points for licensed producers and make products readily accessible to consumers. It will require collaboration with the Canada Revenue Agency (CRA), which has indicated its willingness to work with the industry to redesign the excise stamp, to better suit business and market realities while fulfilling the purposes of the *Cannabis Act.*[101]

Challenges

The CRA is responsible for licensing cultivators, producers, and packagers of cannabis products, as well as collecting duties and taxes on cannabis products. Excise stamps are the CRA's method of ensuring that duties are paid and remitted to the appropriate jurisdiction, hence the need for 13 unique provincial and territorial excise stamps.

Amendments to the *Excise Act* by Parliament should modify the cannabis excise duty framework. Changing this regime would require consultation with provincial and territorial governments to ensure that duties are fairly collected, and existing controls remain in place. The move to a single stamp may be met with resistance by provinces and territories, that may interpret the amendment as federal overreach.

Further, changing the excise regime to a single national stamp will not yield significant waste reduction, due to the need to incorporate the stamp into product design regardless of jurisdiction. As such, this strategy is not aligned with Health Canada's mandate, but it represents high viability and reduced costs for producers, while denoting potentially higher costs to governments to undertake implementation.

8. Permit bulk cannabis sales

Overview

Moving towards a bulk cannabis distribution model could significantly reduce packaging waste and increase the reuse of containers. Such a model would see consumers bring their own opaque resealable containers, such as aluminum tins, to a cannabis retail outlet to purchase cannabis products. Bulk cannabis would be decanted directly into containers by trained staff. Labels would be applied to containers on-site.

To begin introducing such a model, Health Canada would need to change requirements around cannabis exit packaging. Exit packaging is the packaging cannabis products are contained within when leaving a retail outlet. Decanting cannabis into resealable containers would require further study on achieving waste reduction goals while upholding the mandate of Health Canada to reduce inducements to consume cannabis.

Opportunities

Cannabis delivered to retail outlets could be packaged and transported in larger quantities, which would reduce overall packaging waste. Requiring consumers to bring in their own resealable containers would increase container reuse and reduce overall packaging waste.

Challenges

Resealable containers brought in by consumers will vary and may or may not be child-resistant. Reusable containers may not be sterilized, and could lead to increased risk of product contamination. Consumer-supplied containers would also require on-site labelling or additional product information to be provided at the point of purchase. Our team recognizes the complexity around the potential for new public health concerns surrounding youth inducement to consume cannabis.

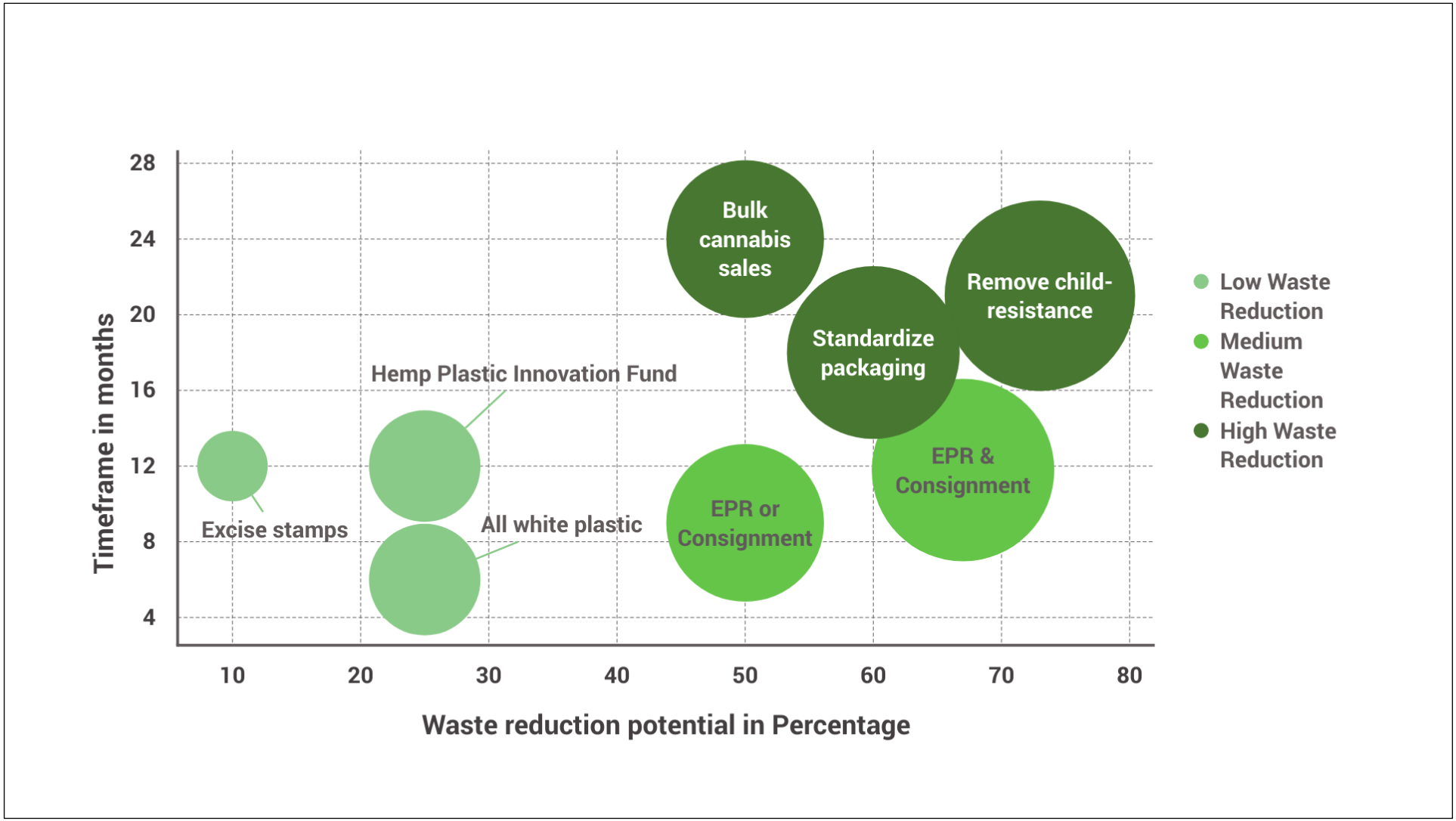

Figure 1. Waste Reduction Impact Model.

