Making Automotive-Related Packaging Sustainable

A Real-World Collection and Recycling Pilot Program to Explore Future Application

NLCRC

The National Lubricant Container Recycling Coalition

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Contents

Acknowledgments

We extend our heartfelt gratitude to all the program participants whose invaluable contributions have made this initiative a success. Special thanks to NAPA Auto Parts, Live Thrive, Inc., and members of the NLCRC, including Safety-Kleen and Nexus Circular, as well as other valued contributors. Your collaboration and dedication have been instrumental in advancing sustainable waste management practices and promoting environmental stewardship.

Abstract

The collection and recycling of oil bottles (or any container that contains petroleum-based liquids) is a considerable challenge in the United States due to the residual liquid product remaining in the packaging after use, hindering acceptance by the residential and commercial municipal solid waste (MSW) haulers and recycling facilities. The limited acceptance of collection and recycling is exacerbated by the petroleum packaging industry's relatively minor contribution of packaging waste when compared to other industries, limiting opportunities to influence broad adoption or community-based solutions. Thus, there is an urgent need for alternative ways to collect, transport, and recycle petroleum packaging beyond "curbside."

To better understand the potential opportunities, the National Lubricant Container Recycling Coalition (NLCRC) launched a 21-month collection and recycling program in the spring of 2022 in the Atlanta, Georgia region. This program was developed to assess 1) the practicality of developing a functional collection and recycling model for automotive-related plastic packaging, and 2) the likelihood of expanding the model to other markets or regions where economically feasible.

The program demonstrated that the practicability of a collection and recycling system for petroleum and automotive packaging is not only possible, but when stakeholders from across the value chain are effectively leveraged, the opportunities to develop an economically viable program are achievable and scalable ***when incentives are applied***. These findings are critical to the industry's understanding of the prerequisites needed to expand the program into states that are adopting Extended Producer Responsibility (EPR) laws.

Introduction

The Complexities of Collection and Recycling of Petroleum Packaging

Numerous industries depend on disposable plastics, such as bottles, straws, and bags, which are made from fossil fuel-derived chemicals and are intended for single use before disposal. The disposal of these plastics is a well-known environmental issue present in some U.S. states' agendas.[1] Among these plastics is high-density polyethylene (HDPE), which is used in the petroleum packaging industry because of its versatility and resistance to various chemicals, including acids, alcohols, and oils.[2] HDPE is extensively used in industries ranging from healthcare to automotive, with the latter serving as the primary material for multi-quart-sized packaging formats.

The size of the U.S. automotive engine oil market is estimated to be 771 million gallons in 2024, and is projected to increase 1.7% by 2026.[3] Despite the expanding market and the prevalent use of plastic packaging, recycling packaging containing fossil fuel–based chemicals is typically not accepted by curbside recycling programs due to the residual liquid product.

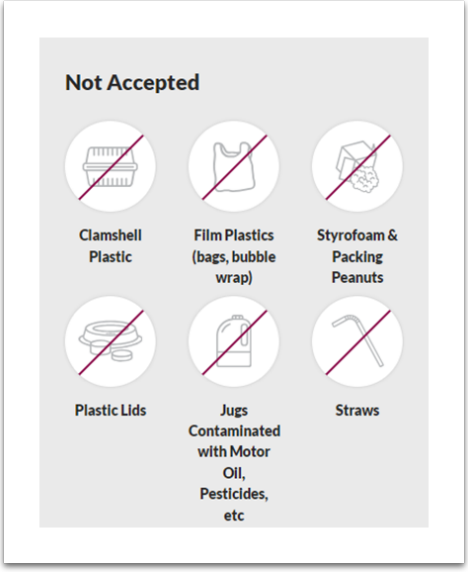

Figure 1. *Example 1 of prohibition for disposal of motor oil bottles from curbside recycling.*

Source: Pride Recycling.

Residual liquid product is retained in the packaging waste stream for several reasons:

1. because of incomplete use (disposing of a product container before empty),
2. because the original product is replaced with used product or other liquid, and
3. because the packaging tends to retain a small amount of residue product after use, even when properly emptied.

[1] For example, the case of the State of California. Governor Newsom Signs Legislation Cutting Harmful Plastic Pollution to Protect Communities, Oceans and Animals (June 2022). Follow the link.

[2] Acme Plastics: "What is High-Density Polyethylene?" Follow the link.

[3] Mordor Intelligence: US Automotive Engine Oil Market Size & Share Analysis – Growth Trends and Forecasts up to 2026. Follow the link.

The residual product presents significant challenges to MSW haulers and mechanical recyclers because of the contamination the oil will leave on their recycling equipment and other wastes, requiring additional cleaning. This is particularly challenging for processes when the equipment is used to process other "non-contaminated" wastes. Secondly, the processing and cleaning of oil bottles[4] also adds costs for environmental compliance to properly manage the disposal of liquid wastes that are generated.

Waste haulers and mechanical recyclers generally do not accept post-consumer automotive packaging as a result of the residual product contamination and the associated costs.

Since most municipalities in the United States (cities, towns, etc.) establish long-term, competitively bid contracts with collectors, the added costs of automotive packaging recycling are not part of the scope, so the municipalities tend to ban automotive packaging from curbside collection.

