Title: Amendment to the Environmental Permitting (England and Wales) Regulations 2010 - new schedule for Materials Recovery Facilities (MRFs) **IA No:** DEFRA 1481 **Lead department or agency:** Department For Environment, Food and Rural Affairs **Other departments or agencies:** Welsh Government	**Impact Assessment (IA)** **Date:** 21/01/2014 **Stage:** Final **Source of intervention:** EU **Type of measure:** Secondary legislation **Contact for enquiries:** Louise Clark, Waste Policy, Area 2B Nobel House, SW1P 3JR

Summary: Intervention and Options

RPC Opinion: GREEN

Cost of Preferred (or more likely) Option				
Total Net Present Value	**Business Net Present Value**	**Net cost to business per year** (EANCB on 2009 prices)	**In scope of One-In, Two-Out?**	**Measure qualifies as**
£-8.49mm	£-8.49m	£0.80m	No	NA

What is the problem under consideration? Why is government intervention necessary?

Our approach to collecting recyclate needs to generate material of sufficient quality to meet the needs of reprocessers (a requirement of the EU Waste Framework Directive WFD) and comply with international rules on waste shipments. Market signals regarding quality are not working in the way they should, partly because not all Material Recovery Facilities (MRFs) are measuring the quality of their output material or making this information transparent where they are. This is causing inefficiencies in the market and MRFs delivering recyclate of sub-standard quality in some cases. Government intervention is needed to address the market failure of imperfect information, and demonstrate to the Commission where co-mingling is capable of supporting the WFD objective of high quality recycling.

What are the policy objectives and the intended effects?

The regulations will require MRFs to sample the quality of their input and output material streams in exactly the same way, and then make this information transparent. This will help stimulate the market conditions needed to improve recyclate quality and help to demonstrate compliance with the WFD and with the Waste Shipments Regulation. Delivering high quality recyclate is important because it can help support the economy and growth of the recycling industry by maximising the economic value of the material collected. By minimising the amount of recyclate collected that ends up in landfill it also helps increase public confidence and participation in recycling and maximise the environmental benefits of recycling.

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

The consultation impact assessment considered two options:
Option 0 - do nothing, so maintaining the status quo, not introducing the proposed changes
Option 1 - introduce a mandatory requirement on MRFs, via an amendment to the Environmental Permitting Regulations, to monitor the quality of their input and output material streams.
Option 1 is the preferred option and was supported by the majority of respondents to the consultation (90% agreed with the rationale for intervention and 63% with the proposal to introduce a mandatory requirement). A voluntary approach to encouraging MRFs to measure quality has already been attempted but it failed to attract significant uptake as many MRF operators felt voluntary compliance would leave them at a competitive disadvantage. Industry needs confidence of a level playing field before they are willing to invest in monitoring systems or make information on the quality of their outputs available to the market.

Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** 04/2017

Does implementation go beyond minimum EU requirements?			No		
Are any of these organisations in scope? If Micros not exempted set out reason in Evidence Base.	**Micro** No	**< 20** No	**Small** Yes	**Medium** Yes	**Large** Yes
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:**	**Non-traded:**	

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) that the benefits justify the costs.

Signed by the responsible SELECT SIGNATORY: Dan Rogerson Date: 10/02/2014

Summary: Analysis & Evidence

Policy Option 1

Description:

FULL ECONOMIC ASSESSMENT

Price Base Year 2013	PV Base Year 2013	Time Period Years 11	Net Benefit (Present Value (PV)) (£m)		
			Low: -11.96	**High:** -5.55	**Best Estimate:** -8.49

COSTS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Cost (Present Value)
Low	0.71l		0.74	**5.55**
High	1.19		0.97	**11.96**
Best Estimate	0.95		0.85	**8.49**

Description and scale of key monetised costs by 'main affected groups'

Transition costs to MRF operators for sampling equipment and IT of £0.95m (PV £0.90m), total annual costs (sum over 10 years) to MRF operators of sampling and auditing of £9.4m (PV £7.59m). Costs to government, by the Environment Agency of auditing of £3.2m, are assumed to be passed on to business and are therefore included within the above figure.