Each strategy outlined in Section IV was assessed based on the evaluation criteria detailed in Section III. Options further right indicate higher waste reduction potential. Options further up indicate a longer time frame for implementation.

V. Evaluation of Strategies

Each policy option was evaluated against the following criteria:

- Waste reduction potential;
- Alignment with Health Canada's mandate;
- Ease of implementation;
- Political feasibility;
- Viability for the cannabis industry;
- Cost-benefit analysis; and
- Regulatory Impact Analysis Statement (RIAS) considerations.

Recommendation detailed here attempt to balance Health Canada's mandate as outlined in the *Cannabis Act* with operational considerations and political feasibility. Pursuant to the policy challenge, waste reduction impacts, and alignment with Health Canada's mandate were prioritized. Regulatory Impact Analysis Statement (RIAS) considerations reflect an understanding of the criteria that Government of Canada policymakers must satisfy to advance policy recommendations through the Treasury Board triage process.

CRITERIA							
	Waste Reduction	Alignment with *Act* mandate	Ease of Implementation	Political Feasibility	Viability for Industry	Cost-Benefit Analysis	RIAS Considerations
Target Producers							
Mandate all white plastic	**Low**	**Medium**	**Medium**	**Medium**	**Medium**	Upfront costs to producers that could be passed onto consumers. Environmental benefits to citizens. Increased end-market value.	Would require consultation with industry. Could increase the burden on business.
Packaging Standardization	**High**	**Medium**	**Medium**	**Medium**	**Low**	Upfront costs to producers that could be passed on to consumers, with potential ROI for producers. Highly increased recyclability. Increased end-market value.	Would require consultation with industry. Could increase the burden on business.
Extended Producer Responsibility (EPR)	**Medium**	**Medium**	**High**	**High**	**Medium**	Increased cost to producers that could be passed on to consumers, with potential ROI for producers. Reduced cost to taxpayers. Environmental benefits to citizens. Increased end-market value.	Would require consultation with provincial and territorial governments and industry. Could increase the burden on business.
Hemp Plastic Innovation Fund	**Low**	**Low**	**Low**	**Medium**	**Medium**	Increased cost to the government and taxpayers for uncertain benefits. Uncertain short-term benefits.	Would require consultation with industry. Could increase the burden on business.

Target Consumers							
Consignment and Recycling	**Medium**	**Low**	**Medium**	**Medium**	**High**	Increased costs to government. Potentially decreased costs for producers. Environmental benefits to citizens. Increased end-market value.	Would require consultation with provincial and territorial governments and industry. Could increase the burden on business.
Target Regulatory Norms							
Remove child-resistance from non-psychoactive products	**High**	**Low**	**Medium**	**Low**	**High**	Upfront cost to producers; long-term cost reduction. Reduced cost to taxpayers longer-term environmental benefits to citizens.	Would require consultation with industry. Could increase the burden on business.
Harmonize Excise Stamps	**Low**	**Low**	**Low**	**Low**	**High**	Increased cost to government. Reduced costs for producers. Environmental benefits to citizens.	Would require consultation within federal government and with provincial and territorial governments. Could increase the burden on business.
Bulk Cannabis Sales	**High**	**Low**	**Medium**	**Low**	**Medium**	Upfront cost to producers; long-term cost reduction. Reduced cost to government and taxpayers. Substantial environmental benefits to citizens.	Would require consultation with provincial and territorial governments and industry. Could increase the burden on business.

VI. Recommendations

Based on the analysis of the eight strategies reviewed in the previous Section, we recommend that Health Canada pursue the three following policy measures to reduce packaging waste and encourage more environmentally-friendly packaging for legal cannabis products.

These recommendations are designed to adapt to and complement Environment and Climate Change Canada's pending ban on single-use plastics. The research which guided this analysis considered that Health Canada may ask Environment and Climate Change Canada for cannabis products to be exempt from a single-use plastics ban, but our Policy Lab challenge mandates a shift away from the status quo. We believe that reducing the use of single-use plastics in the cannabis industry is a strategy worth pursuing on its own merits.

1. Extended Producer Responsibility & Consignment and Recycling Program

Rationale

To increase recycling rates in the cannabis industry, we recommend that Health Canada introduce an Extended Producer Responsibility (EPR) initiative in the cannabis industry and implement a consignment and recycling program in public retail outlets. An EPR initiative would give producers the physical and financial responsibility to manage their products' and packages' entire life cycles; it would incentivize them to introduce highly reusable and recyclable packaging and develop recovery and recycling schemes in private retail outlets. In addition, a country-wide consignment and recycling program designed with provincial and territorial governments would ensure coverage in all publicly-held retailers.

This consolidated strategy offers a simple, country-wide solution to reduce packaging waste and incentivize environmentally-friendly packaging.

The introduction of a consignment and recycling system – which could take the form of beverage container buy-back bins that Canadians are familiar with – will ensure that a higher portion of post-consumer packaging is recovered. Health Canada should encourage the industry to financially support this system, such that firms may recover post-consumer waste for reuse and recycling in an open- or closed-loop approach, to their net financial benefit.

An EPR initiative will also incentivize producers to design more environmentally-friendly packaging to improve future recyclability, given the financial benefits, without requiring them to do so through legislation or regulation.

This strategy will have swift and significant impacts on waste reduction.

Regulatory and operational considerations

The introduction of an EPR program will require consultation with provincial and territorial governments. EPR programs are typically made mandatory through legislation, though they can also be adopted voluntarily or following negotiated agreements between governments and industry. Health Canada may choose to introduce an EPR program in one of two ways:

- Through the mechanisms of the Canadian Council of Ministers of the Environment and the Federal-Provincial-Territorial Senior Working Groups, where EPR programs could be negotiated, designed, and managed; or
- By bringing amendments to the Cannabis Regulations (SOR/2018-144), specifically to Part 2: Licensing and Part 5: Good Production Practices, which would require EPR as a condition for licensing and define environmentally-sound disposal and treatment of post-consumer products.

In introducing a consignment and recycling system, it is strongly recommended that the government play an active role, included but not limited to, setting expectations for the industry, launching a public procurement process to seek out suitable third party recyclers in each jurisdiction, and recognizing and or advertising about the system, potentially through environmental performance certification and labelling. Health Canada could introduce on-pack messaging requirements for cannabis packaging through amendments to the Cannabis Regulations.

