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Ensuring Recyclate Quality

Introduction

The following paper explores the issue of recyclate quality. It examines the situation in the UK, where the lack of a specific piece of legislation means that quality standards are dictated by re-processors and materials recovery facilities (MRFs), resulting in a large variation of standards. It also considers how the issue is dealt with in Europe and North America, using a WRAP study conducted in 2006. Although the situation is similar to the UK, the production of quality specifications by the recycling industries in Europe and North America appear to be more structured and detailed. The paper also considers the EU Directive on Waste Shipment which is only concerned with the quality of waste being exported.

The situation in the UK

There is currently no direct legislation relating to the quality of reyclates. What is apparent is that MRFs in England appear to be guided by a wide range of specifications. In the European Commission's reply to the DEFRA and Welsh Assembly Government's (WAG) response to the draft Waste Framework Directive, the Commission made particular reference to the quality of recyclates. It stated that whether collected using source separation methods, or co-mingled methods, the recyclates produced should meet the quality standards for the relevant recycling

sectors. Therefore highlighting that recyclate quality specifications are controlled by the recycling industry, and not by government regulations.[1]

WRAP (Waste and Resources Action Programme)[2] published a report at the end of 2009 entitled '*MRF Outputs Quality Threshold Report*', which found that material quality standards are heavily dictated by re-processors and, despite some written guidelines, there is no standard test for MRF output quality.

The study called for a standard approach to assessing output material quality thresholds in a bid to help increase operator and re-processor confidence in the material outputs.

This was after the research uncovered a major disparity between the way in which MRFs are assessing the quality of their output (predominantly through visual assessment) and how re-processors are conducting it (where weight-based sorting is the most common method)[3].

In a bid to bring some uniformity, the report claimed that WRAP would investigate the possibility of creating a publicly available specification (PAS), for weight-based sampling and testing of material, and that this would provide an incentive to improve product quality.

In most cases, MRF operators had been issued with a written specification by re-processors, but anecdotal evidence pointed to the fact that re-processors would move the goal posts on quality in relation to demand. This meant that there was seemingly a lower quality of material accepted when demand for that material was higher, but this would be replaced by stricter quality controls when demand was low.[4]

This lack of a level playing field where material quality might be assessed and compared is a potential impediment to smooth functioning of materials markets and sustainable recycling.

Comparing the situation in the UK with Europe and North America

A study written by the Dougherty Group LLC on behalf of WRAP in 2006[5], made a comparison of sorting operations based on site visits to selected facilities in England[6], Europe[7] and North America.[8] It found that the situation in all three regions regarding the quality of recyclates was similar, in that quality relied on the production of specifications made by MRFs and re-processors. Understanding that the situation in both Europe and North America may have changed since the study was conducted in

[1] DEFRA and WAG (2009)*Stage One: Consultation on the Transposition of the Revised Waste Framework Directive*, Waste Framework Directive Unit DEFRA. (p26/27)

[2] The Waste and Resources Action Programme (WRAP) is a Defra funded agency which provides support for local authorities on recycling, including funding and training. Visit WRAP's website at: http://www.wrap.org.uk/

[3] WRAP, (2009), *MRF Output Material Quality Thresholds Report* http://www.wrap.org.uk/downloads/MRF_Output_Material_Quality_Thresholds_Report.bb15b7c2.8210.pdf (section 4.2)

[4] Ibid (p.4)

[5] Wrap (2006), *Materials Recovery Facilities* http://www.wastexchange.co.uk/documenti/MRF/MRF_v6__19Dec06_LC.605a7565.pdf

[6] Sit visits were made to: the Onyx MRF in Hampshire, RU Recycling MRF in Darwen, WRG MRF in East Riding of Yorkshire, SITA MRF in Huddersfield, WRG MRF in Luton, NEWS MRF in Norwich, and the Grundon MRF in Slough.

[7] Visits in Europe were made to: Triselec MRF in Lille, France, Onyx MRF in Renne, France, LIPOR MRF in Porto, Portugal

[8] Visits in North America were made to: Eureka Recycling MRF in St. Paul, Minnesota, Waste Management MRF in Minneapolis, Minnesota, Waste Management MRF in Seattle Washington.