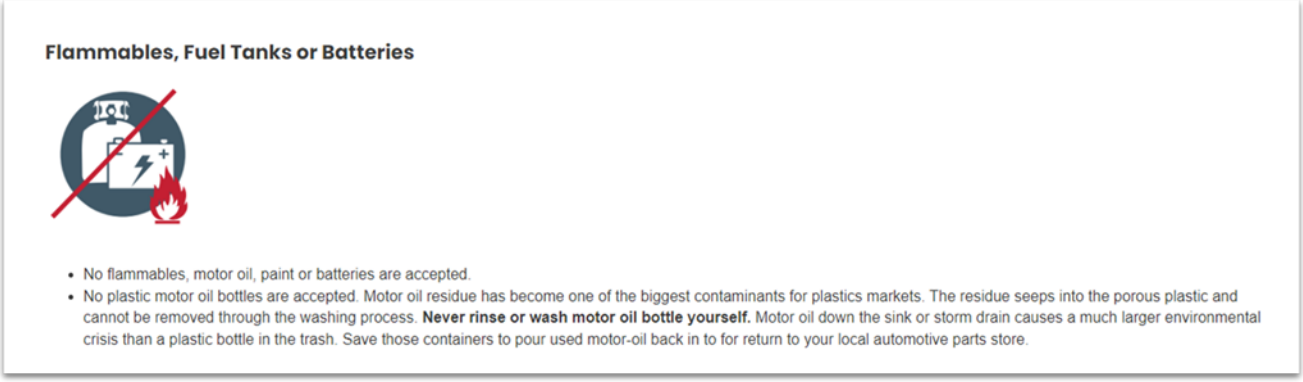

Figure 2. *Example 2 of prohibition for disposal of motor oil bottles from curbside recycling.*

Source: Central Virginia Waste Management Authority.

External Influences

Multiple stakeholders are driving the demand for environmental sustainability in consumer products and their packaging, including plastics from industries such as petroleum and automotive. Consumers are increasingly opting for eco-friendly products, prompting companies to offer greener alternatives. Non-governmental organizations (NGOs) are advocating for reduced environmental impact from businesses, encouraging them to adopt more sustainable practices. Retailers, who have direct contact with customers, are feeling pressure to provide more sustainable products in response to this growing consumer demand. Additionally, investors are taking environmental

[4] In this document, the term "oil bottles" refers to any container specifically designed to hold petroleum-based liquids.

sustainability into consideration when making investment decisions, leading companies to prioritize sustainability initiatives.

Furthermore, legislative actions, such as EPR and post-consumer recycled (PCR) content initiatives, are driving recycling efforts and making progress across the U.S. These laws are designed to transfer the responsibility for managing post-consumer packaging collection and recycling onto producers. Presently, Colorado, California, Oregon, and Maine have implemented packaging EPR laws, while New Jersey and California have enacted PCR laws.

Importance of Collaboration

Improving recycling infrastructure, technology, and practices cannot be accomplished by individual companies alone. Therefore, addressing the challenge of recycling post-consumer automotive and related packaging requires collaboration from stakeholders across the value chain. It is essential for manufacturers, suppliers, distributors, recyclers, and other relevant entities to work together to establish efficient recovery and recycling systems. This collaborative approach allows companies to pool resources and expertise, resulting in more effective investments in initiatives aimed at improving recycling.

Focusing on Collection

MSW haulers often decline to collect oil bottles because of increased processing costs and challenges associated with handling residual liquids. Testing recycling solutions then becomes unfeasible without their cooperation in collecting these bottles.

In response to this challenge, the NLCRC took a proactive step in the spring of 2022 by launching a collaborative collection and recycling program in Atlanta, Georgia. This program prioritized the collection of oil bottles, recognizing it as the biggest gap in the value chain essential for testing the feasibility of recycling solutions. By focusing on this critical aspect, the initiative aimed not only to address the industry's need for a collection and recycling program, but also to serve as a testing ground for assessing the feasibility of developing economically viable, larger-scale initiatives in the future.

The Collection and Recycling Program

To establish the collection and recycling program, a large market with diverse participants was targeted to ensure access to a significant quantity of oil bottles for effective recycling feasibility testing. Recognizing the importance of a diverse participant base, we focused on involving commercial entities and auto care service providers serving both DIY ("do it yourself") and DIFY ("do it for you") markets. In addition to diversity, we prioritized convenient participant locations within a specific area to improve collection efficiency. As a result, the program was launched in spring 2022, spanning over 40 locations in Atlanta, including retail stores, auto care centers, and a community collection center.

The benefit of Atlanta

The decision to establish the program in Atlanta, Georgia, was influenced by several factors. First, the city provided the convenience of having numerous participants with diverse operations, ranging from retail stores to auto care centers, ensuring broad engagement and involvement. Additionally, both the waste hauler (Safety-Kleen) and the recycler (Nexus Circular) are NLCRC members and had coverage in Atlanta for services: Safety-Kleen for collecting and transporting materials, and Nexus Circular for processing the collected plastic through its recycling facility. Lastly, the market dynamics in Atlanta suggested favorable conditions for collecting significant quantities of oil bottles, further supporting our decision to launch the program in this location.

Objectives

The program established clear objectives, including testing the feasibility of an alternative collection and recycling program for plastic oil bottles, gaining deeper insights into waste disposal behaviors, evaluating economic and market drivers for post-consumer recovery and recycling, and establishing parameters for model development and future scalability.

Timeline

The initial timeline set for the program was for a minimum of 12 months, considering the need for a comprehensive understanding of consumer behavior, which may vary seasonally. However, due to a ramp-up period of approximately 9 months to ensure consistent collection services across various participant locations, the pilot was extended until the end of 2023, resulting in a program duration of 21 months.