Other key non-monetised costs by 'main affected groups'

BENEFITS (£m)	Total Transition (Constant Price)	Years	Average Annual (excl. Transition) (Constant Price)	Total Benefit (Present Value)
Low				
High				
Best Estimate				

Description and scale of key monetised benefits by 'main affected groups'

Other key non-monetised benefits by 'main affected groups'

Indirect benefits of better flow and transparency of information may be expected to benefit businesses and local authoritites in the reycling supply chain. The availability of improved information, along with measures in the Quality Action Plan, will encourage behaviour that increases the quality of recyclates. There are benefits to society of reduced greenhouse gas emissions from higher quality recycling.

Key assumptions/sensitivities/risks **Discount rate (%)** 3.5

The appraisal is based on Green Book guidance. Key assumptions affecting the cost of this policy are number of MRFs, based on EA and WRAP data, the costs of sampling, based on WRAP and industry estimates and costs of enforcment and auditing, based on EA estimates. For the wider benefits identified in the evidence base, it is assumed that some parts of the chain are incentivised to increase returns and will respond to greater transparency of information

BUSINESS ASSESSMENT (Option 1)

Direct impact on business (Equivalent Annual) £m:			In scope of OITO?	Measure qualifies as
Costs: 0.80	**Benefits:** 0.0	**Net:** -0.80	No	NA

Evidence Base (for summary sheets)

1. Introduction

On 1 February 2013, the Government published a consultation seeking views on draft Regulations for Materials Recovery Facilities (MRFs)[1] for incorporation alongside a number of other amendments to the Environmental Permitting (England and Wales) Regulations 2010. The consultation, which describes the policy proposals, a summary of the consultation responses and official Government response and related impact assessment are available on the Government website.[2]

The draft MRF Regulations contained requirements for operators of MRFs to test the composition of samples of the material they put into the sorting process, the residues, and the useable output. The intention was that the test results would be made fully transparent, via the Environment Agency, to local authorities, reprocessors and others. It was anticipated that information on the quality of recyclate produced by MRFs would help stimulate the market conditions necessary to improve the quality of the material produced by MRFs so that it could be more readily recycled. This information would also help demonstrate compliance with the separate collection requirements of the revised Waste Framework Directive.

The proposed Regulations were part of a wider package of proposed measures which aim to promote high quality recycling. The Government's vision for improving the quality of recycling, and the full range of measures we plan to take to achieve this, is described within a Quality Action Plan (England only).[3]

The consultation closed on 26 April. The Government has considered the responses submitted and has taken the decision to legislate along the lines proposed in the consultation, revised appropriately to take account of points raised through the consultation. A summary of the final legislative proposals is provided in Section 5. The impacts of the proposed legislation are described in Section 6.

2. Problem under consideration

Market signals regarding quality are not working in the way they should, partly because MRFs are not all measuring the quality of their output material or making this information transparent to the market where they do. This is causing inefficiencies in the market and MRFs delivering recyclate of sub-standard quality in some cases. Government intervention is needed to address the market failure of imperfect information, and demonstrate to the European Commission where co-mingling is capable of supporting the WFD objective of high quality recycling.

For a given amount and cost of recovered material, the aim must be to maximize the benefit of using the recovered material, compared to having to extract and treat virgin material. The higher the financial and environmental cost of using virgin material, the greater the benefit of recycling. In most cases this would occur when the recovered material is being used for high quality applications[4], and examples include:

[1] A Materials Recovery Facility (MRF) is a specialised plant that receives mixed dry recyclable materials (e.g. paper, plastics, metals, glass) which it then sorts, via a combination of manual and automated processes, into separate material streams and prepares for marketing to reprocessors.

[2] https://www.gov.uk/government/consultations/draft-materials-recovery-facility-mrf-regulations-for-insertion-into-environmental-permitting-england-and-wales-amendment-regulations-2013

[3] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221028/pb13875-qap-recycling.pdf

[4] This is not to say that there isn't a place for 'down-cycling', and it is recognised there will be limitations, such as cost, market demand/capacity and food contact issues, to the amount of material that can be subject to closed-loop recycling.