2006, the Local Government Association's European and International Unit confirmed via communication, that after conducting a search, they were unable to find any introduction of legislation for recyclate quality in both regions since 2006.

While the absence of legislation suggests a similarity between the three regions, evidence from the WRAP study implies that the difference lies in the quality and structure of specifications. According to this study, while there appeared to be a fairly high degree of clarity on specifications in the other countries visited, it materialised that the MRFs visited in England were guided by broader specifications. Unlike the MRFs in the other countries, the team making the visits did not detect a well defined set of specifications for supplying the materials' industry.

Comparison of Specifications

In North America and Europe, paper specifications are publicised and made available on paper mill web sites for all potential suppliers.

Objective testing procedures are implemented to determine the quality of materials received, which involves random sample testing of materials shipped from MRFs and received at mills. According to the WRAP (2006) report, this has been adopted at several Mills in the UK e.g. Aylesford, however, there is no standardised testing procedure.

Most re-processors purchasing recovered materials prefer that materials are sorted at the kerb-side, as this minimises the potential for cross contamination and generally produces higher quality materials. Therefore, the main challenge for two-stream[9], and more so single stream[10] MRFs, is to meet the specifications required by the materials markets/re-processors.

According to the WRAP study[11], the following techniques are used by MRFs to control the quality of the materials shipped from them, so as to build market confidence that their sorted materials meet or exceed the market specifications:

- Quality control or inspection stations at the end of each sorting line;
- Visual inspection of the materials at various levels in the storage bunkers;
- Random sampling of bales prior to shipment; and
- Quality control feedback systems between the market and the supplier.

(For more detail on each of the above techniques, refer to the report p.21[12])

Under the study, WRAP made comparisons between the specifications stated by the MRFs visited in the UK, Europe and North America, which have been summarised in the table over leaf.

[9] Fibre can be collected separately from other co-mingled materials (such as glass, plastics, and cans etc) or glass is collected separately from the other materials. Consequently, collection vehicles have two compartments to keep materials separate.

[10] All dry recyclables are co-mingled and collected in a single compartment of a collection vehicle

[11] Wrap (2006), *Materials Recovery Facilities* http://www.wastexchange.co.uk/documenti/MRF/MRF_v6__19Dec06_LC.605a7565.pdf

[12] ibid

Europe	North America	UK
Market specifications are established by the producer responsibility organisations. The specifications do not offer any flexibility, and according to WRAP, MRFs are acutely aware of the acceptable levels of contamination. Each of the facilities visited had established inspection and testing procedures.	Specifications provided by the MRF staff were fairly detailed. Inspection and testing procedures were in place to monitor the quality of sorted materials in relation to the market specifications.	The staff interviewed at the MRFs in England presented more general specifications than their counterparts in other countries. Quality inspection systems and quality testing of sorted materials was less prevalent.

Market specifications from selected European MRFs

The following information is taken from Appendix 2 of the WRAP (2006) study[13], which is a compilation of specifications provided by the MRFs' managers during interviews conducted during visits to selected the MRFs.

The MRF sites that were visited in Lille and Renne, must adhere to the specifications set by Eco-Emballage, the French producer responsibility organisation. Some of the specifications include:

Deliveries of liquid food packaging e.g. tetra pak and assimilated materials have to:

- contain less than 5% in inappropriate materials;
- have a humidity rate of less than 12%;
- be packaged in bales between 400 and 1200 kg
- be in 20 tonne consignments

Deliveries of mixed paper and card must:

- Contain around 90% of useful material, which includes more than 50% of tangled papers and cards, less than or equal to 40% newspapers, magazines, brochures and leaflets.
- Contain less than 10% of inappropriate materials e.g. dirty papers and non pulpable materials.
- Have a humidity rate of less than 12%
- Be packaged in bales between 400 and 1000kg
- Be delivered in consignments of 20 tonnes if on a trailer, around 9 tonnes from an unsorted dumpster, around 20 tonnes for bales on maritime containers.