ON-PACK MESSAGING:

On-pack recycling messaging with instructions, such as the industry-led How2Recycle label, could be used by the Government of Canada to communicate to consumers how to properly recycle cannabis packaging. This type of label has been shown to increase recycling rates and has led to packaging redesigns to increase recyclability.

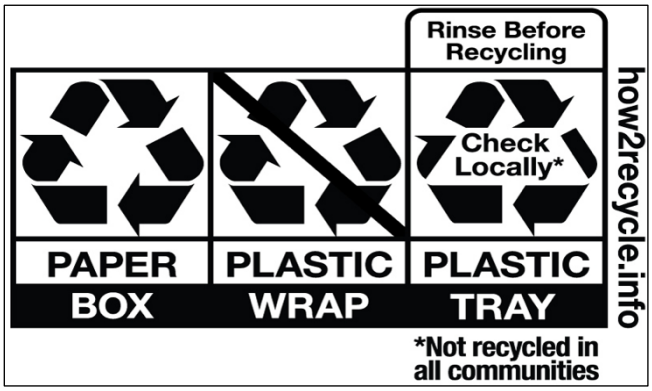

Figure 1. How2Recycle label. Source: "The How2Recycle Guide to Recyclability," GreenBlue. How2Recycle, 2020, https://how2recycle.info/guide.

As an initial step, the government should develop a pilot project with both public and private stakeholders to test the system's effectiveness before implementing a simple, mandatory system. Health Canada should identify promising consignment and recycling initiatives in the public sector and encourage inter-jurisdictional policy learning.

Health Canada should also specifically encourage subnational governments and the industry to engage in innovative joint ventures. The Société québécoise du cannabis (SQDC) and Canopy Growth are currently developing a public-private partnership, alongside the third party recycler TerraCycle. Through this partnership, SQDC retailers will provide free-to-user, in-store consignment bins, the contents of which are recycled by TerraCycle and recouped by Canopy Growth.

In this configuration, consignment and recycling initiatives are introduced, at little to no cost for governments and taxpayers. The industry, which benefits financially from reduced packaging material costs, funds the consignment and recycling in public retailers.

Fiscal and financial considerations

This consolidated recommendation will shift the financial burden of waste management upstream to producers, away from public institutions and taxpayers. This strategy would create significant savings for municipalities and taxpayers.

Health Canada should encourage the industry to financially support this introduction of a consignment and recycling system in public retailers, such that firms may recover post-consumer waste for reuse and recycling in an open- or closed-loop approach, to their net financial benefit.

Health Canada may consider offering small financial incentives to the industry to further encourage the development and design of environmentally-friendly and recyclable packaging through an Innovation Fund. For instance, an industry-wide competition could be launched and grants awarded for innovative solutions in this area. Health Canada may wish to coordinate with Innovation, Science and Economic Development Canada to encourage the use of materials sourced and produced in Canada, such as zero-carbon aluminum, which may also foster job creation.

Timeline for Implementation

We recommended that Health Canada design a pilot project in partnership with a public-run cannabis retail outlet. We believe that this strategy can be implemented in the shorter term, with an ideal pilot designed and trialed within 12 months, with ample time for consultation with industry stakeholders and consumers. Implementing this strategy relies heavily on provincial and territorial regulators working in tandem with Health Canada, which may impact the strategy's overall implementation timeline.

Introducing either strategy alone may be faster to implement, but only the consolidated recommendation will ensure harmonized coverage of all retailers across the country.

EXTENDED PRODUCER RESPONSIBILITY (EPR):

In 2009, the Canadian Council of Ministers of the Environment launched the Canada-wide Action Plan for Extended Producer Responsibility, with coordinated commitments and policies for concrete action at different levels of government. The Action Plan proposes key strategies to adopt EPR approaches to identified policy areas.

The concept of EPR has been used to ensure proper treatment and disposal of a wide range of consumer goods, including batteries, pharmaceutical products, and used oil. EPR initiatives have gained popularity since their introduction in the early 1990s and Europe and have been implemented in Australia, Japan, Korea, and other countries.

2. Packaging standardization

Rationale

Following legalization, producers had a short time frame to navigate *Cannabis Act* compliance. To meet regulated packaging and labelling requirements, producers have often resorted to using multi-material packaging. While the materials used may be individually recyclable, the combination, such as plastic-coated cardboard, is more difficult to sort, separate, and recycle. Our research indicates that recycling facilities often do not have the capacity to easily and economically recycle multi-material packaging, and instead divert them to landfills.

The optimal solution would mandate packaging made exclusively from one highly recyclable material, such as cardboard or light-coloured plastic. Packaging could be required to be easily reusable and have a low carbon footprint throughout its life cycle. Health Canada has voiced support for more environmentally sound packaging, provided the requirements in the regulations are satisfied, but this is not yet codified in regulation.

Having one mandated environmentally-friendly packaging model per type of cannabis product would reduce plastic waste and pollution. Health Canada, through the Cannabis Regulations, could therefore encourage the cannabis industry to regulate the material, shape, and size of all cannabis packaging.

Harmonizing packaging would allow third party recyclers and or municipalities to sort and clean post-consumer packaging more efficiently and at lower costs. To the economic benefit of the cannabis industry, packaging could be reused and recycled by all actors: post-consumer packaging could be both reused by any individual firm in the industry and recycled in an open- or closed-loop mechanism to ensure a feedstock of material with known and desired properties. This strategy would reduce plastic waste and enable even smaller companies to benefit from a return on their investment, thereby evening out the variable economic capacities between individual firms. It will have significant impacts on waste reduction.

Technical requirements

Standardized packaging may be introduced by bringing amendments to the Cannabis Regulations (SOR/2018-144), specifically Part 7: Packaging and Labelling, Sections 108 to 122.2, which outline immediate container appearance and feature specifications.

When designing new regulations, Health Canada should mandate packaging made from renewable materials that pose no risk to human health and, more importantly, can be easily and economically reused and recycled. In an optimal scenario, these regulations could spark the emergence of a circular economy in cannabis packaging, while avoiding incineration and disposal of post-consumer materials in landfills and nature.

Health Canada could specifically require environmentally-friendly and non-fossil fuel-derived materials, mandate a set quantity of recycled content, and seek to reduce the overall carbon footprint of packaging options throughout their life cycles. Health Canada may wish to coordinate with Innovation, Science and Economic Development Canada to encourage the use of materials sourced and produced in Canada, such as zero-carbon aluminum, which may foster job creation.

