

Case Study

Plastic fantastic

Reading's new MRF reaps outstanding results from a fully automated plastics sort.



Baled 'natural' HDPE bottles

“We have every confidence that the material [from Smallmead] is always as described and contains zero contamination”

Will Lee, Buyer,
J & A Young

Entering full service in December 2008, the advanced Materials Recovery Facility (MRF) at Smallmead in Reading can process up to 58,000 tpa (based on two shifts) of fully co-mingled dry recyclables. The MRF is a key element of a 25-year £610 million Private Finance Initiative contract awarded to Northamptonshire-based Waste Recycling Group (WRG) in October 2006 by the re3 Waste Partnership (re3). The latter consists of three unitary authorities (UAs): Reading Borough Council, Bracknell Forest Borough Council and Wokingham Borough Council.

What makes the plant special is the outstanding quality of the plastic it produces while handling a large volume of material and not compromising on the quality of other material outputs. These high standards are maintained even though feedstock is sourced from three different UAs. This case study reveals some of the secrets of Smallmead's success.

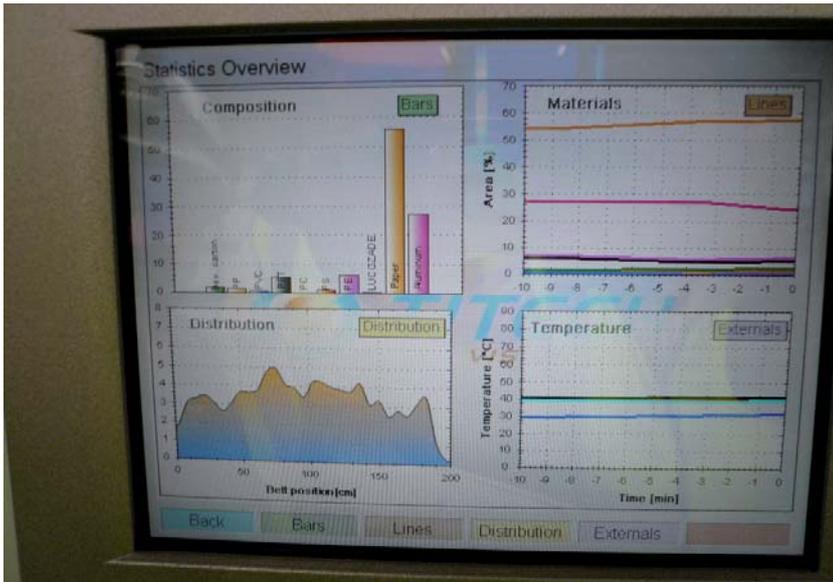
Maximising polymer quality

Smallmead was designed and built by OK-LM, a joint venture partnership between British company OK Engineering and LM from Germany. WRG and re3 favour automated over manual sorting of recyclables and asked OK-LM to incorporate as much automation in the facility as possible without compromising quality.

Smallmead MRF - key facts

- Operator: Waste Recycling Group
- Commissioned: December 2008
- Capacity: 58,000 tpa
- Tonnage processed: 25 - 30,000 tpa
- Recovery rate: Designed to recycle 95% of mixed dry recyclable input
- Employees: 20 including sorters, managers, drivers and baling staff
- Inputs: Co-mingled and source-segregated dry recyclables from Reading Borough Council, Bracknell Forest Borough Council and Wokingham Borough Council. Commercial organisations served on a limited ad hoc basis
- Outputs: News and PAMs, waste paper grade, OCC, HDPE natural and coloured, PET clear and jazz, steel, aluminium
- Not accepted: Glass, textiles, hazardous waste, organic waste, batteries or small WEEE

With plastics such as PET and HDPE bottles, OK-LM had to ensure that sorting accuracy was not compromised by the speed of through-flow. “The volume of material being processed meant that hand-sorting would not be an efficient way of recovering different types of plastic,” says MRF Supervisor, Andrew Sullivan. Instead four Titech Polysorts were fitted which use near-infrared (NIR) light to distinguish and segregate HDPE natural and coloured, and PET clear and jazz (coloured). “Each machine can process up to 14 tonnes of plastic hourly,” says Mr Sullivan. “To achieve the same throughput manually,



Control panel for the near-infrared optical separation equipment

“The volume of material being processed meant that hand-sorting would not be an efficient way of recovering different types of plastic”

MRF Supervisor, Andrew Sullivan

Smallmead would have had to employ a further 10 to 12 sorting operatives in addition to the 16 currently employed.”