For more specifications in Europe, see Appendix 2 of the WRAP report "Material Recycling Facilities"[14]

[13] Ibid (Appendix 2)

[14] http://www.wrap.org.uk/downloads/MRF_v6_19Dec06_LC.52a1549b.3528.pdf

Market Specifications from selected North American MRFs

E.g. SP Recycling MRF in Atlanta, Georgia:

- Contains sorted, fresh, dry sunburn free newspapers
- Contains no more than the normal percentage of inserts, with samples removed
- May contain over-issue news (polyethylene bags must be removed)
- May contain pressroom scrap without heavy ink sheets or over-issue inserts
- Maximum age 3 months
- Moisture content 10% (air dry)
- Total contamination: 0.5%
- Prohibitives: None
- Provide supplier with feedback reports.

Prohibitives are any materials and contaminants other than paper; including:

- Plastic bags, flexible film
- Adhesive tapes
- Carbon papers
- Plastic window envelopes
- Glued magazines
- Waxed paper
- Pressure sensitive tapes and labels
- Ropes, strings, twines, strapping
- Metal, glass, dirt, cloth
- Wood, floor sweepings, beverage cartons

Out-throws are papers (fibre) other than old newspaper.

- Aged newspapers, sunburned newspapers
- Shredded papers,
- Corrugated boxes, kraft bags, folding cartons, junk mail,
- Office, computer, coated or treated papers

Other specifications:

- Bales should be dense and solid and be uniform in size within a load
- Bales and loads must be tare free
- Container should be swept clean before loading

UK Market specifications

The following examples from UK MRFs show a considerable lack of detail in comparison to the specifications shown from the examples taken from Europe and North America.

Norwich MRF

- Fibre: typically 1% contamination, however, the market has less tolerance for cardboard.
- Containers: 1% contamination. Plastics are sorted into individual polymers and exported to Asia.

East Riding MRF

The recycled paper must meet the following general specification:

- All paper must be not more than 6 months old
- Maximum of 1% of contraries such as metal, plastic string.
- Maximum of 12.5% moisture
- Maximum of 2.5% coloured newsprint
- Maximum 1% telephone directories/envelopes
- Maximum 10% catalogues

Luton MRF

- Typically the markets accept about 1% contamination in the various sorted materials.

Huddersfield MRF

- Most markets accept 1% contamination in the materials

Hampshire MRF

- Generally 1% contamination for most materials
- Specific criteria have been agreed with a UK paper mill

Darwen MRF

- Mixed papers are sent direct to Aylesford (not sorted at the MRF)
- Plastics sorted by resin and colour must have less than 1% contamination

UK Development on specifications

Since this study was conducted in 2006, Resource Futures was contracted by WRAP in 2009 to carry out a project to investigate the quality requirements of UK re-processors and their relationship to the output from UK MRFs.

The study found:[15]

- There is a major disparity between the way in which MRFs are assessing the quality of their output (predominantly through visual assessment) and how re-processors are doing it (where weight-based sorting is the most common method).
- There is a lack of consistency in assessment methodologies even within these two broad types of assessment.
- Many sampling and testing approaches are not formally written down and available for inspection
- MRFs and re-processors are carrying out materials quality analysis that, while perhaps useful for internal monitoring or decision making, is not standardised enough to be comparable with data from other MRFs or re-processors.

Recommendations

The major recommendation to emerge from the analysis of material testing methodologies is the need for a standardised approach that can be applied by both MRFs and re-processors. According to WRAP, such a system would have to be practical for both MRFs and re-processors, and should be as similar as possible across material streams in order to make implementation at the MRF more straightforward. This would enable MRFs to produce clear descriptions of product quality, and re-processors would be able to test the material they receive using the same method and compare the results. Consequently this would help to prevent and resolve disputes; in addition, the information produced by both MRFs and re-processors could be shared, reducing the overall testing workload.[16]

Waste Protocols Project

The Waste Protocols Project is a joint Environment Agency and WRAP initiative in collaboration with industry. It is funded by the Department for the Environment, Food and Rural Affairs (Defra), the Welsh Assembly Government (WAG), and the Northern Ireland Environment Agency (NIEA), as a business resource efficiency activity.