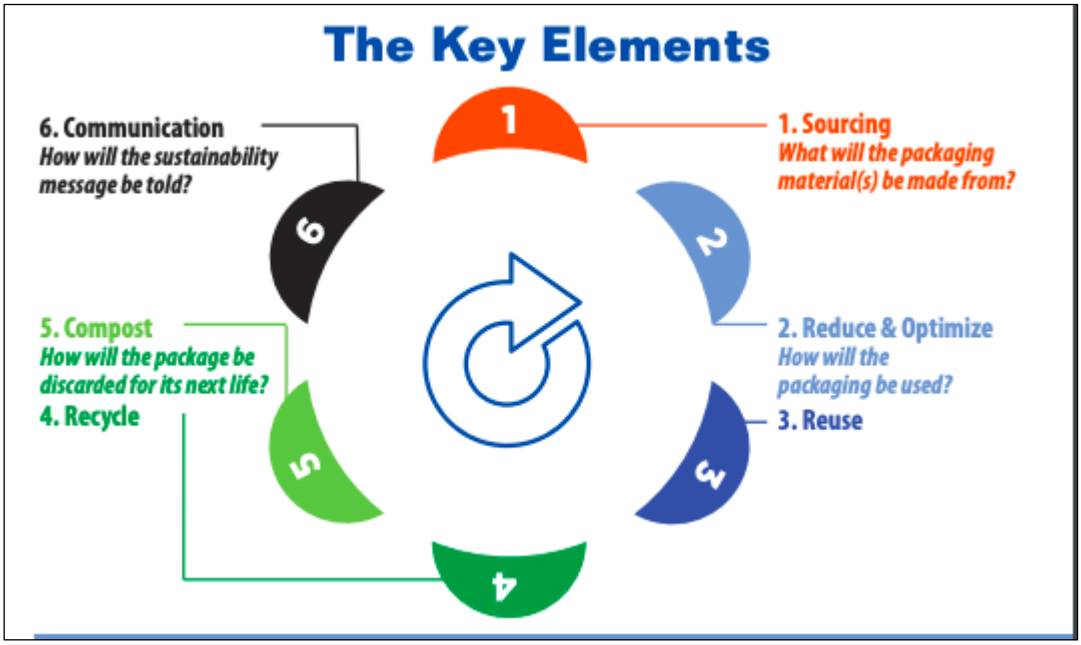

Figure 2. Determining the best products to ensure sustainability.
Source: "Sustainability Checklist for Structural Package Designers," PAC Packaging Consortium, 2018, http://www.pac.ca/ePromos/promos/pac0945.

This recommendation would require significant upfront costs for cannabis producers to make the necessary supply chain and equipment modifications. Once implemented, however, producers may see a substantial return on their investment in the form of recouped post-consumer packaging optimized for reuse and recycled materials for manufacturing purposes.

This recommendation should work hand in hand with take-back programs to boost the creation of a circular economy for cannabis packaging.

Timeline for Implementation
Health Canada should convene an industry-wide working group to encourage collaboration with the cannabis industry to design standardized packaging. This working group should aim to assess the technological capabilities, costs, and barriers to standardizing packaging and develop a reasonable timeline for implementation.

We believe that implementing this strategy can be done in the medium-term, on a 12 to 18-month horizon. Consultation with the industry, municipalities, and the public should not be rushed, though the potential for job creation should be a priority for the Government of Canada heading into a sustainable recovery following the current economic downturn.

3. Remove child-resistance from non-psychoactive THCA products

Rationale

As of April 2020, 73% of cannabis products sold in Canada are dried flower products or pre-rolled joints that contain non-psychoactive tetrahydrocannabinolic acid (THCA).[102] Non-activated THCA confers no euphoric or therapeutic benefit when consumed raw. When THCA is heated or vaporized – a process called decarboxylation[103] – it is converted into delta-9-tetrahydrocannabinol (THC), which can have psychoactive effects when consumed.

We recommend dividing products based on whether they include psychoactive THC or inactive THCA. Creating a product division based on the biological activity and potential for harm eliminates the need for child-resistant packaging on the vast majority of cannabis products sold, which confer no effect when consumed raw and pose minimal health risk. Removing child resistance from THCA products is grounded in biomedical evidence that Health Canada outlines in its Information for Health Care Professionals: Cannabis (marihuana, marijuana) and the cannabinoids, which outlines that THCA must go through the decarboxylation – or heating – process to be converted to active THC.[104]

Strong evidence exists to support child-resistant packaging on products that contain high concentrations of THC such as edibles, oils, and beverages.[105] We do not recommend removing child-resistance requirements on high concentrate THC products.

Removing child resistance from THCA products will significantly increase the range of packaging materials available to producers and reduce overall packaging waste and cost. Producers could package dried cannabis using resealable, single-source materials such as compostable bags and uncoated cardboard containers. This recommendation does not impact stringent labelling standards and quality control measures.

Removing child resistance may be introduced by bringing amendments to the Cannabis Regulations (SOR/2018-144), specifically Part 7: Packaging and Labelling, Section 108: Immediate container, which requires that the immediate container in which a cannabis product is packaged meet the requirements of a child-resistant package under subsections C.01.001(2) to (4) of the Food and Drug Regulations.

What differentiates psychoactive THC from inactive THCA?

The principal phytocannabinoids in cannabis are tetrahydrocannabinolic (THC) and cannabidiol (CBD). When metabolized, cannabinoid chemicals interact with the body's endocannabinoid system resulting in changes and sensory effects.[106]

In the living plant, phytocannabinoids exist as both inactive monocarboxylic acids (THCA) and active decarboxylated forms (THC). Raw cannabis contains the non-psychoactive cannabinoid THCA. Heating (at temperatures above 120 degrees Celsius) promotes decarboxylation and converts THCA to THC.

Consuming raw cannabis flower does not confer psychoactive or euphoric effects. Studies have deemed the possible therapeutic effects of consuming THCA comparable to eating leafy greens such as kale. Research indicates that THCA can convert to THC over long periods, but this would require further study.

Psychoactive THC products:

- Edibles, such as gummies or chocolates;
- Oils, vapes, soft gels;
- Topicals; and
- Infused drinks.