Although NIRs have high capital costs – approximately £250,000 each – with maintenance and running overheads, OK-LM calculated that the machines would pay for themselves within a few years. Unlike manual picking systems, the optical sorters also can easily recognise other polymers such as PP and PVC, while requiring far less space. “A single NIRs takes up less room than 10 pickers, and does not require heating, lighting or air conditioning,” says Mr Sullivan.

WRG ensures that the equipment is set up, used and maintained properly – see background box. The optical sorters are now working at optimum efficiency, recovering – depending on the grade – between 13 and 50 tonnes of PET and HDPE per month. WRG employs one person on the plastics line for quality control, but, Mr Sullivan says, “they do not have much to do as the material coming through is already such good quality.”

Varying input format

Part of the challenge of any MRF is coping with varying input streams. The Smallmead plant is designed to sort paper, cardboard, PET and HDPE plastic bottles, aluminium and steel cans. When the facility was commissioned, Reading Borough Council was collecting recyclables fully co-mingled in wheelie-bins emptied on alternate weeks, while Wokingham and Bracknell Forest Borough Council required householders to use source-segregated bags or boxes.

Smallmead MRF was designed to accept both formats. Today, all three Councils supply Smallmead with a co-mingled input stream which can be introduced directly into the MRF.

Educating the public is vital to ensure that Smallmead can maintain the exceptional quality of its output materials. Each Council is responsible for educating residents about what they can and cannot place in the co-mingled bins through leaflets, websites and kerbside calendars, but re3 provides additional resources to ensure that messages given to residents are consistent across the area.

“There was some confusion amongst residents about the types of materials they were able to put into their recycling bins – plastics are a good example of this. We only accept plastic bottles, but residents find this very confusing, wanting to include other plastic packaging items.” says re3 Waste Minimisation Manager, Ella Clarke. “By ensuring that all the councils now have a consistent message about recycling and backing this up with information on the re3 website, we will begin to resolve this problem.”

Ms Clarke and her colleagues also run road-shows and stakeholder meetings, while the Smallmead facility itself has an education room with a viewing window enabling visitors to see the MRF in action.

The results: top quality outputs

WRG is delighted with the results. “The decision to go for automatic rather than manual sorting of plastic has really paid off,” says Thomas Coleman, Smallmead’s Operations Manager. “I believe Smallmead’s HDPE and PET output quality is second to none. Re-processors are desperate for our product.”

Plastics re-processors have indeed praised Smallmead MRF for its PET and HDPE outputs. “We have been taking loads from Smallmead for several months now and have had no kickbacks on quality,” says Will Lee, a buyer at Leicestershire-based plastics recycler J & A Young. “We have every confidence that the material collected is always as described and contains zero contamination.” The Smallmead MRF also boasts good quality for its other material outputs. For example, its News and PAMs output is of sufficient quality to meet the UK paper mill specifications – Aylesford Newsprint in Kent is one of its regular customers.

In the early days at Smallmead, cross-contamination of one material by another during the baling process sometimes occurred; WRG solved the problem using corrugated cardboard as wadding to clean out the baler and also to separate the bales. WRG believes the PET and HDPE recovered and baled at Smallmead now fetches the highest price from buyers due to its purity.

Smallmead currently processes 25-30,000 tpa in a single 8 hour shift. In the future, WRG will look to operate two shifts enabling the plant to accept up to capacity of 58,000 tpa. Although currently operating at half contracted capacity,

WRG expects the quality of the plastics output will be maintained as Smallmead's throughput grows, as plastics will continue to be processed at the same 14 tonnes per hour rate, though on longer shifts.