- The use of recovered glass in remelt applications to create new glass products (rather than for aggregate in construction);
- The separation of recovered plastic into individual polymers to produce, for example, new food and drinks containers (rather than the use of mixed polymers for low grade construction products);
- The use of recovered paper for the production of new paper products (rather than other uses such as animal bedding, insulation etc.).

Indeed, the revised Waste Framework Directive (rWFD) requires us to promote high quality recycling as a way of maximizing the environmental benefits of recycling. The rWFD also recognises that high quality recycling operations, which turn waste back into the same product as it came from, need good quality material as feedstock. Specifically, Article 11 states:

> *Member States shall take measures to promote high quality recycling and, to this end, shall set up separate collections of waste where technically, environmentally and economically practicable and appropriate* ***to meet the necessary quality standards for the relevant recycling sectors****.*

When we talk about the quality of recyclates we are generally referring to its grade (e.g. polymer type) and composition (i.e. how much of the consignment is made up of **target material** compared to the amount of **non-target material** and other **non-recyclable material**).

Only target material is likely to be recycled, so a high proportion of non-target and non-recyclable material will reduce the quantity of recycling, or yield. A high proportion of non-target and non-recyclable material can also make it more difficult for reprocessors to achieve 'high-quality' recycling and if the recyclate is of poor quality it is more likely to end up being down-cycled or, in more extreme cases, sent to other recovery or landfill.

The Waste Review recognised quality of recyclates as one of the principal challenges that need to be addressed if we are to realise our longer-term vision of a green, zero waste economy. The Waste Review states that we want to:

> *Ensure our approach to extracting recyclables, such as paper and plastic, from our waste generates material of sufficiently high quality to meet the needs of reprocessors here and abroad and to comply with the international rules on waste shipments. (para 32 of the Waste Review)*

We believe that the market should deliver recyclates of sufficient quality to meet the needs of reprocessors. However, although buyers and sellers are agreeing prices in the market for recyclates, there are strong indications that market signals regarding quality appear not to be working in the way they should. This is resulting in inefficiencies in both economic and environmental terms, and delivering material of sub-standard quality in some cases.

Whilst MRFs are capable of meeting the quality specifications of reprocessors, there is evidence that this is not always the case in practice. Table 1 summarises the results of WRAP research[5] which identified a broad range in quality with some good quality outputs but also some with high levels of non-target and non-recyclable material. A WRAP survey[6] indicated that reprocessors saw the need for there to be improvements in the quality of material from UK MRFs:

- Over 60% said only "some" or "hardly any" output from MRFs met their quality specification

[5] MRF Quality Assessment Study, 2009

[6] MRF Output Material Quality Thresholds, 2009

- Over 75% said the quality of outputs from MRFs was worse than material from other sources.

Table 1: Percentage of MRF non-target and non-recyclable material

Target material	Min %	Mean %	Max %
Aluminium	0.0	2.5	8.1
Steel	0.4	6.2	23.8
News and PAM	1.9	9.8	22.0
Mixed Paper	2.1	15.8	36.7
Card	1.9	12.0	57.4
Mixed Plastic	0.6	18.2	43.5
Mixed Plastic Bottles	0.5	12.2	23.0
HDPE Coloured Plastic Bottles	3.3	8.7	12.2
HDPE Natural Plastic Bottles	0.8	4.5	14.6
PET Clear	0.5	7.5	20.1
PET Coloured	3.0	8.1	13.2

The causes of this problem are complex; one contributing factor is that a significant proportion of MRFs do not currently measure the quality of their input and output material streams on a routine, robust or consistent basis, or where they do measure, make this information transparent to customers. This has a number of negative impacts, including:

- If a MRF doesn't measure quality, then it cannot manage quality; and
- Customers of MRFs (e.g. local authorities, reprocessors) experience difficulty differentiating between high and poor quality MRFs, therefore market signals for quality outputs are not as strong as they could be and there is little competition between MRFs on grounds of quality.