Program Participants

To facilitate the program's operation, we engaged multiple participants to support the collection, transport, and recycling of plastic oil bottles.

Program participants included NAPA Auto Parts; Live Thrive, Inc.; and members of the NLCRC, including Safety-Kleen and Nexus Circular, among other valued contributors.

Throughout the collection process, these participants enabled various locations to collect the bottles. They provided space for collection bins, maintained cleanliness around the area, and communicated with the waste hauler when additional collection services were required. Collection participants included retail stores, auto service centers (which also included locations for instant oil changes, heavy-duty servicing, and service centers from auto auction facilities), and community collection centers.

The waste hauler was responsible for transporting the collected bottles to the recycling facility, managing logistics, scheduling transportation services, communicating with collection participants, and maintaining a data management system to track services and collections. Upon receipt, the Recycler received the oil bottles to assess feasibility for recycling.

Process Description

The collection and recycling process followed a systematic flow, starting with the collection of oil bottles at participant locations, then transferring the gathered material to a central transfer station, and finally transporting it to the recycler. At the collection locations, a 95-gallon bin was provided to accommodate the oil bottles. Retailers were tasked with placing the bins in an accessible and visible location for participants, while auto service centers positioned them conveniently for employees. The community collection center received a gaylord container, equivalent to four 95-gallon bins. This diversity in collection locations led to varying disposal methods, with retail stores and community collection centers relying on customers or users for disposal, while auto service centers engaged employees in handling the bottles during servicing.

Following the collection phase, the waste hauler initially gathered oil bottles from the bins at scheduled intervals. Users had the option to request a service if the bins reached capacity. As the program progressed, the collection frequency was adjusted accordingly. Subsequently, the bottles were transported to transfer stations, where they accumulated until there was sufficient volume for shipment to the Recycler. At the

recycling facility, the plastic from the bottles was processed via pyrolysis, breaking it down into its molecular building blocks in liquid form, which can be used to create new plastics.

To effectively monitor collection services and track the amount of material collected by location and participant type, it was necessary to adopt a data management system, which was developed and managed by the waste hauler.

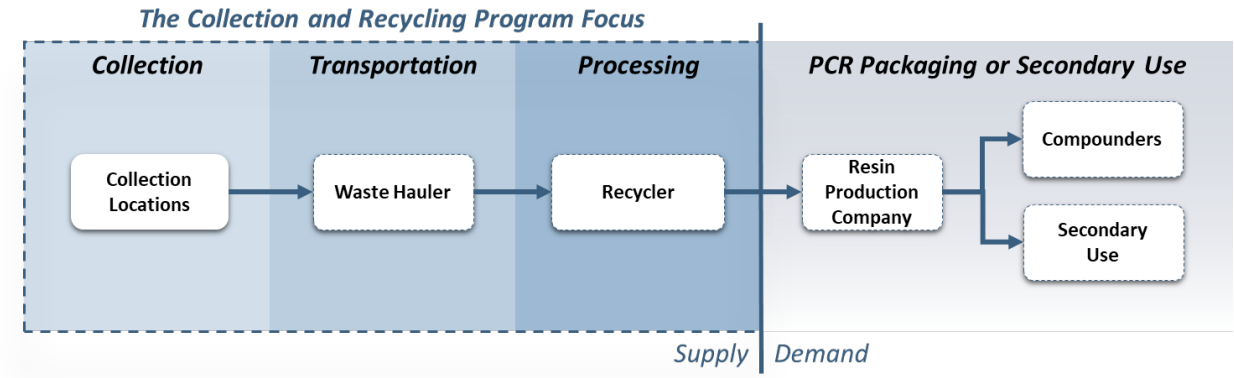

Figure 3. *Collection and Recycling Program process.*

Collection Criteria

To optimize collection efforts, we established a comprehensive set of criteria. This included defining a specific list of acceptable materials, optimizing collection bin placement and visibility, and establishing effective collection service frequencies.

Acceptable Materials

To ensure the plastic packaging collected met recycling standards, the program established criteria for acceptable materials. These requirements specified that accepted bottles must be drained by gravity and briefly inverted, as well as having been associated with an automotive lubricant such as oil, grease, antifreeze, or additives. The program also accepted various container sizes, such as pint, quart, half-gallon, 1-gallon, 5-gallon (plastic pails without metal handles), and ePODS™. Certain materials were excluded, such as food, liquid, paper, absorbents, metal, rags, glass, certain plastics with multiple layers, pouches or tubes, bag-in-box, rope, and any other materials not specifically mentioned as acceptable.

Figure 4. *Signage for the collection bins detailing accepted materials for the recycling program.*

Collection Bin Placement

To ensure effective oil bottle disposal, we carefully selected suitable collection bins for each location, determined the necessary number of bins, and strategically positioned them for accessibility and visibility.

Frequency of Collection Services

Improving the efficiency of transporting oil bottles from collection sites to transfer stations and ultimately to the recycling facility was the main objective. Initially, collection frequencies were set for each location based on rough estimates of bottle generation. As more data was collected, these frequencies were adjusted to better meet the needs of each location. For instance, auto service centers were expected to generate more bottles compared to retail stores, where disposal depended on customer willingness.

Results

Over the 21-month period of program operation, a total of approximately 11,170 lbs of packaging material was successfully recovered, which is equivalent to diverting nearly 90,000 quart-size oil containers from landfills. The distribution of recovered plastic illustrates the varying participation levels across different collection points: auto service centers contributed 57%, community collection centers 26%, and retail stores 17%. Notably, auto service centers outperformed retail stores by 20% in monthly average collection per location, aligning with expectations due to the nature of bottle disposal at these locations.

