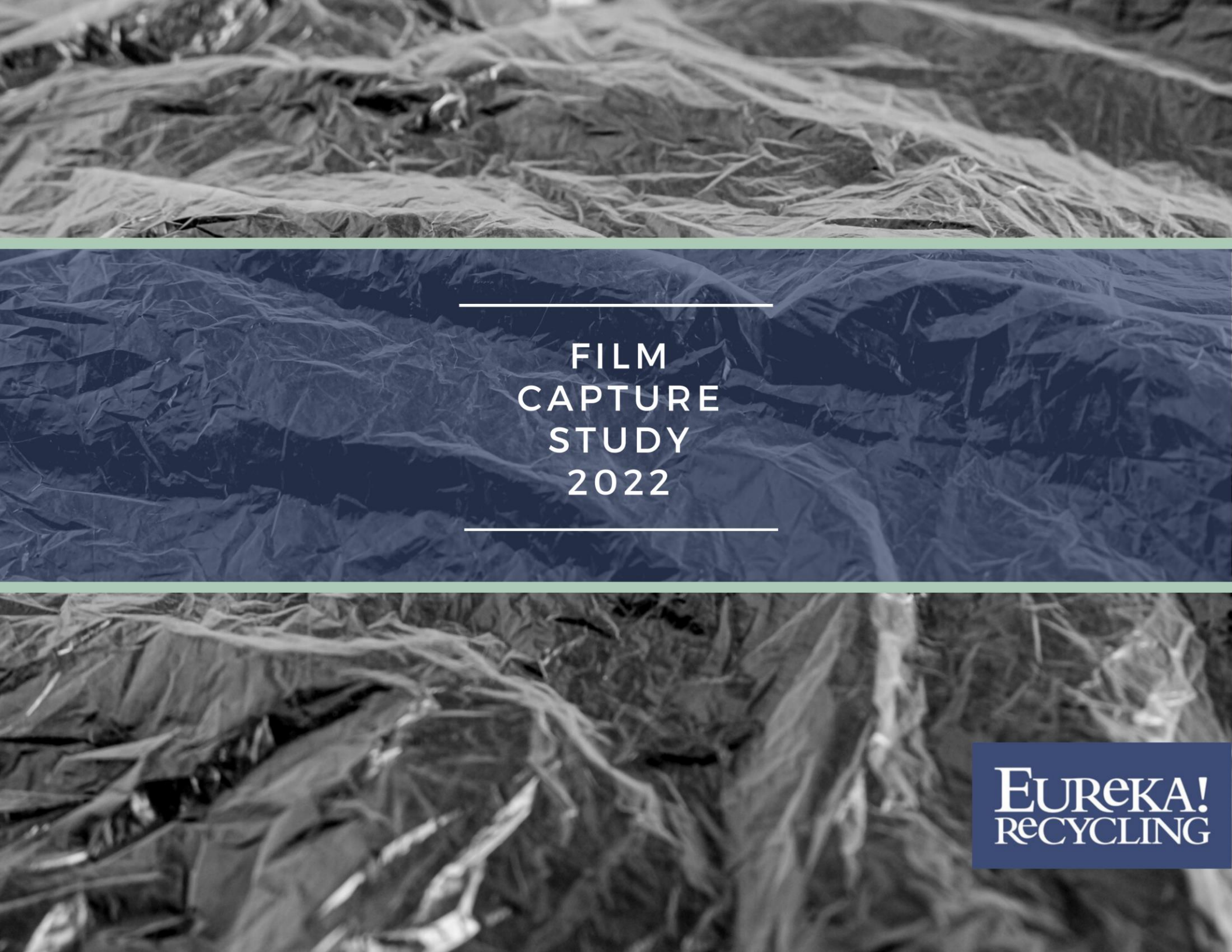


FILM CAPTURE STUDY 2022

EUREKA! RECYCLING

ABOUT EUREKA

Eureka Recycling is a non-profit social enterprise recycler focused on changing the systems that perpetuate waste through demonstration, education, and advocacy. Using our programs and operations, we test, pilot, and demonstrate innovative and effective Zero Waste strategies to address climate change, local and regional economic development, and justice.

Our Material Recovery Facility (or MRF for short) processes an average of 400 to 450 tons of recycling every day. Using a combination of machines, technology, and hardworking people, we turn a giant pile of mixed recyclables into about a dozen different material categories to be fed back into the supply chain and made into new products.

