

A CASE STUDY

# Plastic Film Management Insights from Marck Recycling

2020

# Acknowledgements

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## Context

In 2019 and 2020, the Northwest Arkansas Council and The Sustainability Consortium partnered to conduct a study called, “Creating Circular Economies in Northwest Arkansas.” As an extension of that work, The Sustainability Consortium was able to work with Marck Recycling, a recycler in the region to better understand how one material in particular is managed and recycled - plastic film. For more context and the overall recommendations for the region, please refer to the broader report and economic analysis that can be found on TSC’s website.

## Marck Recycling at a Glance

In the Northwest Arkansas region, Marck Recycling is one of the companies that handle plastic film. They have over 23 years of experience collecting, processing, and marketing recyclable materials. The team is comprised of recycling, waste management, and environmental professionals who have specific areas of focus and specialties to manage all recycling and waste needs. They currently operate nine facilities across the Midwest and Southern United States, including two recycling facilities in Northwest Arkansas and one in Fort Smith, Arkansas. Operations at these facilities include Material Recovery Facilities, Baling Operations, Waste Hauling Operations, an OTR Trucking Company, Recycle Equipment Sales, and Service and Recycling/Waste Brokerage companies who operate nationwide. Their mission is to reduce landfill input by providing convenient and quality programs for clients and the communities they serve. On average, they handle 2,400,000 lbs. of plastic film a year from Rogers, Fayetteville, and Fort Smith (Dougherty, 2020). Most of this film is low density polyethylene (LDPE), coming from post-industrial sources. The sources of this material, as shown in Table 1, reflect the region.



## Background

Plastic film is a versatile packaging material that has found a wide range of applications in commercial, industrial, and retail operations. Because of its ubiquity, effective end of life management for it is necessary. When handled appropriately, it can be a valuable commodity. When not, it can do damage to material recovery facilities (MRFs) and find its way into the environment and contribute to plastic pollution issues (Bradbury, 2019; Elejalde-Ruiz, 2015). There are a variety of ways plastic film is handled after its primary use phase, but currently about 90% is incinerated or ends up in landfill in the U.S. and Canada (Closed Loop, 2019). Energy recovery through incineration is a common way to reduce volumes of this material but is typically met with strong societal opposition due to environmental and social justice issues associated with this process (Achilias et al., 2007). Chemical recycling converts plastic waste polymers to original monomers or other valuable chemicals that can be used as a feedstock for downstream industrial process or as a transportation fuel (Achilias et al., 2007). While promising chemical recycling technologies have existed for many years, they have not been widely adopted at scale (Closed Loop, 2019). Mechanical recycling options exist for plastic film but face a number of challenges discussed through-out this report.

Retailers, the consumer goods industry, and other industries that produce a large amount of film in their operations are aware of the challenges and, in recent years, have started looking for solutions. Very little has been done to understand how and in what volumes plastic film is available to the recycling market, which complicates developing actionable and sustainable solutions for end of life management. This case study is about the difficulties of handling plastic film from the perspective of a recycling company in Northwest Arkansas.

The challenges in dealing with plastic film are like those of other materials – collection, mixed material types, and the existence of viable end markets.

*Collection:* Unlike plastic bottles and cardboard, plastic film needs to be kept separate from other recyclables. If film works its way into a materials recovery facility, it can get tangled in or melt to the processing equipment, causing downtime for the recycling facility and creating a risky situation for the workers who have to manually remove the film. Post-consumer film is usually collected separately at drop-off bins rather than through curbside collection. This is good for keeping the film clean and dry but is reliant on consumers remembering to take the right type of film to a drop-off location.



Drop-off bins found at major retailers

*Mixed material types:* Because of the way film is collected, films made of many different polymer types are mixed in a typical collection bin. Recyclers can use optical sorters and other technologies to separate different kinds of plastic bottles or other containers, but no such technology exists for mixed plastic film streams. Post-industrial film, which comes from commercial or manufacturing operations, is less impacted by this challenge. In those environments, the used film generated tends to be of a single type, produced in much larger volumes, and more easily aggregated in a single place compared to post-consumer film collection.



*Viabile end markets:* For recycling to be successful, the recovered material needs a destination where it can be used. The cleanest and least contaminated film has a robust market for recycling, as the film is easy to process into new plastic resins for manufacturing. The options for recycled plastic decrease when there are multiple types of plastics mixed together (e.g., LDPE dry-cleaning bags and HDPE grocery bags) or the material is wet, dirty, or otherwise contaminated.



Grade A film

## Categories of Plastic Film and Associated Challenges

The category of “grocery store” represents the front-of-store drop-off bins most consumers are familiar with. In the region, bins can be found at major retailers such as Walmart and Target, and grocery stores such as Harps and Whole Foods. How post-consumer film is handled varies by company. One approach is to take all recyclables collected at a store, including plastic film, and send them back to the company’s distribution center for aggregation and recycling. A second common approach is to have regular pick-ups from each store directly, and then have all the material aggregated at a local site before being sold into the commodity market.