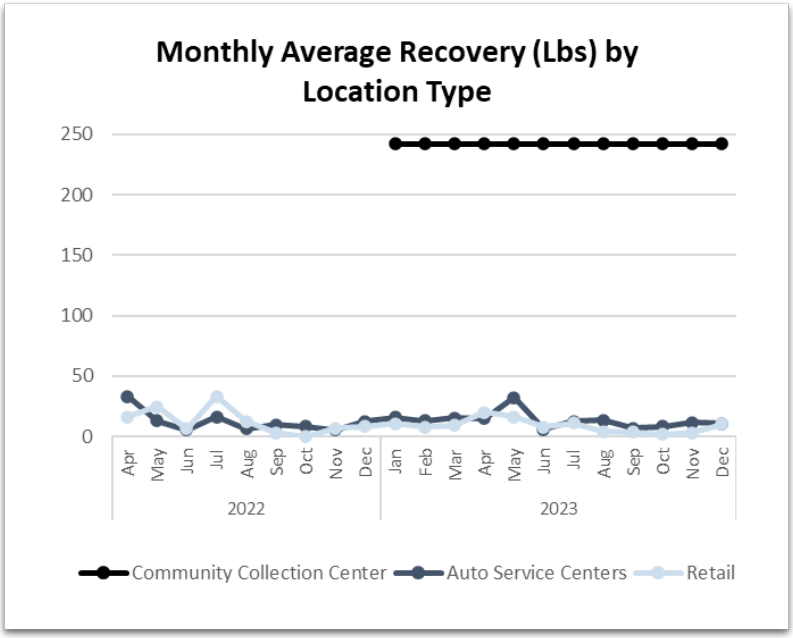

Figure 5. *Average monthly collection by type of location.*

Even though the community collection center joined the program in January 2023, ten months after the program started, its contributions remained significant, making up 26% of the total plastic collected.[5] The program experienced a positive collection trend over time, with participation increasing as more participants joined, although it took approximately 9 months to establish and optimize operations.

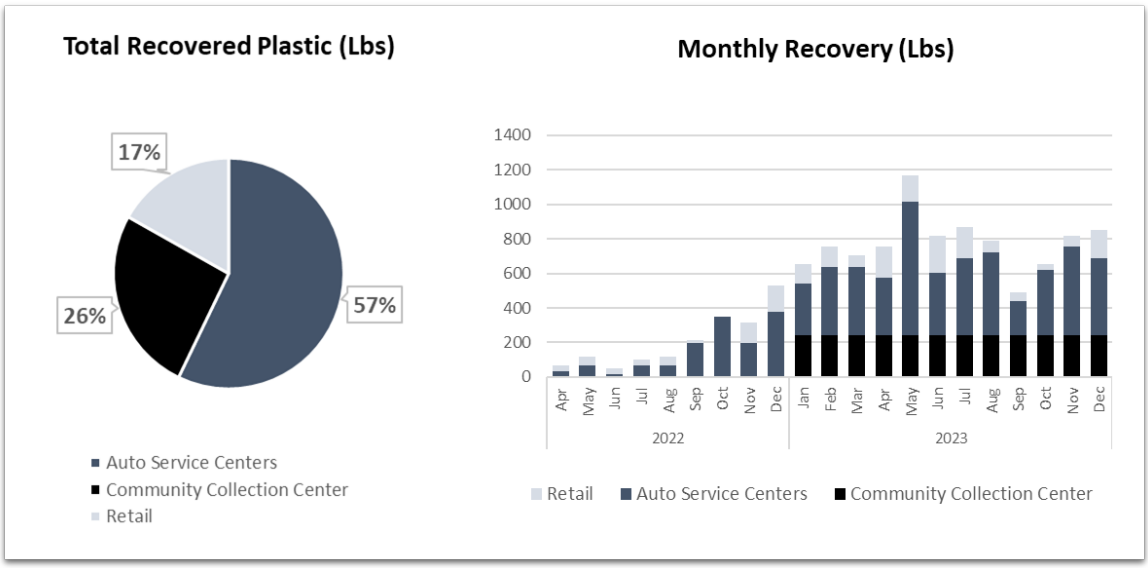

Figure 6. *Total recovered plastic and monthly collection breakdown by participant type in the program.*

[5] The collections per month shown in the graphic represent calculations of the monthly average, as monthly measurements were not available.

Regarding the types of bottles collected and their materials, it was noted that collection bins accumulated 5-gallon pails more than anticipated, leading to faster bin filling rates. While the program generally met accepted material criteria, occasional exceptions occurred, particularly with plastic jugs. Although no reports indicated excessive oil remnants in containers, a dumpster dive exercise revealed some bottles with significant liquid contamination. To ensure compliance with recycling criteria, waste hauler operators inspected materials during pickup, refusing collection if criteria were not met.