Keen to continue improving Smallmead, WRG is now investigating the recovery of additional materials from the rejects and residuals like shredded paper and other plastic polymers such as large detergent bottles which at the moment are being lost at the trommel stage. The company also hopes to attract recyclables from other local authorities.

Background: Getting the best out of optical sorters

These are some of the ways Smallmead optimises the effectiveness of its NIR optical separation equipment:

- **Use a long, wide acceleration belt:** Optical separators work by using light beams to recognise approaching target materials, and communicating their position on the belt to air jets down-stream which then blow the items onto a separate belt or into a container. The process works best if objects do not overlap and are not moving relative to the belt. Overlap is minimised by accelerating the belt prior to the optical separator thus scattering the items, and by using as wide an acceleration belt as possible to give the scattered materials plenty of space over which to spread. At Smallmead the acceleration belts approaching the paper and plastics sorters are 120 cm and 150 cm wide respectively: the standard is 90 cm wide. A long belt ensures that the accelerated materials have had time to stabilize before being scanned. The belts approaching the plastics sorter at Smallmead are 4 to 5 metres long in order to achieve this.
- **Establish a regular monitoring and maintenance regime:** At Smallmead, an hour is spent daily on maintenance and inspection, while two on-site cleaners work continuously throughout the shift. As part of the routine, all ejector units on the optical separators are checked for blockages, and where necessary the back-valve bar which holds the ejector nozzles is cleared. The sensitive panels on the machines are cleaned every two hours, and self-diagnostic units on each optical separator are checked. All motors have devices measuring temperature and current which are monitored to predict potential issues and future breakdowns. Smallmead believes the secret to its success is using in-house people rather than external contractors to perform monitoring and maintenance activities, ensuring closer control over these vital tasks.
- **Put in an air knife:** Plastic film can sometimes be hard to separate from paper because both are 2-dimensional and flexible. A Fibre Sort optical separator was installed at Smallmead to distinguish between News and PAMs and contraries such as film. The Fibre Sort also removes lower grades of paper. However, plastic film can sometimes 'hide' under single large sheets of newspaper and may not be spotted by the optical separator. To tackle the problem an air knife has been fitted early on in the process line at Smallmead. This equipment generates a high intensity, balanced sheet of laminar airflow across the mixed recyclates on the conveyor belt, blowing off large pieces of paper and plastic film, leaving smaller, heavier items to travel onwards. The air knife also reduces the amount of material the optical separators have to scan.
- **Follow the manufacturer's specifications:** Smallmead believes optical separation equipment has to be installed, fine tuned and operated very carefully. Material Sorting Programmes have to be developed with the equipment supplier until they meet the standards required for the individual MRF and its specific feedstock. This approach has the added benefit that the manufacturer can make adjustments to their equipment remotely over the internet.
- **Never work on fresh stock:** At Smallmead it has been found that, if the input material is left to compress on the tipping floor for a day or two, when it enters the trommel it passes more easily into the appropriately sized holes.
- **Keep the input stream mix homogenous:** Segregation systems in MRFs – both automated and manual – work better if the input stream does not vary widely in composition. Smallmead is designed to process 14 tonnes per hour of a specific blend of mixed dry recyclables. Waste which is too rich in any one recyclable, such as paper, can overload the lines.

Abbreviations

- HDPE: High Density Polyethylene
- MRF: Materials Recovery Facility
- NIR: Near Infrared
- News and PAMs: Newsprint, Periodicals and Magazines
- OCC: Old Corrugated Cardboard
- PET: Polyethylene Terephthalate
- PP: Polypropylene
- PVC: Polyvinyl Chloride
- tpa: Tonnes per annum
- UA: Unitary Authority
- WCA: Waste Collection Authority
- WRG: Waste Recycling Group



Mixed plastic approaches a near-infrared optical separator

“I believe Smallmead’s HDPE and PET output quality is second to none.”

Thomas Coleman,
Operations Manager,
Smallmead MRF

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