Inactive THCA products:

- Raw cannabis flower; and
- Pre-rolled joints.

Shelf stability

Heat, light, humidity, acidity, and oxidation all affect the stability of cannabis and phytocannabinoid. Standard pre-rolled joints are stable for months if stored in tightly-closed containers, particularly when stored below 0 degrees Celsius in the dark.

Child resistance

Child resistance is outlined in Canada's Food and Drug Regulations. The *Cannabis Act* and associated regulations require cannabis products to be sold in child-resistant packages, in order to reduce the risk of accidental consumption and overconsumption, reduce the appeal of cannabis products to young persons, and provide consumers with the information they need to make informed decisions before using cannabis.

Child resistance on chemical products, oral prescriptions, and aspirin-containing products have been associated with reductions in child mortality. The rationale for requiring this type of packaging is to restrict access and accidental poisoning.[107] It is justified for products with potentially toxic or poisonous effects, and has been shown to reduce exposure in children. The rationale for child resistance weakens when the product it conceals does not confer harmful effects when consumed.

Tobacco product packaging may provide a precedent for policymakers and consumer expectations. Consuming raw tobacco can induce nicotine poisoning, but dried tobacco products are nevertheless sold without child-resistance. For many producers and consumers, the inconsistency in child-resistance requirements for tobacco and cannabis products resists explanation and appears grounded in an abundance of caution, rather than public health or science.

Activated THC products that can induce psychoactive effects if directly consumed should continue to require child-resistant packaging.

Waste reduction potential

In the 2019 update to the Cannabis Regulations, Health Canada stated in the Canada Gazette that, "based on the experience of U.S. jurisdictions that have legalized and regulated cannabis, child-resistant packages are available in more environmentally-friendly materials, such as cardboard and recycled materials. Over time, we expect innovations by the licensed industry and programs to address waste from cannabis product packaging to emerge".[108]

Child-resistant packages can indeed be made of more environmentally-friendly materials, but this neglects to mention that such packaging comes at increased cost, and is typically made of multiple materials. Virgin plastic is the most widely used packaging material today because it is the least expensive to produce. The cannabis market is undergoing significant consolidation; producers are extremely cost-sensitive. It is overly optimistic to believe that producers will take on the increased expense of environmentally-friendly child-resistant packaging, when significantly less expensive options exist.

Similarly, the assertion that child-resistant packaging can be made of more environmentally-friendly materials neglects to consider packaging is typically made of multiple materials, such as plastic-coated cardboard. Packaging made of multiple materials is much less recyclable and is tantamount to greenwashing. A cardboard container may appear more sustainable, but the inlaid plastic child-resistant mechanism makes it more likely to be landfilled than recycled.

Waiting for the cannabis industry to move away from low-cost plastic to more expensive mixed-material packaging is therefore not a winning strategy to realize meaningful waste reduction. If Health Canada is serious about reducing waste, it should take aim at the requirements that creative excessive packaging for 73% of products sold. This strategy will have swift and significant impacts on waste reduction.

Packaging raw cannabis flower and pre-rolled joints without child resistance will significantly increase the use of non-plastic packaging material options such as compostable bags, mushroom packaging, uncoated paper boxes, and aluminum tins. Eliminating child resistance will also significantly reduce the use of mixed-material packaging, which limits post-consumer reuse and recyclability. Existing Canadian standards on plain labelled tobacco packaging can demonstrate how labelling standard and excise stamp requirements can be maintained.

Communicating risk to the public

The *Cannabis Act* advocates for greater public awareness of the health risks associated with cannabis use. Creating this product division presents the opportunity to educate the public about the risk specifically associated with consuming psychoactive THC products, complementing Health Canada's "Start Low and Go Slow" campaign that aims to raise public awareness around safe cannabis use. Changing perceptions around child resistance to reduce packaging sizes and plastic waste could demonstrate that Health Canada has listened to stakeholder feedback, and is introducing policy based on science, rather than an abundance of caution and risk-aversion.

Timeline for Implementation

We believe that implementing this strategy can be done in the longer term, on an 18 to 24-month horizon. Consultation with public health experts, the industry, provincial and territorial governments, and the public should not be rushed. It is recommended that a thorough communications plan and public awareness campaign accompany this strategy.