Clean Harbors | safety-kleen
A Clean Harbors Company

Lubricant Container Recycling Program
"TRIAL Phase"

Safety-Kleen & NAPA

How it will work:

- Safety-Kleen will deliver labeled 95-gallon bins to NAPA Locations (***refer to Page 3***). A signature will be required upon delivery.
- NAPA will decide where to place the 95-gallon bins where customers will not have access.
- NAPA will receive acceptable empty lubricant containers (***refer to Page 2***) from their customers. Only NAPA employees will place the empty containers into the Safety-Kleen labeled 95-gallon container
  - Pour off any excess lubricant or UMO into the DIY UMO tank. Once emptied and re-capped, place the container into the 95-gallon bin.
  - NOTE: If a plastic lubricant pail is presented, ensure the pail has residual lubricants only and remove any metal handles
- When one 95-gallon bin is full and the second 95-gallon bin is half full, the NAPA representative must call the number listed on the label of the 95-gallon bin (***refer to page 4***).
- A Safety-Kleen service rep will come to the location **within 2-4 days of the call** to deliver empty 95-gallon bins and remove the full 95-gallon bins with the lubricant containers. A signature will be required upon collection.
- 95-gallon bins that contain items not listed under the acceptable list will be deemed non-compliant and will not be collected until non-compliant items are removed.
- Weekly calls will be coordinated by the NLCRC with appropriate pilot representatives.

Figure 7. *Guidelines provided to the program participants.*

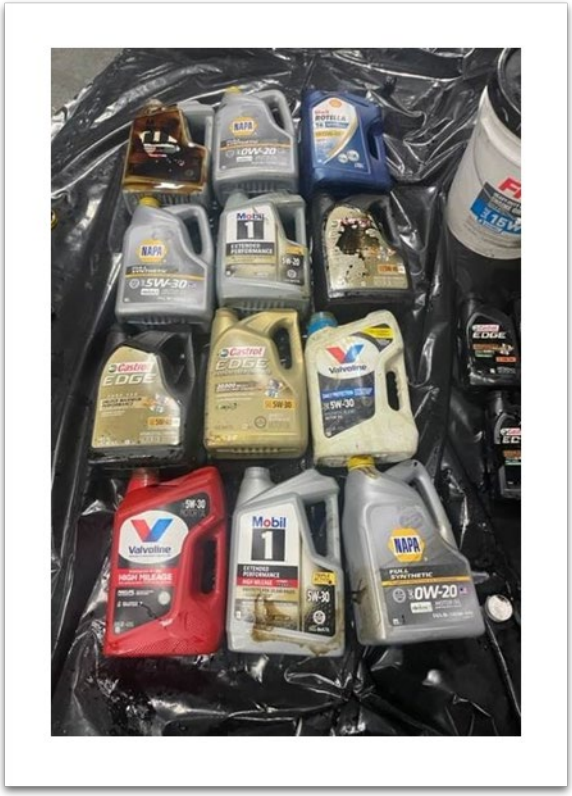

Figure 8. *Picture of plastic bottles collected at a retail store as part of the program.*

Insights from the Program Participants

Following the completion of the program, interviews with program participants were conducted to collect feedback.

> ***Key findings for retail stores:***
>
> *1. The program posed no significant burden on location staff.*
>
> *2. Collection rates are influenced by customer density and demographic characteristics, placement of collection bins in high-traffic areas, and the existence of oil collection programs.*
>
> *3. Customer education is needed for proper draining of remaining liquids from the bottle.*

Retail Stores

Insights gathered from retailers revealed important aspects of bottle collection practices. Notably, collection rates varied among stores due to factors like customer density[6] and demographic characteristics. Stores located in areas with a high concentration of customers tended to collect more bottles, especially those visited by DIY enthusiasts or service employees. Placing collection bins in high-traffic zones and existing oil collection programs was seen to boost collections. Retailers emphasized the importance of further educating customers about the proper disposal of oil bottles, including draining out the remaining liquid and promoting recyclability.

Feedback showed that managing the program was not burdensome for employees, mainly involving maintaining cleanliness and occasional communication with the waste hauler. Retailers perceive that the program can benefit them with higher foot traffic, as customers who dropped off oil bottles tended to spend more time in the store, potentially leading to increased purchases.

Auto Service Centers

In implementing the program, auto service centers emphasized three critical success factors, as bottle disposal relies on the centers' employees. First, they stressed the importance of clear leadership messaging, establishing the program as mandatory and ensuring all employees understand its expectations and requirements. Second, participants highlighted the need for ongoing maintenance of the program, suggesting

> *Auto service centers highlighted that for the program to operate correctly, they need clear messaging from leadership, regular program maintenance to ensure its proper functioning, and appropriate on-site conditions (collection bin placement).*

[6] Concentration of customers within a given area.

recognition or other incentives to keep employees engaged once it is operational. Finally, they emphasized the importance of proper conditions for effective bottle disposal, including appropriately sized containers, sufficient bins based on waste generation, and conveniently located spaces near service areas. Additionally, some participants had company-wide zero-waste-to-landfill goals, making this program of high interest to support reaching their sustainability objectives.

Community Collection Center

The community collection center operates differently from retail stores and auto service centers. People voluntarily bring hard-to-recycle materials here, which reflects a growing interest in environmental sustainability. The center accepts various items like electronics, paints, chemicals, tires, mattresses, and oil bottles, which are later transported to our program recycling facility. Its versatility in handling these materials makes it a convenient one-stop solution for disposing of hard-to-recycle items. Despite the center joining the program in January 2023, this location contributed 26% to the program's total plastic packaging collection.

Education and community engagement are considered crucial for the center's success in waste collection. Approximately half of the center's resources are dedicated to educating people through programs, visuals, and friendly reminders for proper waste sorting and handling. To meet the program criteria, staff helped users make sure there was no remaining oil in the bottles.