EUREKA! RECYCLING

Pre-Collection and Preparation

To obtain an accurate estimate of the amount of incidental film available for capture, we first conducted several audits to assess the quantity of film currently in our system. While we do not accept film in our recycling program, we do receive some as contamination which is pulled out throughout the sorting process.

Pre-Sort Trash Audits

One of the first steps in the MRF sortation system is for staff to hand pull non-recyclables in the Pre-Sort House. This material includes plastic wrap, trash bags (including bags full of trash), small appliances, clothing, electronics, and other household goods that are not accepted in our program. We audited our pre-sort material three times before and one time after the trial. The presort audits identified that 5.17% to 8.87% of the non-accepted material sorted in our pre-sort area is film content.

Pre-sort Trash amounts to approximately 2.7% of the total received single-stream material. In a year where Eureka receives 105k single-stream tons (which is our average), we expect to receive between 146 and 252 tons of film in the pre-sort trash; roughly amounting to 1,115 to 1,938 pounds per day.

146-252 TONS OF FILM ANNUALLY IN TRASH

Screen Cleaning Audits

Plastic bags and film cause major issues in a MRF. They wrap around rotating discs on screens preventing them from working effectively to move and sort material. We measured and sorted material removed from the screens on three separate dates and found that bags and plastic wrap were between 29% and 38% of the contaminants stuck in the screens by weight. This amount of plastic film weighed between 56 and 94 lbs. on the material audit days. So, in a year, there might be 14,000 – 26,000 lbs. (7-13 tons) of this material ending up wrapped around and cleaned off screens, and as little as 2% of the total bags and film aimed to be removed in the presort.