According to the Environment Agency, waste management regulations, which fall under the EU Waste Framework Directive, are designed to protect human health and the environment. However, the Agency states that this can impose administrative and legislative burdens on business. It also highlights that due to the complexity of the legislation, difficulties can be experienced by businesses when trying to differentiate

[15] WRAP (2009), MRF Output Material Quality Thresholds Report, http://www.wrap.org.uk/downloads/MRF_Output_Material_Quality_Thresholds_Report.bb15b7c2.8210.pdf (section 4.2)
[16] Ibid

when the wastes they produce are fully recovered (and are no longer classed as 'waste') and the legislation no loner applies[17].

To address these issues, the project aims to produce a quality protocol for each waste material, explaining what has to be done to produce a fully-recovered, non-waste, quality product.

Objectives of the project:

- The production of a quality protocol[18] which presents the procedures that need to be followed for the successful transition of waste to a non-waste product or material that can be reused by business or industry, or supplied into other markets. According to WRAP, this enables recovered products to be used without the need for waste regulation controls.
- The production of a regulatory position statement, which gives the business community regulatory obligations they must comply with.

Examples of protocols

The Quality Protocol for the manufacture of secondary raw materials from waste non-packaging plastics[19]

This was launched in May 2009 and was produced in consultation with key stakeholders from the plastics industry. It establishes end-of-waste criteria for the production of secondary raw materials from waste non-packaging plastics.

The advantage is, that plastic converters or manufacturers who buy 'Quality Protocol' compliant material may benefit from a reduction in their material costs; and will have the assurance they are purchasing a fit-for-purpose and consistent non-waste product[20].

To see the Non-Packaging Plastics Quality Protocol visit: http://www.environment-agency.gov.uk/static/documents/Business/Quality_protocol_for_non-packaging_plastics_.pdf

For extra information visit the Environment Agency: http://www.environment-agency.gov.uk/business/topics/waste/114437.aspx

Current state of progress

According to the Environment Agency, they have published final quality protocols for the following waste materials:[21]

- Biodegradable waste (source-segregated) for compost

[17] http://www.environment-agency.gov.uk/business/topics/waste/32154.aspx

[18] According to the WRAP website, a Quality Protocol gives guidance on how to recover waste, remove it from the regulatory regime and unnecessary regulations.

[19] According to the good practice guide, non-packaging plastics are process scrap such as polymers left from the production of non-packaging plastics, off cuts etc; and post-consumer non-packaging plastics - drainpipes, guttering, broken children's toys etc. http://www.wrap.org.uk/downloads/Good_Practice_Guide_for_non-packaging_plastics.73caaa55.6943.pdf

[20] WRAP, Quality Protocols [online] http://www.wrap.org.uk/recycling_industry/quality_protocols/

[21] Environment Agency, State of progress for each material [online] http://www.environment-agency.gov.uk/business/topics/waste/114460.aspx

- Biodegradable waste (source segregated) for anaerobic digestate
- Cooking oil and rendered animal fat
- Glass – flat
- Plastics (non-packaging)
- Tyres – tyre-derived rubber material
- Plasterboard
- Lubricating oil

Protocols for other materials e.g. ash, wood tyre bales etc are currently at draft stage, or their development in being considered by the project.

To see the protocols for the rest of the materials listed above, visit the WRAP website: http://www.wrap.org.uk/recycling_industry/quality_protocols/

According to the Environment Agency, it is expected that protocols for the first 12 materials will create around £1 billion in business savings and increased sales of waste derived products by the year 2020 (through strengthening existing markets and generating new ones). The protocols aim to give end users confidence in the sustainable resources they purchase.

It has also been estimated that the quality protocols will divert around 17 million tonnes of waste from landfill, preserve 14 million tonnes of raw materials and avert at least 2.1 million tonnes of carbon dioxide equivalent emissions (CO2).