Waste Hauler

The waste hauler, Safety-Kleen, provided feedback on the program's implementation and operation. Since the program was new when deployed, the pilot participants did not have data on bottle generation at their service locations, making it challenging to estimate an adequate collection frequency.

More effort is required to obtain accurate estimations of bottle disposal at each location, so that collection services can be scheduled appropriately.

Initially, each location required an additional collection bin for program continuity, as the trucks would pick up the collection bin with the collected bottles and replace it with an empty one. This issue was later resolved by implementing liners in the collection bins. Safety-Kleen also provided a transfer station, essential for effective and continuous collection services, allowing the program to accumulate sufficient material before transporting it to the recycling facility.

During program operation, they observed that the placement of collection bins at the participants' facilities influenced material collection rates. When bins were more easily accessible, participants perceived more material was generated, whereas locations with bins near dumpsters collected less.

Adjustments to the data management system were also necessary during the program operation, highlighting the need for waste haulers to develop a tailored data management system to address situations not typically encountered in standard collection services—such as recording unexpected scenarios where trucks could not collect bins due to on-site issues or lack of material.

For optimizing collection services, Safety-Kleen evaluated a solution that involved using a shredding truck to collect the oil bottles and shred them on-site. This approach would allow the truck to collect more material, given that unshredded oil bottles take up more space. However, this solution was not tested during the operation of the program.

Recycler

Nexus Circular was the recycler for this pilot program, receiving oil bottles at their recycling facility in Atlanta. The low bulk density of the loose bottle shipments required significant warehouse space to accommodate intermittent loads which proved the need for a transfer station to accumulate the collected materials.

Figure 7. *Nexus Circular recycling facility.*

Throughout the operation of the program, it was demonstrated that collected oil bottles can be converted into the molecular form of plastic through pyrolysis, resulting in the production of a liquid product which can then be used in the creation of new plastics.

Key Observations and Lessons Learned

Below is a summary of the key observations and lessons learned gathered throughout the program's operation.

Retailers

- Collection rates varied based on factors like customer density, demographic characteristics, and existing oil collection programs at locations.
- Placing collection bins in high-traffic areas significantly boosted collections. However, participants required time to determine optimal locations for visibility and accessibility, despite initial planning.
- Employee management of the program was straightforward, primarily involving area cleanliness upkeep and occasional communication with haulers.
- Retail stores anticipate benefits from the bottle collection program, including increased foot traffic potentially leading to higher customer purchases.

Auto Service Centers

- Clear leadership messaging, regular maintenance, and proper on-site conditions are essential for program operation.
- Some participants had company-wide zero-waste-to-landfill goals, increasing interest in supporting the program.

Community Collection Center

- More people are showing concern for environmental sustainability, as seen in the community collection center's significant contributions despite joining the program in January 2023.
- Crucial to the center's waste collection success is extensive education and community engagement, with roughly half of its efforts dedicated to providing resources, visuals, and friendly reminders for proper waste sorting and handling.

Waste Hauler

- Transfer stations proved necessary for effective collection and operation continuity, especially when the recycling facility could not immediately receive collected bottles.
- More effort is required to obtain accurate estimations of bottle disposal at each location, facilitating appropriate programming of collection service frequencies.

Recycler

- It was proven feasible to process and convert plastic oil bottles into a product usable for creating new plastics, completing the loop for an end-to-end technical solution for recovering and recycling oil bottles from multiple sources in the Atlanta Market.

Relevant Perspectives from Canada

Canada initially prioritized petroleum and automotive materials and began their collection efforts with used oil.

During the program operation, it was identified that Canada has extensive experience in operating collection and recycling initiatives, including those for oil bottles. The Used Oil Management Association of Canada (UOMA) programs were developed in the 1990s and early 2000s, as each Province passed an EPR law for petroleum and automotive material. Similarities with U.S. EPR laws include producers appointing Provincial UOMAs for compliance management, funding association activities via fees, and overseeing recycling networks, resulting in an impressive 85% recycling rate for lubricant containers in Canada.

Operationally, the Canadian program also shares similarities with the U.S.-based collection and recycling program. Oil bottles are disposed of at participant locations, then collected by a waste hauler, accumulated at transfer stations, and finally transported to recycling facilities. The main difference is that in Canada, the program is limited to certain types of contamination, and it began with the collection and recycling of used oil.

Key Learnings

Recognizing the similarities between the programs, there is potential for leveraging their experience in implementing and operating collection and recycling programs. Useful insights have been gathered from industry experts such as RPM eco, an NLCRC member, and information from the stewardship programs in Canada. This effort aimed to better understand operational conditions influencing the economics of the model and the economic drivers for program operation. Key factors identified include market density, operating costs, and the aftermarket value of plastic packaging.

Market Density

Population and market density significantly influence material collection efficiency. In Canada, zones within provinces are classified based on market density, road systems, and demographics. Areas with higher population and market densities collect more effectively due to shorter distances between collection points. Conversely, rural or suburban zones with lower densities face challenges in achieving efficient collection due to greater distances between sites.