3. Policy objective

To help stimulate the market conditions necessary to achieve an improvement in recyclate quality, and support the objective in the rWFD to promote high quality recycling, by establishing a consistent, industry-wide method for sampling and compositionally testing the quality of input and output material streams from MRFs in a robust manner.

Delivering high quality recyclate is important because:

- It can help **support growth and the economy** by maximising the economic value of the waste material collected. Higher income levels from the sale of quality recyclates can return value to local authorities, householders and businesses. Conversely, poor quality recyclates can undermine the viability of recycling and have significant environmental and economic costs (e.g. represents a lost opportunity to recycle material and increases the need to mine and process virgin materials).

- It can help **increase public confidence and participation in recycling.** There is a certain amount of cynicism amongst the public about what happens to their recycling. Householders and businesses want to know that the action they are taking is making a

genuine contribution towards protecting the environment and improving resource efficiency.

- It can help **increase the environmental benefits of recycling**. Lower contamination levels in recyclates will reduce the amount of waste discarded during the recycling process, which typically ends up in landfill.

4. Rationale for intervention

4.1 Market failures

Recycling policies have traditionally addressed the market failure related to the environmental externality. The developing markets for recycled materials can also be subject to non-environmental market failures and barriers, such as imperfect information, market power and transaction costs which impede the smooth functioning of markets. Evidence (Improving Recycling Markets, OECD 2006) shows that presence of non-environmental market failures reduces efficiency of recycling activities and there is a potential case for intervention.

As mentioned previously, many MRFs do not assess the quality of the recyclable material they produce, and for those that do, the information is not made transparent to the market. This is due to competitive pressure on operating costs, e.g. those MRFs that do measure quality and make the information available may be undermined by those that either do not measure quality, or provide inaccurate information. Reprocessors are often conflicted between a desire for high quality material, and concern about maintaining their suppliers, where demand outstrips supply. Of those MRFs that do measure quality, very few are transparent about this information due to concerns about revealing information that competitors may capitalise on. It may also be the case that in the absence of mandatory standardised sampling and reporting, a signal of quality from any single MRF is not seen to be credible. Consequently, there is a lack of robust and consistent information on quality of outputs.

In a market where there can be a wide variation in quality, and if it cannot be immediately identified at the point of purchase, there can be impediments to improving market efficiency. A lack of flow of information through the recycling supply chain can also impede development of the market. Some parts of the recycling supply chain are not wholly incentivised to ensure the efficiency of the collection and recycling process and maximising revenue relative to costs. For example, most local authorities are charged a fixed gate fee per tonne of material sent to a MRF and therefore do not routinely request this information. In a market with an export outlet for a range of quality of recyclate, some reprocessors accept a range of quality, despite preferences for higher quality recyclate.

In the worst case a lack of information can cause a bias towards lower quality. This occurs if customers are only willing to pay a lower price, regardless of quality as they would rather not risk overpaying. At the same time sellers may not be willing to produce higher quality material if they are not certain that it will fetch a higher price. This lack of information for buyers and sellers creates a bias towards lower quality output, even though both parties could benefit from selling higher quality output. For example, the sellers could obtain a higher price, and the buyers would receive more recovered material in each batch thus reducing the volume of material that would need to be processed and potentially delivering efficiency gains. There is evidence that reprocessors can incur high costs from low quality recyclate (Resource Association report “The Costs of Contamination” estimates the cost of contamination to the reprocessing sector at £51m). This market failure leads to market inefficiency, as both parties could see an improvement in their revenue and/or costs from a move to higher quality recyclate. The existing voluntary RRS should have been an opportunity for businesses in the higher quartile to distinguish themselves and achieve a higher price. It is unclear why those who did

measure quality did not reveal it, but it is possible that uncertainty due to imperfect information across the whole sector was an impediment to this. Those MRF operators that did measure quality felt that they could have been at a competitive disadvantage for disclosing, compared to those who did not measure quality.

The regulatory proposal aims to address this market failure by making it mandatory for MRFs to measure recyclate quality, and for all MRFs to measure and sample recyclate quality in exactly the same way (e.g. weights and frequency of sampling are specified in the regulations) and to make this information transparent.