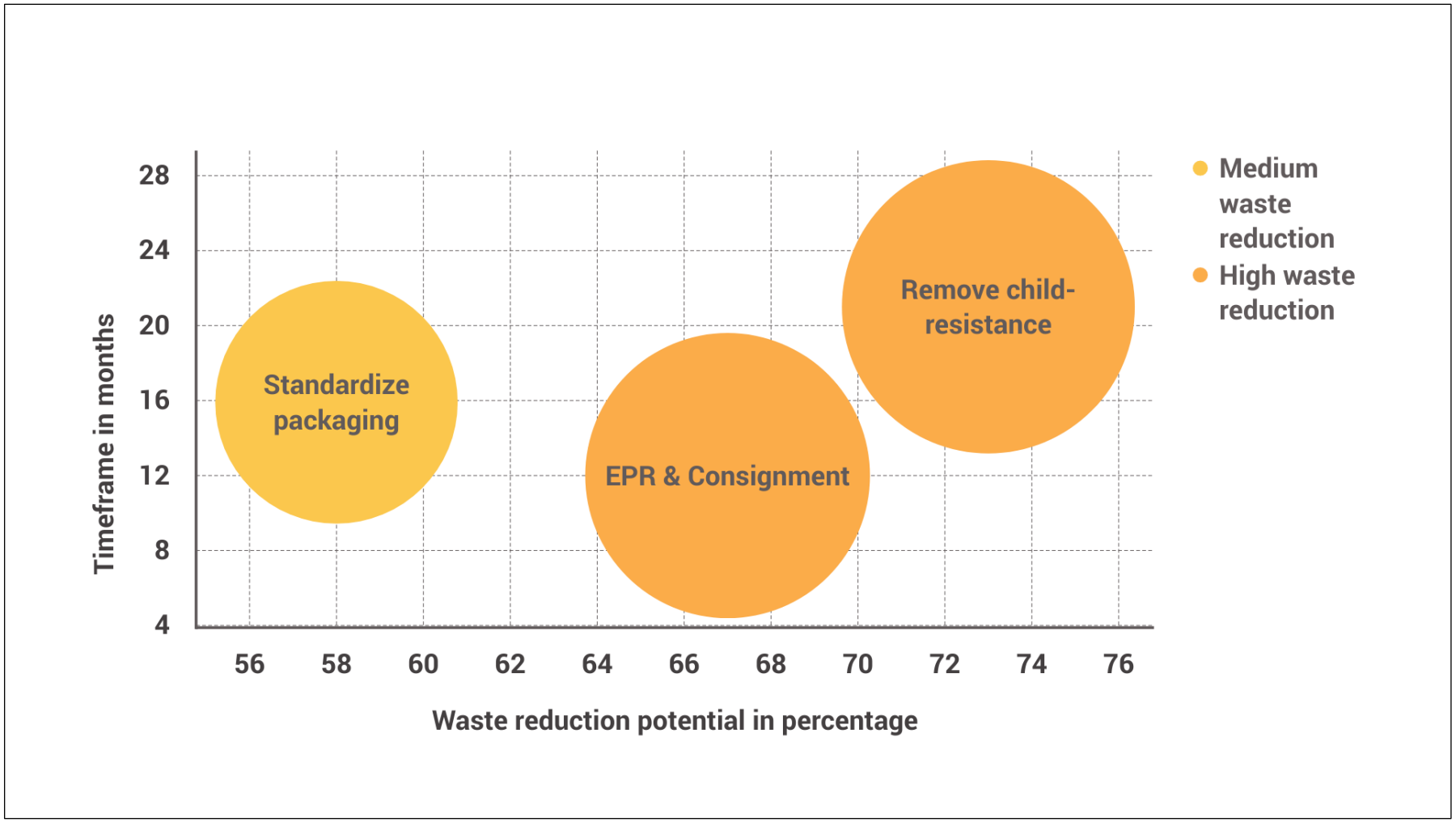

Figure 3. Waste Reduction Impact Model.

Each recommendation outlined in Section VI was assessed based on the evaluation criteria detailed in Section III. Options further right indicate higher waste reduction potential. Options further up indicate a longer time frame for implementation.

VII. Conclusion and Next Steps

As cannabis legalization approaches the two-year mark, clear trends have emerged from regulatory decisions and shifts within the industry. Packaging waste with low recyclability or post-consumer use is a visible and growing problem. This waste will be with us in landfills and waterways for decades, if not centuries to come. But the bureaucratic disconnect that has created the packaging waste problem and the reputational damage it has caused can be resolved. The recommendations put forth in this report prioritize waste reduction and the mandate of the *Cannabis Act,* while balancing the realities of a financially constrained industry and cautious regulator.

We contend that the greatest waste reduction would result from siding with science and removing child-resistance requirements from non-psychoactive THCA products like dried flower and pre-rolled joints. Opportunities to create a robust circular economy for packaging undergird our recommendation to introduce Extended Producer Responsibility programs and in-store consignment and recycling regimes. Similarly, standardizing packaging across the industry would reduce waste and greatly enhance the reusability and recyclability of packaging.

The *Cannabis Act* mandates a review of public health and safety regulation three years after legalization, in October 2021. The goal of such a review is to hold policymakers accountable for the impacts of legalization and develop new policy learning. Environmental impacts and unintended waste should factor heavily into this review.

Canadian federalism also presents opportunities for inter-jurisdictional policy learning. We recommend that Health Canada convene a working group to learn from, and create connections between, provinces and territories with varied legalization frameworks. Municipalities are at the forefront of cannabis retail and should be consulted alongside other levels of government. Generally, we believe that establishing clearer and more collaborative lines of communication between Health Canada and the industry would encourage greater compliance and foster innovation around packaging.

In 2015, the Liberal government was elected on a platform to legalize recreational cannabis at a moment when the public was calling for greater action on climate change. Stringent public health and safety objectives guiding cannabis legalization are inadvertently undermining the government's environmental commitments. The moment is ripe to return to a culture of circular economies, aimed at eliminating waste by favoring responsible and continual reuse of resources. Proactively addressing the reality of cannabis industry waste puts Health Canada in a position to mainstream climate action and lead on a critical government priority. If calls from the public and the realities of a changing climate are heeded, we believe it is possible to uphold public health and safety while meaningfully reducing packaging waste.

VIII. Appendix

A. Supporting Materials

Classes of cannabis[109]

1. **Dried cannabis:** Any part of a cannabis plant, except seeds, that has been through a drying process (dried flowers, pre-ground/milled (trim/shake), pre-rolls).
2. **Edible cannabis:** Products that are solid or liquid at a temperature of 22 ± 2 degrees Celsius and that are intended to be eaten or drunk the same way as foods such as chocolate, cookies, sodas, teas.
3. **Cannabis extracts:** Products made using extraction processing methods or by synthesizing phytocannabinoids and intended for inhalation or ingestion, including by absorption in the mouth or other routes of administration (e.g., vape pens, hash, tinctures, softgels, suppositories).
4. **Cannabis topicals:** Products that include cannabis as an ingredient and that are intended for use on external body surfaces such as skin, hair, or nails.
5. **Plants:**
    - Vegetative cannabis plants: Cannabis plants that are not budding or flowering (clones and seedlings).
    - Whole cannabis plants: Budding or flowering cannabis plants (unpackaged only).
6. **Cannabis seeds:** Viable (growable) seeds of a cannabis plant.

Cannabis Act and Regulations packaging guidelines[110]

1. **Brand element:** As defined in the *Cannabis Act*, includes a brand name, trademark, trade name, distinguishing guise, logo, graphic arrangement, design or slogan that is reasonably associated with, or that evokes, (a) cannabis, a cannabis accessory or a service related to cannabis; or (b) a brand of any cannabis, cannabis accessory or service related to cannabis.
2. **Exterior display surface:** As defined in the Cannabis Regulations for the purposes of its Part 7, means the area on the exterior surface of an immediate container to which a label is applied and that is visible under customary conditions of purchase or use.
3. **Immediate container:** As defined in the Cannabis Regulations, means a container that is in direct contact with cannabis or a cannabis accessory that is a cannabis product or, if a wrapper is in direct contact with the cannabis or the cannabis accessory, with the wrapper.
4. **Label:** As defined in the *Cannabis Act*, includes a legend, word or mark that is, or is to be applied or attached to or included in, or that accompanies or is to accompany, cannabis or a cannabis accessory or a package.
5. **Package:** As defined in the *Cannabis Act*, means any inner or outer container or covering.
6. **Point:** As defined in the Cannabis Regulations, means the unit of measurement for type size that is known as a PostScript point and is equal to 0.3527777778 millimetres.
7. **Principal display panel (PDP):** the surface that is displayed under normal or customary conditions of purchase or use.