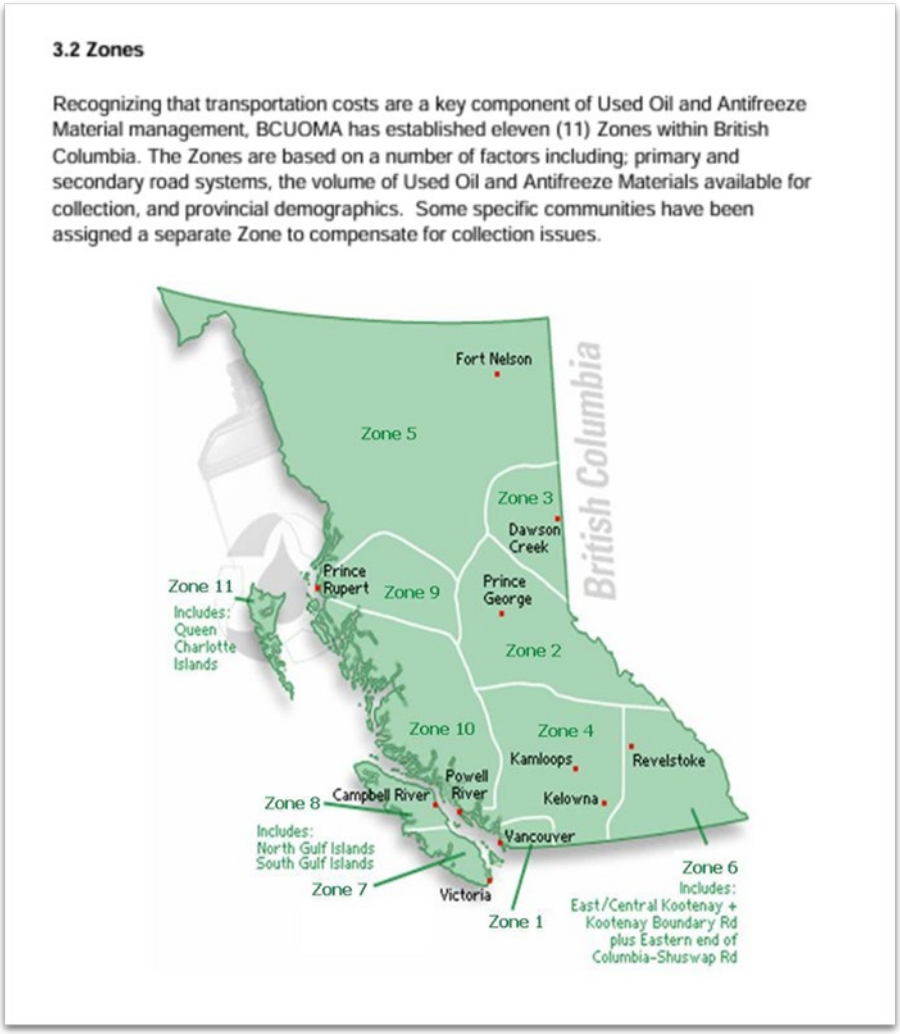

Figure 8. *Zone classification of British Columbia, British Columbia Used Oil Management Association.*

Source: Manual for Registered Processors and Collectors.

Operating Costs

The stewardship programs use funding from producers to incentivize the market by offering pay rates to companies for collecting the applicable material. These companies, whether accepting the offered pay rates or not, constantly seek cost-efficient operations for profitability. If no company accepts the offered incentives or pay rates, the stewardship program must decide whether to improve the pay rates or explore alternatives to enable the required collection and recycling rates.

Given the offered pay rates, collection companies must cover operational costs, including acquiring and maintaining transportation units such as trucks and transfer stations, as well as costs associated with shipment to transfer stations and recycling facilities, which include expenses for fuel, labor, and insurance. These costs vary based

on market conditions and location, with urban areas typically facing higher expenses. As operating costs rise over time, these companies and the PRO organizations need to assess whether it is feasible to continue operating the program with the agreed pay rates or if adjustments are needed to align with market fluctuations.

Aftermarket Value of Collected Plastic

The interest of companies in purchasing recycled plastics is relevant, as it impacts the economic viability of the system. This serves as an economic incentive for waste management companies and recyclers, as it can help offset operational costs. However, to align with market conditions, adjusted support incentives are still necessary.

While the aftermarket value of collected plastic serves as an incentive for the system, it has been observed that even with cost-efficient collection operations, this value will not offset producers' costs.

Companie's willingness to pay for recycled plastics largely depends on market demand, often shaped by regulations like post-consumer recycled (PCR) content laws, which push for new plastic products to incorporate recycled materials. Additionally, the choice of pigments in plastic packaging affects its aftermarket value, as brands and products often require specific colors.

System Optimization

To optimize the cost efficiency of the program operation, several initiatives can be implemented, based on successful practices observed in Canada:

Utilization of AI Systems for Logistics Optimization:

Implementing AI systems to support logistics can significantly enhance cost efficiency. By analyzing trends in bottle generation, these systems can determine optimal collection frequencies and identify when collection bins are full. Additionally, AI can optimize truck routes to ensure maximum material pickup and identify the most efficient routes for reaching distant locations, minimizing transportation costs.

Integration of Transfer Stations:

Using transfer stations is not only beneficial but essential for optimizing logistics and ensuring program continuity. Transfer stations play a crucial role in consolidating materials before transportation, streamlining operations, and reducing overall costs. This aligns with what we learned from the NLCRC program.

Program Adoption:

Emphasizing education and communication initiatives can promote widespread adoption of the program while addressing relevant challenges for the industry, such as the residual liquid product in the bottles. RPM eco estimates that in Canada, approximately 13%-15% of the liquid product in the bottles remains as residue, and through education and operational controls, this wastage could be reduced. Additionally, industry-related organizations such as retail stores and auto service centers can adopt this program, making it a standard practice easily managed by local staff, which doesn't require significant effort to oversee.

