



Working Paper - Markets and Sorting Assessment - Addendum

Oregon Plastics Recovery Assessment

June 2014

Section 1: Introduction

This Addendum contains information in addition to the initial report dated April, 2014. Specifically, this Addendum provides:

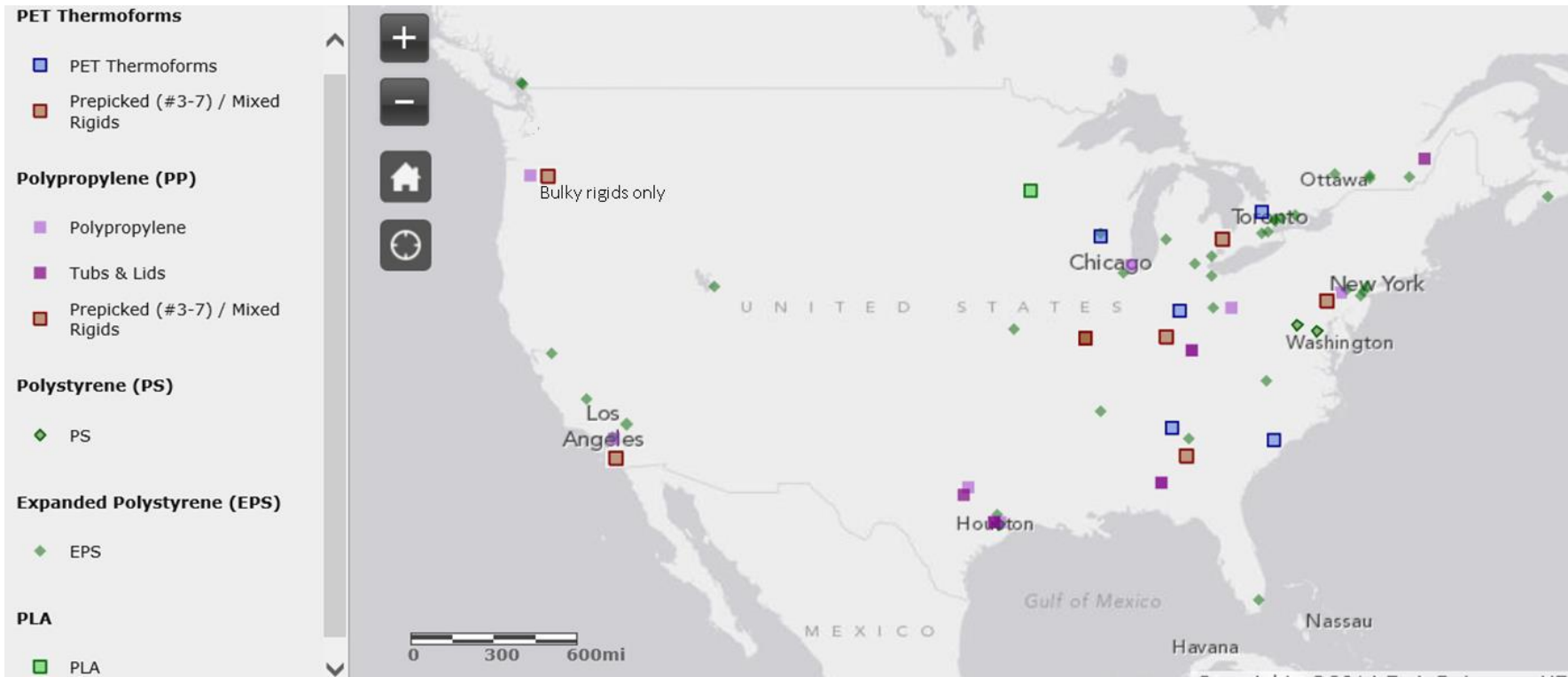
- Updated information regarding certain pyrolysis, plastics recycling facility, and iron reducing agent companies;
- Results from an in-depth investigation of plastics recycling facilities (PRFs); and
- Obstacles related to recyclables markets and sorting.

Section 2: Recycling Markets Updates

- **Denton Plastics**, Portland OR – in addition to recycling other plastics, Denton Plastics also recycles bulky mixed rigid plastics (but not small mixed packaging plastics collected from residences).

Figure 1 shows emerging domestic plastics markets for plastics materials like PET thermoforms and mixed grades of plastics. As the figure shows, there are virtually no markets for these grades in the Northwest.