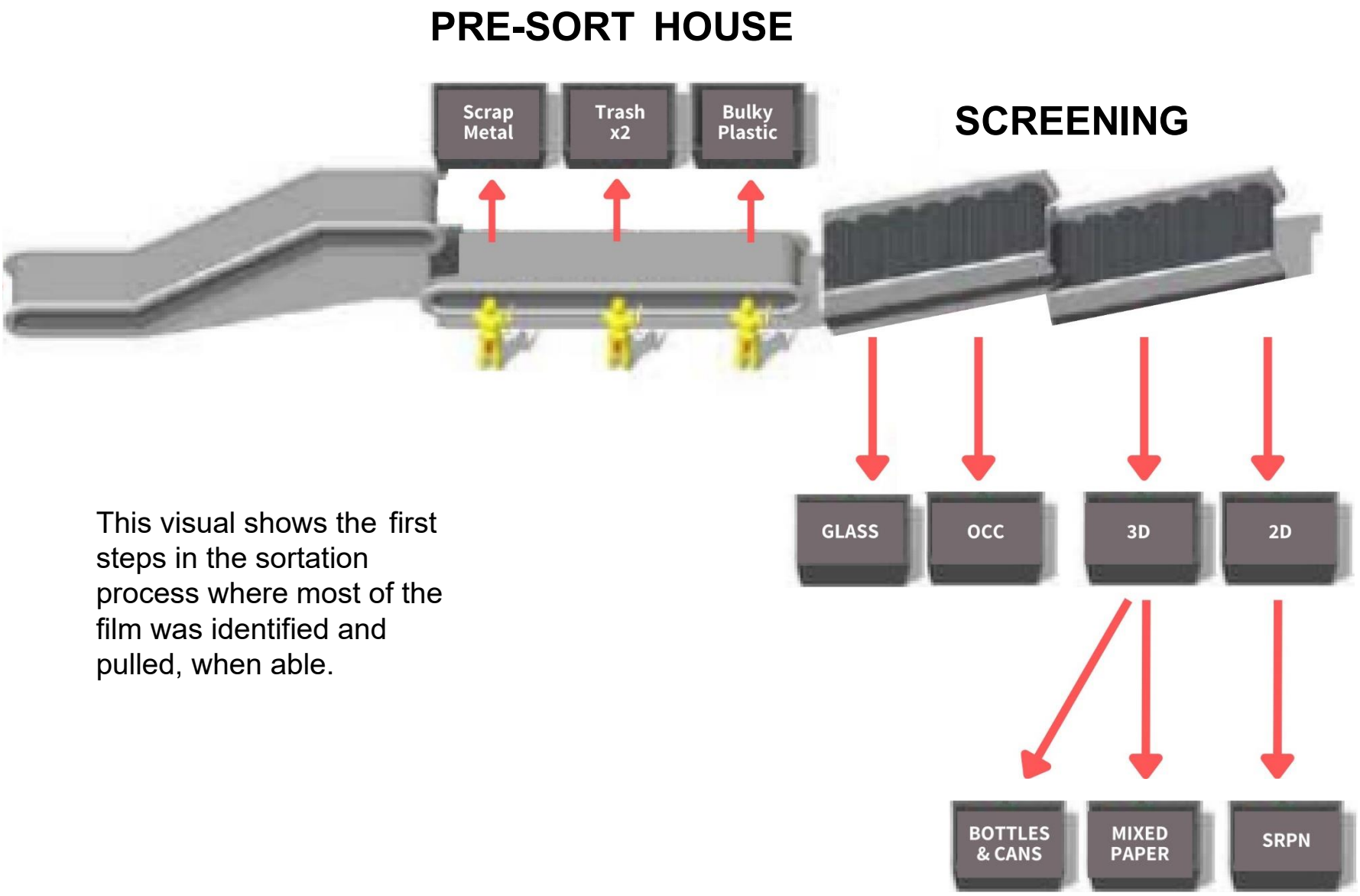
7-13 TONS OF FILM ANNUALLY ON SCREENS

Fiber Audits

Four samples of sorted mixed fiber were collected after it had gone through the pre-sort, glass screens, OCC screens, fiber screens, and ballistics. These samples weighed between 100 - 230 lbs. (about half a minute of run time). These audits showed a range from .31% to 1.18% of the sorted mixed fiber by weight is film. Fiber not sorted by the OCC screen is about 30% of the total material sorted. Using these numbers as a baseline, we estimate between 194,000 and 744,000 lbs. (97 - 372 tons) of film end up in our fiber per year.

97-372 TONS OF FILM ANNUALLY IN FIBER

Sorting Process and Material Flow



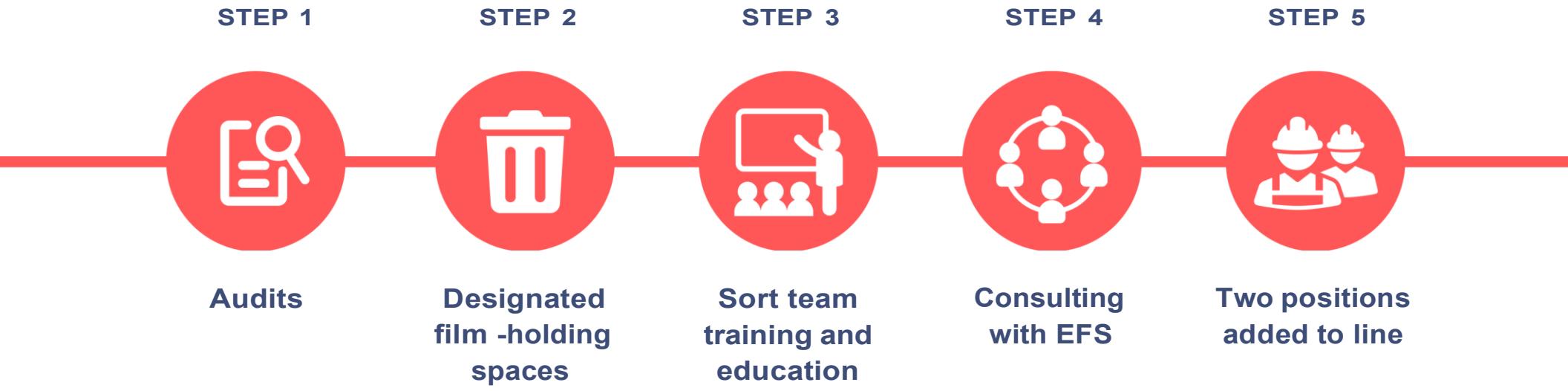
This visual shows the first steps in the sortation process where most of the film was identified and pulled, when able.

METHODOLOGY

Using the educational signs provided by EFS and physical samples of the various types of film, sorting teams were trained on what types of film should and should not be sorted for the purposes of this study. Direction was also provided to the sorting teams about how to identify and pull film in the pre-sort process. *Note: since safety is always a first priority, staff are instructed to always prioritize removing hazardous items from the line such as batteries, scrap metal, propane tanks, needles, etc.* In the first week of sorting film, managers and supervisors routinely checked in with the staff at all the sort spots at least once during their shift to ensure they were actively and properly collecting the designated film material to be sorted and baled for EFS. During this time, we also consulted with EFS to confirm and get clarity on some materials. For example, pet food bags come in a variety of materials and formats. After consultation, it was concluded that there was too much variation in pet food bags, and teams were trained to discard this type of bag in the trash.