Cannabis metrics

Health Canada collects data under the *Cannabis Tracking System Ministerial Order*, and classifies its metrics as follows:[111]

1. **Unpackaged production:** The amount of cannabis produced from activities conducted on-site by cultivators and/or processors and added to the unpackaged inventory during the reporting period.
2. **Packaged production:** The number of cannabis products resulting from unpackaged cannabis being placed into final packaging for sale to consumers at the retail level during the reporting period.
3. **Unpackaged inventory:** Cannabis held in stock by a cultivator or processor that is not packaged for sale to consumers at the retail level.
4. **Packaged inventory:** Cannabis held in stock by a cultivator, processor, distributor, or retailer that is packaged for sale to consumers at the retail level.
5. **Medical sales:** Cannabis products sold directly to medical clients by holders of a federal licence for medical sales.
6. **Non-medical sales:** Cannabis products sold directly in the Canadian retail market, online or in-person, by a provincially or territorially authorized distributor or retailer, for non-medical purposes.

Waste reduction equivalency model

Our team relied on Statistics Canada and Environment and Climate Change Canada data about recycling rates and the rate of waste diverted from landfills to assess trends in the public's recycling habits. To visualize the weight of waste typically quantified in tonnes, we developed a calculation based on what Montréal metro car would weigh at capacity on a pre-pandemic weekday during rush hour.

A typical metro line has nine cars and a capacity of 1,104 people. We relied on technical specifications provided by the Société de transport de Montréal to calculate that the combined metro line weighs 326,253 kilograms when empty.[112] (An individual AZUR metro car weighs 26,467 kilograms.)

We used Transportation Canada's standard weight of passengers aged 12 years and up for the aviation industry to calculate the average weight of a woman, man, and child.[113] Combining average winter and summer weights, the average weight of a woman in our model is 79.4 kilograms, a man is 94.8 kilograms and a child is 13.6 kilograms. We assumed that the average metro car at rush hour would include 45% women, 45% men, and 10% children. Based on this breakdown, we took the average passenger to weigh 79.75 kilogram.

We then calculated that the weight of a nine-car metro line at a capacity of 1,104 would equal 326,253 kilograms. An individual car would weigh 36,250.33 kilograms.

Cannabis packaging: Examples

Example of **FRONT** Example of **BACK**

Figure 1. Dried cannabis generic bag.
Source: The Canadian Press, "Handout," undated, https://business.financialpost.com/cannabis/health-canada-unveils-strict-rules-surrounding-pot-packaging-small-cannabis-growers.

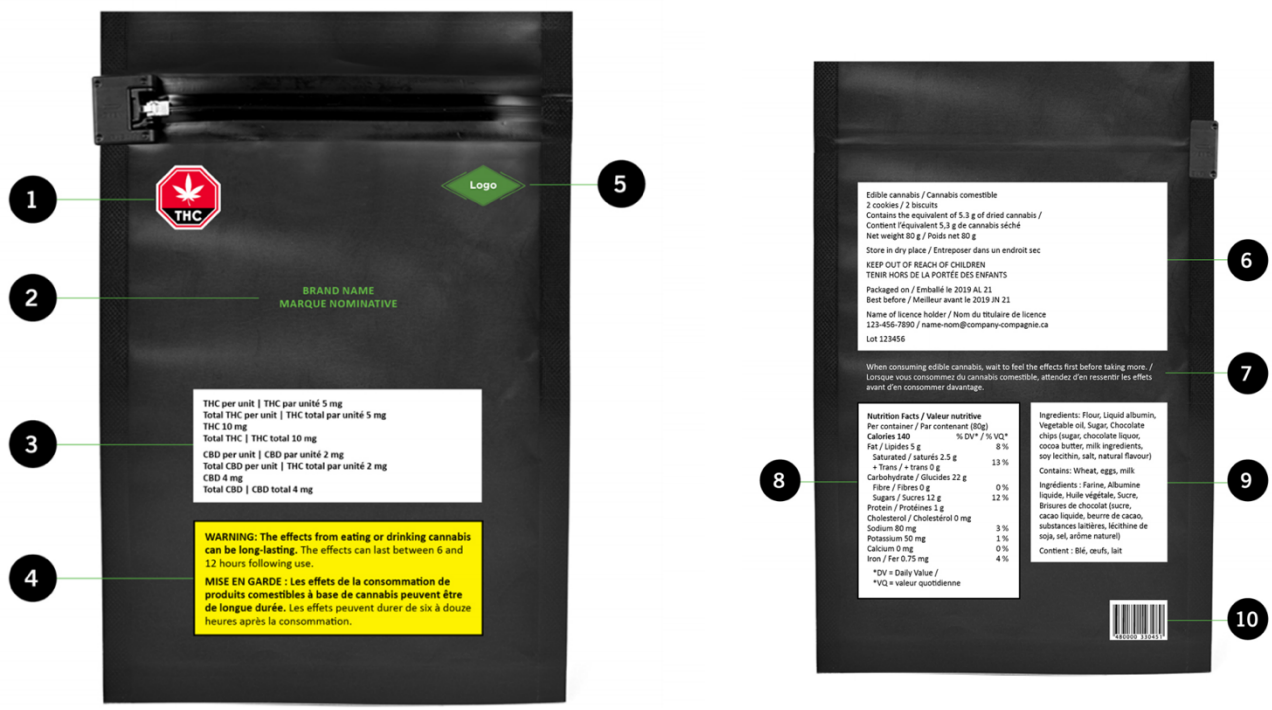

Figure 2. Edible cannabis generic package.
Source: “Packaging and labelling guide for cannabis products” 2019.

Legend:

1. The standardized cannabis symbol
2. The brand name of the cannabis product
3. THC and CBC content
4. Health warning message
5. Other brand element
6. Other required information about the cannabis product
7. Non-required information about the cannabis product
8. Nutrition facts table
9. List of ingredients
10. Bar code

Figure 3. Plastic container for 3.5 grams of cannabis.
Source: Helene Gerber, “Sin Tax? Canada to Tax Cannabis by THC Concentration,” RxLeaf. April 3, 2019, https://www.rxleaf.com/sin-tax-canada-to-tax-cannabis-by-thc-concentration.