4.2 Legal drivers

The two main legal drivers for Government intervention are the EU revised Waste Framework Directive and the EU Waste Shipments Regulation.

Implementing the revised EU Waste Framework Directive (rWFD)

The rWFD requires us to take measures to promote high quality recycling and, to this end, to set up separate collections of waste to meet the necessary quality standards for the relevant recycling sectors.

The Government supports the objectives of the rWFD but believes there should be flexibility about the choice of collection system employed in any given area as each system has its strengths and weaknesses. However, if collection systems other than separate collection, involving some degree of co-mingling, are employed then it is important they deliver the requirements of the rWFD and promote high quality recycling.

The regulatory proposal is part of our approach to implementing the "separate collection" requirement of the rWFD and represents the minimum necessary to achieve compliance (i.e. it is not gold-plating). It will help ensure co-mingled collections and MRFs are producing, and have the information to demonstrate they are producing, recyclate of sufficient quality to meet the needs of reprocessors.

The information currently recorded in Waste Data Flow identifies amounts sent to different MRFs and amounts rejected for each LA. This information could be used to calculate the effective rejection rates for each MRF but it is not currently based on a robust methodology and therefore is insufficient to meet the requirements of the revised Waste Framework Directive.

Implementing the EU Waste Shipments Regulation

The UK needs to meet the requirements of the waste shipment controls. It is illegal to export waste for disposal,[7] but the controls allow for so-called "green list" recyclates to be exported for recovery overseas in a manner that represents a broadly equivalent standard of environmentally sound management. Recyclates can only be exported as "green list" if they are classifiable under one entry under Annex II (Green List) of the Waste Shipments Regulation. The regulations prohibit exporting low quality recyclate contaminated to the extent that any would need to be disposed of in the receiving country, or pre-sorted before recycling. This effectively means that no further sorting is necessary to separate out different entries in the Green List once it reaches its overseas reprocessing facility – e.g. paper being exported for recovery should not require further sorting, and as such should not include other materials such as glass, metal or plastic.

The export of such recyclate does not require notification to the Environment Agency (EA), but paperwork accompanying the shipment must be completed by the person or company exporting

[7] Exports for disposal are prohibited save for the exceptions identified in the UK Plan for Shipments of Waste.

the recyclates. Some countries may not have the equivalent controls on wastes that are disposed of, leading to pollution. Consequently the environmental externalities – such as the cost of disposal, where in the UK this is captured by the landfill tax – would not be captured. Such exports are illegal and the EA will take action against such activity.

The regulatory proposal aims to provide the Environment Agency with access to information which will help them identify, and take effective action against, those not complying with the law. This will increase confidence that exports of dry recyclates are legitimate and confidence of a level playing field.

4.3 Alternatives to regulation

A voluntary approach has been attempted by the waste management industry already. The mandatory option being consulted upon, builds upon the provisions of the existing 'Recycling Registration Service' (RRS) which was launched in April 2007 by the Environmental Services Association (ESA), the trade association for waste management companies. The RRS established similar monitoring requirements, but it failed to attract significant uptake (only about 20 MRFs, 15% of total MRFs).

Feedback to the ESA from its members suggests that the main reason for its failure was because it was a voluntary scheme; many MRF operators felt compliance with the code would leave them at a competitive disadvantage. Industry needs assurance of a level playing before they are willing to invest in the quality assurance programmes required by the code.

The Government worked closely with stakeholders from across the supply chain in developing the policy proposals ready for consultation. A series of events were held during 2012, involving local authorities, MRF operators and reprocessors, to discuss drafts of the QAP and MRF Regulation. The majority of stakeholders present at the events supported the vision set out in the QAP, and all agreed to the principle that MRFs must measure quality and that this requirement must be made mandatory if it is to work. MRF operators saw the value in measuring quality as it helps protect the image of their industry and root out illegitimate operators. However, they were clear that the requirements would not be implemented unless they were made mandatory as they were concerned they would otherwise be undercut by competitors. This view was supported more widely through responses to the consultation (see Section 5).