Post-consumer film is a small portion of the film that moves into the recycling system. Commercial and industrial facilities produce much greater volumes than what is collected from individuals. These sources generate used film in large quantities, are kept clean and dry, and enable aggregation of one polymer type of film (Taylor, 2018). Distribution centers, manufacturing facilities, and food production facilities are typical sources for post-industrial film. Segregating used film by type or function increases the value of the material on the market and the likelihood there will be an active market for it. Post-consumer film is more challenging because different types of plastics are used across a range of applications, all of which is collected in the same bins (Bradbury, 2019). Not only is it practically impossible to separate the different types of plastic, but it can also be contaminated with labels or printing that may not be compatible with recycling processes. These factors combine to create a low value, mixed plastic stream that can be difficult to find a market for.



MRF/ post-consumer film

## Categories of Plastic Film and Associated Challenges cont.

One category to note is that of “poultry products”. The dominant processor in the region is Tyson, which generates significant amount of both contaminated and non-contaminated film from their facilities. The contaminated film is a continual challenge for all meat processing companies since it is unable to be recycled with other film (Mahoney, 2020).

End market availability is highly dependent on the quality and purity of the film. The Institute of Scrap Recycling Industries (ISRI) publishes specifications for recycled material, to help those who handle recycling to get the best value from their material (ISRI, 2020). Currently, ISRI lists 9 grades of film bales, which are shown in Table 1.

**Table 1: ISRI Film Grade Definitions (ISRI, 2020)**

Plastic Film Grade	Definition
<b>Premium</b>	100% clean, clear, dry, post-industrial film consisting of LLDPE film or LDPE film
<b>A+</b>	99% clean, clear, dry, post commercial and/or post-industrial film consisting of LLDPE pallet stretch film. May contain small amount of LDPE film.
<b>A</b>	95% clean, dry, clear, natural LDPE or LLDPE film. Any mix of post commercial or post-industrial film. Minimal amount of HDPE allowed.
<b>B</b>	80% clear, up to 20% color, clean, natural LDPE and/or LLDPE films. Any mix of post-commercial or post-industrial film is allowed. Minimal amounts HDPE or strapping allowed.
<b>C</b>	50% clear, 50% color, dry, LDPE or LLDPE films. Can be any mix of post-commercial or post-industrial film. HDPE or PP films are allowed.
<b>MRF</b>	Film collected and sorted at a MRF, typically generated from curbside collections consisting of HDPE grocery/retail bags, LDPE, or LLDPE films.
<b>Grocery</b>	Any mix of clean, dry, grocery, retail, packaging film or dry cleaner bags collected from store return programs. Males may contain HDPE, LLDPE, or LDPE films combined.
<b>Agricultural Greenhouse</b>	Films not used on the ground for agriculture or farming. Examples of which may be bale wrap, greenhouse films, dairy bags and bunker silo films which are polyethylene based.
<b>Agricultural Ground Cover</b>	Any film collected after in field use. Examples of which may be mulch film and irrigation (drip) tubing which is polyethylene based.

## Improving Film Management

Recyclers like Marck are successfully recycling film, keeping it out of the environment and keeping it in useful applications. Because plastic film has only recently become a material of interest, existing systems have yet to be optimized and there is room for improvement. This section looks at best practices in place today, and what could improve the effectiveness of film management.

Contamination is always a challenge, regardless of source. In commercial and industrial generators, contamination might be a matter of colored film getting mixed in with a clear film stream. The first action to counter this is generator engagement (Dougherty, 2020). Regular communication about quality and improved source separation with generators who supply film has been shown to work. Part of the challenge is that there tends to be a high turnover in employees in the positions responsible for film sorting, so training and education need to be continuous efforts. With post-consumer film, multiple types of film are collected in the same bins and there is a greater probability of materials other than plastic finding their way into the stream (Bradbury, 2019; Taylor, 2018). In this case, sorting can be much more difficult. Under very controlled circumstances, film may be able to be sorted by existing plastic sort machinery, although traditional optical sorters have a difficult time with some film types. Otherwise, this process can be done through “floor sorting”, where workers hand-sort the mixed stream and laser readers are used to help distinguish between different types of film. This can be effective but labor-intensive, so useful only when the film recovered is marketable (Dougherty, 2020).



Plastic film floor sorting

A second challenge with film is obtaining a consistent volume of film, according to Wes Dougherty of Marck Recycling (2020). What end markets are available for film is dependent on aggregating enough volume of one type to bale according to ISRI specifications, so not having a consistent stream of material or knowing when the needed volumes will be available complicates logistics and can strain available storage space at recycling facilities. With commercial and industrial generators, this is again less of a problem compared to post-consumer materials. In commercial and industrial settings, generators have chosen a particular packaging solution with a particular type of film, and it can be difficult to change materials. Also, because the packaging materials are bought in bulk, they can be accompanied by a Material Safety Data Sheet (MSDS) that allows the generator and their recycler to know exactly what type of polymer is used. Good training programs for employees responsible for sorting these materials is also important. These factors combine to produce a consistent, well-defined stream of material that is easily handled for recycling. For post-consumer material, the only real solution is further education. Because there is a low awareness among the general public regarding plastics in general, most consumers are not going to know that different types of films should or shouldn't be recycled. Dougherty is supportive of efforts by groups like the American Chemistry Council's Wrap Recycling Action Plan (W.R.A.P) which includes a film recycling program that provides information to consumers regarding film recycling (ACC, 2020).