Figure 4. Plastic container for 7 grams of cannabis.
Source: Vanmala Subramaniam, “Meet the little stamp that became a big headache for licensed cannabis producers,” Montreal Gazette. October 15, 2018, https://montrealgazette.com/cannabis/meet-the-little-stamp-that-became-a-big-headache-for-licensed-cannabis-producers/wcm/9676842b-ab9e-4a98-b881-4a5b367e946b.

Figure 5. Multiple material jars for 1, 3.5, 7, and 15 grams of cannabis, respectively.
Source: Greg Mercer, “Canada readies itself for one of its biggest policy shifts ever with pot legalization,” The Star. October 12, 2018, https://www.thestar.com/news/cannabis/2018/10/12/canada-readies-itself-for-one-of-its-biggest-policy-shifts-ever.html.

Figure 6. Plastic container for 1 gram of cannabis and sample pack.
Source: David George-Cosh, “Baggies, no more: What pot products will look like when they hit Canadian shelves,” BNN Bloomberg. September 21, 2018, https://www.bnnbloomberg.ca/baggies-no-more-what-pot-products-will-look-like-when-they-hit-canadian-shelves-1.1140632.

Figure 7. Assorted packaging options.
Source: “Resource for Health Canada’s Guide to Packaging and Labelling and Cannabis Regulations”, Cannasupplies, Pharmasystems. September 21, 2018, https://cannasupplies.ca/resource-health-canada-guide-to-packaging-and-labelling-cannabis-products.

Figure 8. Cannabis extract package.
Source: “Canadian Concentrate Jar: CanDab15,” CannaSupplies, Pharmasystems. 2020, https://cannasupplies.ca/product/concentrate-jar-candab15.

Figure 9. Assorted dried cannabis packages.
Source: “Baggies, no more,” 2018. https://www.bnnbloomberg.ca/baggies-no-more-what-pot-products-will-look-like-when-they-hit-canadian-shelves-1.1140632.

B. Glossary

Unless otherwise noted, all definitions are adapted from *The Future of Packaging: From Linear to Circular* by Tom Szaky.[114]

biodegradable Any material that can be decomposed by living microbes. Typically refers to organic material that, under the right conditions, will completely biologically break down. Biodegradables break down faster than non-biodegradables, but can still take months or years. They can also leave toxic waste behind and emit greenhouse gases.

cannabis concentrate A substance that has a concentration of greater than 3% of THC, taking into account the potential to convert THCA into THC.[115]

carbon dioxide equivalent A metric measure used to compare the emissions from various greenhouse gases on the basis of their impact on global warming, by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.[116]

closed-loop recycling A system whereby a product can be recycled back into itself; ideally, it can be circulated from production to consumption and back repeatedly.

compostable Any organic material that can be decomposed and converted into a nutrient-rich mixture helpful to grow plants. Its degradation by biological processes causes no harm to the environment, and leaves no visible, distinguishable, or toxic residue. All compostable material is biodegradable, but not all biodegradables are compostable.

decarboxylation A chemical process that occurs when cannabis is heated, which removes the carboxyl of cannabinoid molecules, turning non-psychoactive cannabinoids such as THCA or CBDA into their psychoactive derivatives, THC or CBD.[117]

edible cannabis A substance or mixture of substances consumed in the same manner as food. It does not include dried cannabis, fresh cannabis, cannabis plants or cannabis plant seeds.[118]

fresh or raw cannabis Freshly harvested cannabis buds and leaves, but does not include plant material that can be used to propagate cannabis.[119]

greenwashing To make people believe that your company is doing more to protect the environment than it really is.[120]

incineration The process by which waste materials are burned or gasified, depending on product. It may or may not generate fuel energy. The original product is destroyed during this process as high temperatures break it down at the molecular level.

landfilling Disposing of waste in a pile and covering it with dirt and other materials to mummify the material so very little decomposition can occur due to the lack of air circulation and sunlight. The process does not recover any material, except in occasions where landfills can syphon off methane gas for energy use.

open-loop recycling A system whereby a product can be recycled into other types of products; ideally, it can be circulated from consumption to manufacturing.

recycling A general term covering the process chain of collection, sorting, reprocessing of end-of-life materials into raw material that can be used as an input into new product manufacturing.

recycled materials Materials that are collected, processed, and purchased for use in new production. Recycled content refers to the percentage of this recycled material in a new product.

reusable Using a product again for the same or similar purpose for which it was made without destroying or altering it.

post-consumer Waste generated after a product has been used and disposed of by a consumer. This is the type of waste people are most familiar with, as they mostly throw it in a garbage can or recycling bin.

product stewardship A system whereby everyone involved in the life cycle of a product is called upon to take responsibility to reduce its environmental impact. For manufacturers, this includes planning for and, if necessary, paying for the recycling or disposal of the product at the end of its useful life. For retailers and consumers, this means taking an active role in ensuring the proper disposal or recycling of an end-of-life product.[121]

pre-consumer waste Waste generated in a factory from completed products, often in the form of misprinted, defective, or excess products.

sustainability Ability to be maintained at a certain rate and or level that avoids the depletion of natural resources to maintain ecological balance.

THC refers to delta-9-tetrahydrocannabinol. It is responsible for the way brains and bodies respond to cannabis, including the high and intoxication. THC has some therapeutic effects and harmful effects. Harmful effects may be greater when the strength of THC is higher. The potency (concentration or strength) of THC in cannabis is often shown as a percentage of THC by weight (or by volume of an oil). THC potency in dried cannabis has increased from an average of 3% in the 1980s to around 15% today. Some strains can have an average as high as 30% THC. Cannabis that contains very low amounts of THC in its flowers and leaves (less than 0.3%) is classified as hemp.[122]

THCA refers to delta-9-tetrahydrocannabinolic acid. Live cannabis plants contain tetrahydrocannabinolic acid (THCA), the non-active version of this compound. When cannabis is decarboxylated through heating to a high temperature, drying or curing, the acid molecule (the “A” in THCA) drops off, and the THC is activated. This results in the effects we associate with consuming THC. It also means that cannabis in its fresh form is not yet active with THC.[123]

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