Figure 1 Emerging US Plastics Markets



Section 3: Recovery Market Updates

Pyrolysis

- **Rational Energies**, Plymouth, MN, is a pyrolysis plant that uses Agilyx's technology – the facility has a capacity to pyrolyze 40 tons of plastics per day. The business plan for this enterprise included an agreement with Hennepin County's whereby Rational Energies would install and operate mixed waste sorting equipment at the county's Brooklyn Park Transfer Station to recover metals and plastics from mixed solid waste, with non-recyclable plastic to be prepared and sent to Rational Energies' pyrolysis plant. Rational Energies is no longer operating the waste processing equipment and the waste processing equipment is reportedly for sale – without the intended source of supply of plastics, the viability of the pyrolysis plant is also now in question.

Industrial Uses

The initial report identified that Ash Grove Cement, Durkee, Oregon is the only cement plant in the state, and that approximately 8 percent of its fuel comes from the combustion of scrap tires, with the remainder from coal. There is the potential that this facility would combust certain non-recycled plastics. Furthermore, the following paper mills in Oregon combust solid fuels for at least part of their heat demand, and they potentially as well could be considered potential industrial users of non-recycled plastics subject to permit modifications and testing for the need to modify emissions treatment equipment:

- **Collins Products**, Klamath Falls – is approved to combust wood waste;
- **SP Fiber Technologies**, Newberg – is approved to combust tire-derived fuel and hogged waste (including construction/demolition debris with incidental plastics);
- **IP Masonite**, Pilot Rock – is approved to combust waste wood;
- **IP**, Springfield – is approved to combust hogged waste; and
- **GP**, Toledo – is approved to combust tire-derived fuel and hogged waste (including construction/demolition debris with incidental plastics).

International Recycling Group – the initial report discussed that International Recycling Group had acquired and was operating the former NURRC PET bottle reclamation plant in Spartanburg, SC, to recycle PET bottles. International Recycling Group also intended that the facility would function as a PRF and process mixed "previously unmarketable plastic" into a low-cost reducing agent for blast furnaces. PET bottle reclamation has stopped, and for now the viability of International Recycling Group's combined plastics reclamation/PRF/iron-reducing agent business plan is in question.

Section 4: Plastics Recovery Facilities

The initial report provided a high-level overview of PRFs. This Addendum provides the result of additional research into PRFs. Figure 1 illustrates the location of five PRFs in the United States and one in Canada (near Detroit).

Description of New and Existing PRFs

QRS Recycling operates two PRFs, the first of which opened in New Albany, IN in 2011 at the site of its existing commercial single-stream (dry waste) MRF. QRS opened its second PRF in Atlanta, GA in 2012 in a leased 100,000 square foot building. These two facilities make use of advanced optical sorting technology. QRS Recycling has also entered into joint venture partnership with broker and industrial plastics recycler Canusa Hershman to open a 128,000 sq. ft. PRF in Sparrows Point, MD, which is scheduled to open in December, 2014. The facility is being designed to process 55,000 tons per year of mixed plastics, which will be sourced from MRFs throughout the Mid-Atlantic region. Except for QRS' first facility that was located its existing MRF, QRS' other facilities are operated as merchant stand-alone sorting centers that are not attached to some other MRF or plastics reclamation operation.

Trigon Plastics, located in Newmanstown, PA, is the only plastics reclaimer that operates a PRF. Trigon constructed a single-stream materials recovery facility at the location of its existing plant that washes HDPE and produces plastic lumber. In addition to sorting, baling, and shipping of single-stream recyclables (including paper) from the MRF to markets, Trigon installed four optical sorters to perform advanced plastics sorting. These sorters were installed in early 2013. This MRF/PRF can sort 12,500 tons of mixed plastics per year. Polyethylene is used in-house by Trigon for its plastic lumber products.

Entropex, located in Sarnia, Ontario, is a Canadian plastics reclaimer that specializes in polyolefins (polyethylene and polypropylene). Entropex has an 180,000 square foot reclamation plant. In 2010 Entropex received a grant between \$1 and \$2 million from Ontario's extended producer responsibility program to add 30,000 tons per year of mixed rigids recycling capacity, which it calls RigidReclaim, to its existing plastics bottles recycling capacity of 20,000 tons per year, for a total recycling capacity of 50,000 tons per year. Entropex sells reclaimed resin pellets into a variety of industries.