Finding appropriate end markets is also an ongoing challenge. Markets for the very highest grades of film are fairly stable, with established domestic markets and end users (Closed Loop, 2019). Lower grades of film were sold into the international market, usually bound for China. Since China instituted their National Sword policy that severely limits what recycled

## Improving Film Management Cont.

material they will import, there have been very few markets available for the mixed film bales (Katz, 2019; Straub, 2020a). There are new domestic film processing facilities under construction, but what grades of film they will take is not clear. Before the pandemic, these new facilities were slated to open as early as 2021 (Straub, 2019; Straub, 2020b). If the economic slowdown due to closures and other supply chain disruptions continues to impact the recycling market, these facilities may not be online until much later, adding additional uncertainty into the plastic film recycling market.

## Driving End Markets for Plastic Film

Of course, there is room for improvement. First would be an effective expansion of curbside recycling of post-consumer film, where residents separate out film from their other recyclables and leave it curbside on their normal recycling day. While this is not a simple task and would require more consumer education, it would increase volumes of film recovered and keep it recoverable and out of the regular recycling stream.

Increasing recovery volume would then open new opportunities in the region. A film-specific processing facility would allow greater volumes of film to be collected and processed under one roof. For example, at other Marck facilities, a dedicated set of employees could be brought in to only work with film and film sortation challenges. These individuals could build up expertise in separating mixed film bales and would be able to produce high-quality film bales cost-effectively. The volumes needed for this kind of facility are not currently available in the region, so volumes would need to increase to support such operations.

Improving end market opportunities for all grades of film would be beneficial. The greatest market obstacles for polyethylene film can be summarized as the cost of washing, a lack of reclamation markets for MRF film, the low cost alternative of virgin resin and recycled resins, and low end-user

## A Closer Look: MoistureShield

One domestic end market that has received much attention is plastic lumber and decking. This industry uses recycled plastic for its products, and plastic film is one of the primary feedstocks (Paben, 2019). Northwest Arkansas is unique in the fact that one of the large plastic decking manufacturers has a facility in the region, opening the question of whether this would be a viable outlet for material generated locally. While these manufacturing processes are more forgiving than other manufacturing processes and can use mixed film bales as input material, the volumes necessary are not available locally in Northwest Arkansas. This means that the company sources material nationally to ensure a regular supply of recycled plastic film, again underscoring the challenges for end market companies to access recycled material locally and the challenge for Northwest Arkansas to find end markets for its plastic film.



Photo Credit: MoistureShield

demand for film to film recycling (RSE, 2017). RSE estimates that in the U.S., approximately 200 million pounds of recycled polyethylene film is incorporated back into film products each year (RSE, 2017). Most of this material is used in the production of recycled content trash bags which are estimated to be comprised



## Driving End Markets for Plastic Film Cont.

of 6% recycled content on average (RSE, 2017). Some of this recycled film is used to make recycled content retail carry out sacks, comprised of an estimated 3% post-consumer recycled content on average (RSE, 2017).

A Film Recycling Investment Report, prepared by RSE USA in collaboration with Closed Loop Foundation, provides a summary of existing domestic end uses for recycled polyethylene film and the processing demand of different applications. As noted previously, a number of factors affect end use demand for recycled film including mechanical performance requirements, product manufacturing technologies, food content packaging constraints, aesthetic or performance sensitivities, and ability to tolerate impurities and inclusions (RSE, 2017). More demanding applications include products that have stringent performance requirements, are color sensitive, and/or require resin homogeneity and consistency (RSE, 2017). From most to least demanding, current domestic end uses are summarized as retail carryout sacks, pallet wrap, industrial bags/sacks, trash bags, construction film/sheeting, agricultural film, composite lumber decking, roofing tiles, transport packaging, and guardrail offset blocks (RSE, 2017). However, both the demand for recycled film and the capacity of film reclaimers in North America are still well below what is currently available to the recyclables market (RSE, 2017).

These options should be carefully evaluated by the region as it explores opportunities to sustainably manage plastic film and keep it in play.

## Conclusion

Turning plastic film from a liability into economically desirable materials would be a positive step toward decreasing plastic pollution and increasing the amount of material kept out of landfills. In Northwest Arkansas, Marck Recycling is an example of one organization making sure plastic film is sustainably managed and recycled to provide new raw materials for manufacturing. Such actions are important for ensuring this valuable material finds its way back to new products and packaging rather than into the landfill.



Recycled plastic is used everyday



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