4.4 Summary

In order to stimulate the market conditions necessary to realise an improvement in quality of recyclates, and support the objective in the rWFD to promote high quality recycling, MRFs need to measure and report the quality of their input, residual and output material. Robust, consistent and transparent information on quality will help:

- Government demonstrate that it is meeting its commitments under the rWFD.
- MRFs manage quality effectively and react efficiently to prevailing market demand.
- Reprocessors identify suppliers of higher quality recyclates, reducing additional costs arising from further sorting, damage to machinery, and the disposal of unrecyclable material to landfill.
- Local authorities to make adjustments to their collection systems, provide further advice or information to householders and businesses if there are particular issues with quality, and decide which MRF to contract with.

Mandatory requirements will provide MRF operators with the level playing field they need to invest in the quality management systems, and share information with reprocessors, without fear of being put at a competitive disadvantage.

The Quality Action Plan (published in February) outlines our vision for high quality recycling in England and proposals for achieving this. It recognises the need for transparent information on quality but also identifies that a range of other actions across the entire supply chain are necessary if we are to be fully successful in achieving our vision.

5. Description of options considered

The consultation IA considered two options:

Option 0 – do nothing, so maintaining the status quo, not introducing the proposed changes

Option 1 – introduce a mandatory requirement on MRFs, via an amendment to the Environmental Permitting Regulations, to monitor the quality of their input and output material streams.

The majority of responses to the consultation agreed with the rationale for Government intervention (90%) and supported the Government's proposal to make the requirements to monitor and report quality mandatory i.e. Option 1 (63%).

Therefore the Government has taken the decision to proceed with Option 1 and make the requirements to monitor quality mandatory in order to demonstrate compliance with the rWFD objective to promote high quality recycling and the separate collection requirement.

The regulations will make it a requirement for MRFs to put in place robust quality management systems and checks which will yield information on the levels of target, non-target and non-recyclable material contained in the inputs and outputs to the facility by material type (i.e. paper, glass, plastic and metal). The requirements will be limited to just those permitted MRFs with an output of more than 1000 tonnes per annum.

The main changes made to the regulatory proposals to take account of issues raised through the consultation include:

- Removal of the requirement for an independent audit; instead greater reliance on the Environment Agency and Natural Resources Body Wales to check compliance with the Regulations. The EA will consult on the necessary charges to do this early in 2014.

- Increase in the weight and frequency of the sampling requirements for both input and output material as per the table below. This follows further discussions with the main trade associations.

	Final Arrangement for the E&W MRF Regulations		
	Sample Weight (kg)	**Sample Frequency (1 sample/tonne)**	
		Initially	**After 2 years**
Input	**60**	**160**	**125**
Paper	**50**	**80**	**60**
Plastic	**20**	**20**	**15**
Metals	**10**	**20**	**20**
Glass	**10**	**50**	**50**

- Removal of both the time-based minimum sampling frequency and the requirement to sample the residual stream
- Improving the clarity of some of the definitions (e.g. "MRF")

Of the 88 consultation responses, 36% agreed with the assumptions made in the consultation IA, 16% did not agree and 47% made no comment / were unclear. 61 responses made some form of other comment on the consultation IA including:

Comment	Government Response
Rationale for intervention	
The proposed Regulations will not drive up quality on their own; entire supply chain needs to take action e.g. quality of input needs to be addressed through controls on local authorities.	The need for other action to promote high quality recycling is recognised in the final IA in Section 4 and in the recently published Quality Action Plan.
Costs and benefits / assumptions	
The impact assessment should take account of costs to local authorities as it is likely that MRF operators will seek to pass on any increase in operating costs via increased gate fees.	Impact Assessment only quantifies direct costs to MRF operators but recognises in Section 6 that they may seek to pass on these costs either via increased gate fees (paid by LAs) or higher recyclate value (paid by reprocessors). In any case, this would be a transfer rather than an additional cost. Given the uncertainty with how MRF operators may choose to pass on costs, the indirect costs to LAs have not been quantified.
A number of responses questioned whether higher quality recyclate would lead to higher prices – various reasons given including a lack of transparency around prices and a lack of willingness to pay by reprocessors in the current economic climate.	A recent Resource Association report highlighted the costs to reprocessors of dealing with contamination. It is not unreasonable to expect that reprocessors would be willing to pay more for higher quality recyclate to avoid these costs. Other responses to the consultation, and our discussions with some reprocessors, support our view that higher quality recyclate will attract a higher price.
Underestimated labour costs (e.g. regional differences, holiday and national insurance contributions) but overestimated time for taking samples and some capital costs (e.g. cost of scales).	Labour costs, capital costs and time for taking samples have been revised for the final IA (see Table 11).
Would like greater clarity behind cost assumptions made in Annex 1 of the impact assessment, particularly in relation to the sampling methodology that was assumed.	Annex 1 now contains a brief description of sampling methodology assumed for the purposes of estimating costs to businesses.
Impact Assessment fails to consider the full costs incurred by reprocessors as a result of poor quality material (several references to the recent Resource Association report on costs of contamination). Suggestion made that the IA should include a cost:benefit analysis of costs to MRFs vs. benefits to reprocessors.	We do not have sufficient information to be able to construct a separate cost benefit analysis as the actual impact up and down the recycling chain is uncertain. That said, Annex 2 estimates the benefits of a step improvement in the quality of recyclate produced by MRFs.
Several responses highlighted an error made on page 10 of the impact assessment relating to the assumed size bands of MRFs.	Corrected.
Concern expressed that the IA is based on information obtained from waste management companies; need to seek information from reprocessors	Rationale for action and assumptions underpinning the estimation of costs and benefits in the consultation IA were based on discussions with and information provided by both waste management companies and reprocessors. All parties were invited to comment as part of the consultation process.
Unintended consequences	
An increase in recyclate cost will mean it is uncompetitive compared to virgin material	We consider it unlikely that recyclate costs will increase to the extent that it will become uncompetitive compared to virgin material. Whilst there will be an increase in

	costs, there will also be an increase in quality (and confidence in this), so it is expected that there will be a concurrent increase in willingness to pay. The effect on demand for recyclate is therefore ambiguous. In any case, the impact is expected to be small as the costs per MRF are estimated to be very low relative to other costs and turnover.
Better information on contamination levels could lead to a drop in recycling rates	We accept that there could be a small drop in reported recycling rates in the short term. However, robust and transparent information on quality is important to maintain the long-term viability of recycling. Other measures are in place to ensure recycling targets are met.
SMEs may struggle to comply as cost is disproportionate for small operators. For example, a MRF processing 5,000 tonnes will incur an annual cost per tonne of £2.65 to meet the legislative requirements whereas a large MRF processing 75,000 tonnes will incur a cost per tonne of £0.75 (or less for higher tonnage processed)	The Government has removed the time-based sampling frequency to help address this. This final IA considers the costs to different sized operators in terms of pounds per tonne of material throughput.
Need to consider how this affects UK competitiveness relative to other EU countries	We do not expect any negative impacts on UK competitiveness. MRF operators have a choice on how to pass on costs. Other European countries often have their own arrangements for ensuring quality of recyclate. Our work on quality is, in part, to protect UK position in competitive global market.
Need to ensure smooth transition and integration with enforcement of Transfrontier Shipment Regulations and avoid disruption to compliant exports	We are working with the Environment Agency to consider how information on quality can help enforcement of export controls.
Proposals may increase production of RDF (refuse derived fuel)	We expect collecting and sorting co-mingled waste for recycling to remain more attractive economically than producing RDF as the costs per MRF are estimated to be very low relative to other costs and turnover.
A weak Code of Practice may not address quality issues	We will keep the effectiveness of the Regulations under review.

The costs and benefits (Section 6) have been updated in light of changes to the legislative proposals and comments submitted in response to the consultation – the main changes are summarised in Table 17.

Changes made following the RPC opinion in August.

Number of MRFs: The Environment Agency has carefully considered the number of MRFs that will be in scope of the regulations, taking into account their permitting records and the views of their technical experts. They have advised us that the regulations will apply to 167 MRFs in England and Wales.