Based on this experience and data, it is clear that program operation costs vary across different zones or areas due to local conditions and market factors, with these costs subject to change over time. This implies that each area adopting the program will differ from others due to its unique characteristics. However, by implementing targeted initiatives and tools, the cost-effectiveness of each zone can be improved, transitioning from initial to mature phases. This highlights the importance of establishing systems for continuous innovation and best practice sharing.

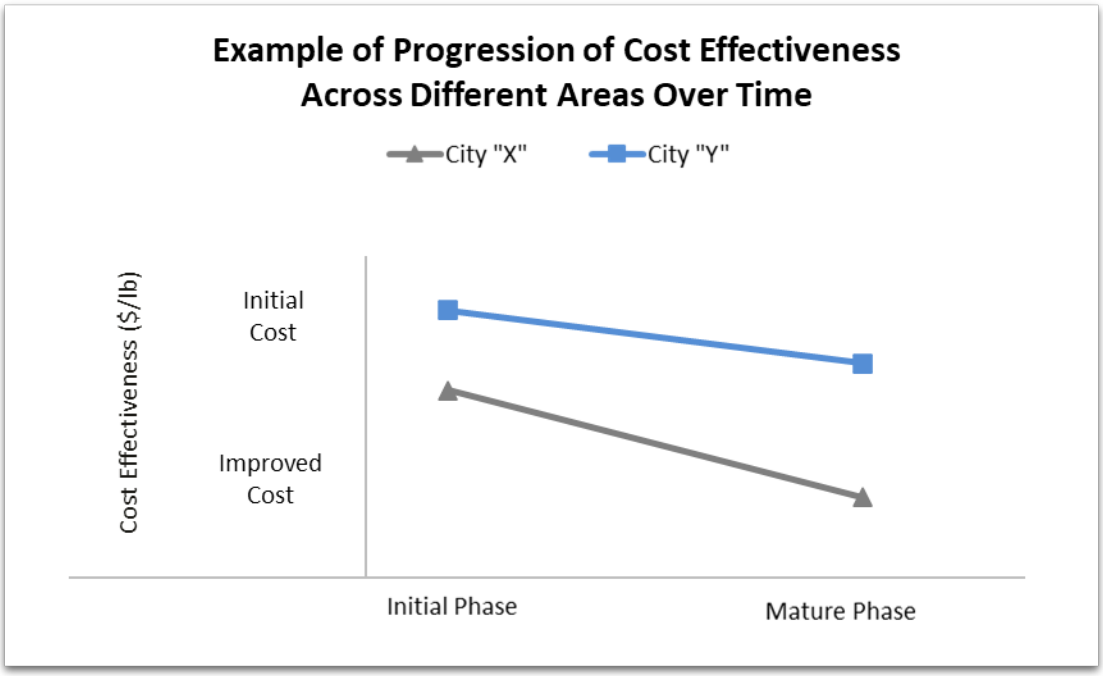

Figure 11. *Chart illustrating how cost effectiveness can potentially evolve across different areas over time.*

Conclusions and Future Application

The cooperation of MSW haulers, essential for enabling testing recycling solutions, was the primary focus of this program. Through this initiative, oil bottles were effectively collected from various locations, including retailers, auto service centers, and a community collection center. And as a result, the program successfully demonstrated the feasibility of addressing the collection gap and recycling plastic oil bottle packaging.

While costs for an alternative collection and recycling program may vary across regions due to factors like market density and demographics, all areas can benefit from optimization to enhance cost efficiency. However, funding such programs will require financial incentives. These incentives could involve companies offsetting collection costs to align with zero-waste-to-landfill goals or realizing commercial benefits such as increased foot traffic at stores. However, voluntary incentives may not suffice to cover all program costs, drawing attention to other mandatory incentives, such as those outlined by the EPR laws.

As EPR gains momentum in the United States, the NLCRC estimates that if producers from the engine oil packaging industry choose to collaborate directly with the state-approved PRO and adopt the statewide, non-industry-specific solution, the cumulative costs over a decade could amount to $2 billion USD. Alternatively, opting for a collaborative approach and establishing an industry-specific solution could potentially save $1.7 billion USD over the same period.

Building on the proven success of the Canadian UOMA program, which uniquely targets the petroleum packaging industry, the NLCRC has decided to create a comparable model in the United States, known as the EPR Compliance Organization. This model will facilitate a collaborative solution, overseeing an “Alternative Collection Program” or collaborating with a State PRO. Regardless of the state engagement approach, the EPR Compliance Organization will prioritize the needs of the petroleum packaging industry, adopting an “industry-first” stance. Through these platforms, the NLCRC will continue to foster collaboration among stakeholders across the value chain, recognizing that improving recycling infrastructure, technology, and practices requires collective effort beyond individual companies.

NLCRC

The National Lubricant Container Recycling Coalition

The National Lubricant Container Recycling Coalition or "NLCRC" is an industry-led coalition funded by a committed consortium of value chain stakeholders focused on establishing solutions for recovery and recycling of packaging for petroleum-based and related products utilized in transportation and industrial applications Industry.

Members include Berry Global, Castrol (part of bp Group), Chevron, CKS Packaging Inc., Graham Packaging, Independent Lubricant Manufacturers Association, Lucas Oil, Nexus Circular, Pennzoil - Quaker State Company, Petroleum Packaging Council, Plastipak Packaging, RPM eco, Safety-Kleen, and Valvoline. For more information, visit https://www.nationallcrc.com.