Titus Services is preparing to open a PRF in Los Angeles, CA, which should officially open in July 2014. This facility is actually a single-stream MRF that Titus has retrofitted – Titus refers to it as a secondary MRF, since Titus' intends to take loose unbaled residue and remainders from the ends of conveyor belts of MRFs in the Los Angeles area, and further sort the material to recover paper, metals, and up to seven plastics grades in one shift (more plastics sorting into additional grades can be performed on a second shift. Titus is encouraging MRFs to save the cost of sorting and baling pre-picked rigids, and instead allow that material to go to the residue/remainders for sorting at Titus. Titus will charge a tip fee to accept and process this stream of material. Titus will also accept and sort baled pre-picked rigids, but would pay a market value for that material, since it would need to compete against export markets. Titus' processing equipment includes proprietary pre-processing equipment, followed by two optical sorters. Titus' system is designed to process approximately 16,800 tons per year of plastics through its MRF. Sorted plastics are baled and shipped to other plastics reclaimers. Titus believes its business model could be of an appropriate scale and could be economically feasible in the Portland Metro area if a closed or under-utilized MRF in the area could be retrofitted with Titus' technology. Titus also welcomes working with joint venture partners. Alternatively, if it is necessary to build and capitalize a new facility, financial assistance of some type may be needed for Titus' business model to be financially viable.

MBA Polymers operates three PRFs, located in England, Austria, and China. These PRFs are totally different from the PRFs described above, and were designed to process mixed shredded plastics and other light materials that remain after durable goods such as electronics, appliances, or automobiles have been shredded and the metals or other heavy items such as glass have been removed. However,

in MBA's England plant, which was designed primarily to recycle plastics from auto shredders, MBA has been processing significant quantities of mixed rigid MRF plastics as well with good process results and facility profit. MBA Polymers does not rely heavily on up-front whole-piece optical sorting, but instead uses a variety of other cleaning and separation processes to ultimately produce reclaimed pellets ready for use in recycled product manufacturing. MBA's plants process from 40 to 80,000 tons per year. The capital cost of the plants range from \$25-\$60 million each, depending on size and capacity.

Long-term commitments with major MRFs within a region may be needed for developers of a stand-alone PRF to consider such a facility in the Northwest. It is also likely that some plastics reclaimers will consider adding a PRF to their existing large reclamation plants as a way to develop new sources of supply for the resins they desire and to save the shipping and handling expense associated with transporting material from an off-site PRF.

Economies of Scale and Applicability to Oregon

The minimum size of a PRF, based on the facilities described above, appears to be at least 15,000 tons per year for a small-scale facility. Preferred sizes for better facility economics, especially if the PRF is to also perform reclamation steps (washing and pelletizing), are 50,000 tons per year or higher. Oregon plastics reclaimers recycle approximately 15,000 tons per year, or approximately 25 percent of Oregon plastics that currently are collected for recycling. These reclaimers have the ability to recycle far more plastics than they currently process and having a PRF in the region would help to supply them with more of the specific resins that they reclaim.

Current levels of residential pre-picked mixed plastics marketed (exported) by Oregon MRFs is estimated to be approximately 6,500 tons per year. Current levels of Oregon residential mixed plastic collected for recycling, alone, cannot support a PRF in the state. Three approaches could be pursued that could make a small-scale Oregon PRF feasible, as follows:

1. Expand the plastics collected from residences by:
 - Working to increase residential recycling rates of plastic tubs, which do not currently have a high recycling rate;
 - Expanding the list of plastics collected from residences to include other RPCs such as thermoforms; and
 - Expanding the list of plastics collected from residences to include non-packaging products such as toys and outdoor plastics furniture;
2. Expand mixed rigid plastics collected from non-residential sources; or
3. Expanding the geographic range from which plastics are sourced to also include Washington.

Over 130,000 tons per year of rigid plastics currently remain in the waste stream and are discarded in Oregon each year. An alternative approach from the small scale PRF would be to divert a significant portion of this material so that it could justify a large-scale facility like those operated by MBA Polymers overseas. Such a facility would begin by shredding all plastics received down to smaller sized particles that would then be cleaned and separated on the particle level rather than on the whole-piece level. This approach may require a transformation in how discards are managed in Oregon from source-separated recyclables collection with MRF materials separation, to dry waste separation with the plastics fraction going to a PRF for further sorting and reclamation.