One of the two bunkers designated for pre-sort trash was repurposed to collect the captured film for the duration of this study. When these bunkers were full, equipment operators would then bale the film material. In general, there was enough material at the end of most days to make one bale.

After a month of collecting film from the pre-sort line, two additional positions were added to the Residential Paper and Newspaper sorting line to focus on collecting film there, as well. During this four-week trial period, much less film was captured than in the pre-sort positions, further details below.



FINDINGS & RESULTS

Pre-Sort Area

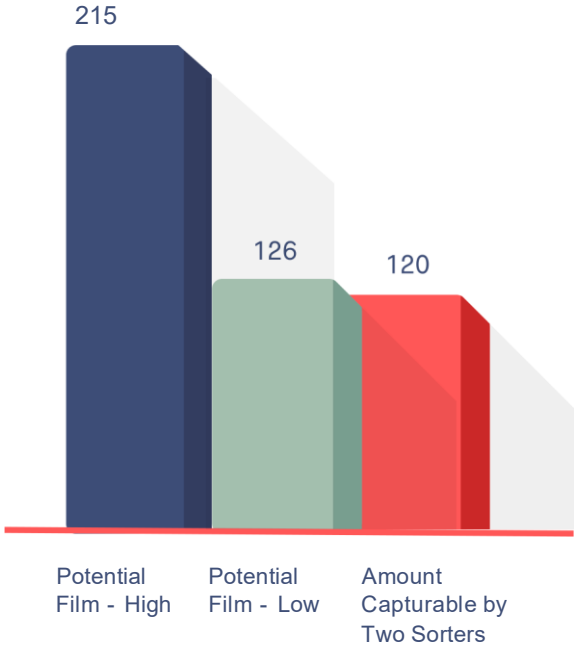
Once material from both the pre-sort house and the fiber line was collected and baled, EFS was notified to schedule pick up. Eight bales were requested; six from the pre- sort and two from the fiber lines. EFS ran the bales without issue and provided feedback that no change in the education of sorters was needed. EFS noted there was no notable difference in quality between the film collected in the pre-sort house compared to the film collected from the fiber lines. After this, Eureka discontinued baling film from the pre-sort and fiber lines separately, as the goal of determining if that process would produce results adequate enough to market the materials was met.

In the 37 days of collecting film in the pre-sort 54,145 lbs. (27 tons) of material was generated, averaging about 7,317 lbs. per week.

As noted earlier, we estimated that only about 2% of the film that could be collected in the pre-sort house ends up tangled in the screens. This was further confirmed when staff who cleaned screens said there was no notable difference in the material on screens, even with the extra sorters positively pulling film from the line in the pre-sort house, before it gets to the screens where wrapping is an issue. This further indicates even if it is capturable film should not be permitted into a MRF because similar to batteries and other hazardous items, even a very small amount not captured can cause serious issues later in the system. Not only do our staff spend hours every day cleaning screens, but about 15% of injuries in the last three years were caused while staff were cleaning screens. In this report, we are quantitating impacts of film but should not dismiss qualitative impacts such as on the health of our staff and the quality of our other sorted materials.

It took 904 sorting-staff hours to positively sort film off the pre-sort line. Considering labor alone (not including capital costs to add a new bunker) in pre-sort, staff was able to collect about 60 lbs. per staffing hour. *Note: this includes all hours the staff was paid (breaks, downtime, etc.).* During these thirty-seven days, the runtime equaled 354 hours. With two sorters,153 pounds were collected per hour of actual production time in the pre-sort house. The fully-loaded (with benefits) sort cost per hour is $30 per hour. Therefore, sorting costs for the pre-sort is $ 0.50 per lb. ($1001.75 per ton). Baling added an additional $.0055 per lb. ($11 per ton) in cost to handle this material separately from other trash. The market value would need to be $0.51 per lb. ($1013 per ton) to justify the investment of staff capacity and equipment to separate out this material.