In 2009 the project won the "better regulation" category of the UK's premier cross-industry accolades of the National Business Awards. [22]

Shipment of Waste Directive

The issue of the quality of materials produced for export is addressed under the Shipment of Waste Directive[23], and also works in combination with the Environmental Services Association's Recycling Registration Service. This scheme is independent and externally audited, which focuses on MRF export standards

How the Recycling Registration Scheme (RRS) Works[24]

- It offers application to MRFs operating in the UK and handling or processing Green List[25] waste materials to be exported for recovery by a re-processor.
- The scheme is operated in accordance with a Code of Practice and Terms and Conditions, which applies to all Members and their registered MRFs.
- To become a member, an applicant must submit its MRF for audit to confirm compliance with the Code of Practice.
- Upon application, and successful audit, the facility becomes a Registered MRF.
- Annual re-audit is needed for continued registration.

[22] Environment Agency, Waste Protocols [online], http://www.environment-agency.gov.uk/business/topics/waste/32154.aspx
[23] European Commission,[online] *Waste Shipments* http://ec.europa.eu/environment/waste/shipments/legis.htm
[24] Environmental Services Association (ESA), *Recycling Registration Service: Demonstrating Compliance with TFS* http://www.wrap.org.uk/downloads/Justin_French-Brooks_-_Recycling_Registration_Service.170f6e44.6072.pdf
[25] Some waste shipments are subject to lower level controls, known as 'green list'. For more information, visit: http://www.environment-agency.gov.uk/business/sectors/37182.aspx

Under the RSS Code of Practice, registered MRFs are required to[26]:

- operate in accordance with good industry practice in the UK an in compliance with al applicable EHS legislation;
- have documented control systems for assessing and accepting/rejecting waste inputs;
- have documented control systems to ensure waste outputs meet applicable commercial specifications and accord with Green List guidance issued by the Environment Agency;
- ensure a written agreement has been entered into with a broker or dealer prior to supplying waste;
- affix an RRS certificate to export documentation relating to each export consignment; and
- complete export and import documentation/information as required under applicable law.

The European Environment Agency

According to information provided by the Sustainable Production and Consumption and Waste Unit of the European Environment Agency (EEA), there is ongoing work in the EU to define when a recyclate is no longer classed as waste in legal terms, but a product that can enter the national materials market. This means that it is not covered by the EU Waste Shipment Regulation which is concerned with exports to other member states.

For more information on the status of this work, visit the website of the European Commission (http://ec.europa.eu/environment/waste/framework/end_of_waste.htm) and the Joint Research Centre (http://susproc.jrc.ec.europa.eu/activities/waste/index.html), both of which intend to develop end-of-waste criteria for materials such as ferrous scrap metal, aluminium scrap metal, copper scrap metal, paper and glass.

Secondly, standardisation organisations such as CEN (European Committee for Standardisation) develop standards for industry for the classification of recycled materials. Examples include:

- EN 13427- Packaging. Requirements for the use of European Standards in the field of packaging and packaging waste[27]
- EN 13430 - Packaging. Requirements for packaging recoverable by material recycling[28]
- EN 13437 - Packaging and material recycling. Criteria for recycling methods. Description of recycling processes and flow chart.[29]

[26] Environmental Services Association (ESA), *Recycling Registration Service: Demonstrating Compliance with TFS* http://www.wrap.org.uk/downloads/Justin_French-Brooks_-_Recycling_Registration_Service.170f6e44.6072.pdf

[27] http://standards.mackido.com/en/en-standards24_view_2512.html

[28]: http://standards.mackido.com/en/en-standards24_view_2516.html

[29] http://standards.mackido.com/en/en-standards24_view_2520.html

Also, should a producer of materials or products want to use waste as an input for processing, in many countries they will need a license to keep, treat, or dispose of the waste. This is known as an IPPC permit which comes under the Integrated Pollution Prevention and Control Directive (IPPC)[30].

In the UK, the Waste Management Licensing Regulation requires businesses to apply to the Environment Agency for an IPPC permit, or a waste management licence.[31]

According to the information provided by the EEA, in Germany, any facility that uses waste as input for production needs a permit to do so. The permit will also specify the type of waste allowed to be used.

[30] http://ec.europa.eu/environment/air/pollutants/stationary/ippc/legis.htm

[31] Waste Management Resources Limited [online] http://www.wastemanagementconsultant.co.uk/legislation.php