Pre-Sort LBS Per Hour



FINDINGS & RESULTS

Main Sort House

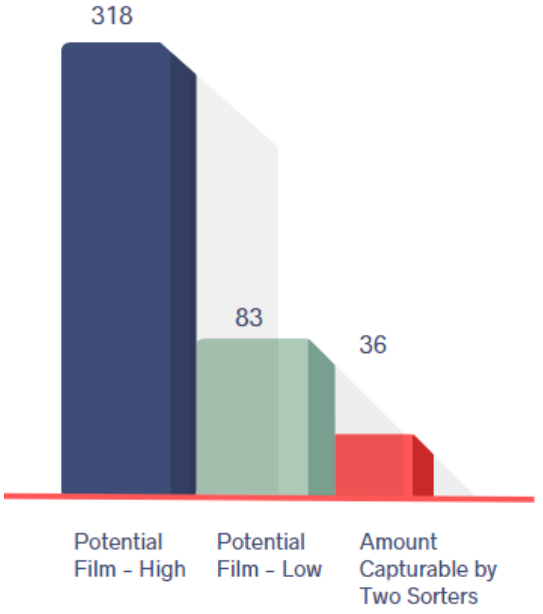
For 25 days, workers on the line collected film from the sorted residential and newspaper line in the main sort house. They collected much less material per hour compared to the presort house.

Audit results suggest there is potentially more film in the fiber than there is in the pre-sort. However, the film pieces on the fiber line are smaller and lighter, and more difficult and less efficient to sort. In this time, two sorters were scheduled for 300 hours to sort film from the fiber lines- so 600 total staffing hours (note: similar to the pre-sort house, these 300 hours were total paid hours, including breaks and downtime). In this time staff separated out 10,675 lbs. (5.3 tons) of film out of 3,017 tons of fiber. We performed audits of the fiber after the film sorting to evaluate if the sorting of the film had material impact on the amount of film in the fiber. Our initial audits before we started separating film showed that the fiber had a range of 0.3% to 1.2% of film. Our audits of fiber while we are actively pulling film from the fiber showed .17% to 1.77% of the fiber had film even after actively pulling. So, although the lower number could indicate sorting film decreased the film in the fiber the higher number on the range shows more film. Thus, the data does not lead us to believe that sorting film by hand from fiber has a material impact on the fiber quality.

The per ton cost of sorting and baling the film from the fiber line was considerably more than what it took in the pre-sort house, equaling $1.70 per lb. ($3400 per ton) compared to $0.50 per lbs ($1000 per ton) in the pre-sort because it took more staff time to collect a ton of material. Additionally, considering how ineffective this was at reducing film in the fiber, sorting the film did not reduce overall film contamination in the paper.

Knowing that hand sorting is not efficient at removing film from the fiber, we asked for a quote for what it would take to use optics to clean the film from the fiber. The quote, which does not include a separate bunker for storing film (which would be required to recycle and separate it from trash) was about $4.2 million. We estimate downtime to install this system and additional equipment to separate bags would add an additional $1 million to the project. If we assume this system could successfully capture 90% of the film in the fiber and would last 10 years depending on how much film is in the paper, which in our audits was highly variable, it could cost anywhere from $0.70 to $2.65 per lb. ($1400 to $5300 per ton) to add the ability to optically separate film from fiber. *Note: this* cost *doesn't include interest and other financing* costs *to manage this type of upgrade, and it* also assumes *that* staff *currently doing quality control on the paper lines could be reassigned to capture clean film and thus there is no labor savings.*

Main Sort LBS. Per Hour



SUMMARY

Training the sorting-line staff to separate film was not as difficult as anticipated. Manually sorting film from a MRF presort and fiber line, has an average cost of $1.10 per lb. ($2200 per ton). In Minnesota disposing of film as trash costs $0.04 per pound so MRFs would need film markets to pay at least $1.06 to justify the investment of staff capacity and equipment. The market has never seen MRF film be above $.05 per lbs. The investment of optical sorters on the fiber line could significantly increase the capture of film from MRFs, however the capital investment needed is as much as $2.65 per lb $5300 per ton) and thus the market value would need to be even higher to provide an adequate return on investment for MRFs.

Additionally, regardless of the cost, the safety concerns of film wrapping around screens add other non-monetary concerns to this material being allowed in MRFs are significant. Even if the markets would drastically increase the value for purchasing film from MRFs, this value does not necessarily out-weigh the impact of film to safety and equipment in a MRF.

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