Sampling: The sampling requirements in the regulations have reduced since the IA was submitted to the RPC in the summer. The revised sampling proposals were broadly agreed by the three main trade associations (Environmental Services Association, Resource Association and the Local Government Association). The revised sampling is as follows:

	Final Arrangement for the E&W MRF Regulations		
	Sample Weight (kg)	Sample Frequency (1 sample/tonne)	
		Initially	After 2 years
Input	**60**	**160**	**125**
Paper	**50**	**80**	**60**
Plastic	**20**	**20**	**15**
Metals	**10**	**20**	**20**
Glass	**10**	**50**	**50**

It is further assumed that 38 MRFs already undertake sampling to 80% of the specification required, a further 40 MRFs undertake sampling to 50% of the specification, a further 19 MRFs do so to 20% of the specification, with the remaining 70 MRFs assumed not to undertake any sampling.

Output of those MRFs in scope is estimated at 3.31m tonnes in 2011. The growth rate is estimated to range between 0-5% (2.5% best estimate). Waste arisings, household recycling rate and collection method (kerbside sort or co-mingled) all interact to influence the amount of co-mingled municipal waste requiring sorting by a MRF.

6. Costs and Benefits

This policy is aimed at MRFs that primarily deal with co-mingled material collected from households or is similar in nature to that from households.

The number of MRFs in scope has been updated following a review of data by the Environment Agency (EA); the number of facilities in scope has increased from 74 to 167. The EA data shows the target waste removed, allowing a split by size (which is necessary as some costs will differ according to size). The MRFs have been classified as small (less than 20,000tpa throughput), medium (between 20,000 and 75,000tpa) and large (over 75,000tpa). It should be noted that estimates are based on data from operator returns, permit information, other data held by the Environment Agency and web site information. There are therefore limitations to the data and the number of sites likely to be in scope can only be an estimate. The Environment Agency intends to write to all those MRFs who are in scope before the regulations come into force. The results are in Table 2 below.

A number of sites will already be taking measures which, to varying extents, will satisfy the requirements of the regulation. This will particularly be the case for those sites which are members of the Recycling Registration Scheme (RRS). The existing level of testing will determine how much additional cost will be faced as a result of the regulations. Further detail on this is presented in the following section. Advice from WRAP on the number of MRFs already testing to different extents leads to the split shown in table 3. It should be noted that these are not based on actual data, rather they are the best available estimates, based on a programme of visits to MRFs undertaken by WRAP.

According to our figures, there are 46 MRFs that are not captured by the regulations due to the 1000 tonne de minimis. As a proportion of the total waste, these facilities only account for about 1% of the tonnage of dry recyclates handled by MRFs in England and Wales. This demonstrates that it is not proportionate to include these facilities in the scope of the regulations.

Table 2: Classification of sites in England and Wales by size and number required to implement the regulations

Number of MRFs	Small	Medium	Large	Total
England and Wales: previous	51	20	3	74
England and Wales updated	113	47	7	167

Table 3: Estimated extent to which MRFs in England and Wales already implement sample measurement to comply with the regulations (based on RRS membership and WRAP advice)

	Small	Medium	Large	Total
MRFs testing to 80% of the requirement	16	17	5	38
MRFs testing to 50% of the requirement	24	15	1	40
MRFs testing to 20% of the requirement	16	3	0	19
MRFs not currently testing	57	12	1	70
Total MRFs	113	47	7	167

EA data shows that for the 167 sites estimated to be in scope, the overall output (target waste removed) was 3.31m tonnes (mainly 2011 data, using 2012 or 2013 where necessary; previous estimate was 2.38m tonnes). The growth rate is estimated to range between 0-5% (2.5% best estimate). Waste arisings, household recycling rate and collection method (kerbside sort or co-mingled) all interact to influence the amount of co-mingled municipal waste requiring sorting by a MRF. In the absence of government intervention, the level and range of quality of MRF output is not expected to change. The Quality Assessment Study found no causal relationship between quality and either the age or size of MRF.

Table 4: Estimated growth in tonnage throughput of MRFs in scope

Total MRF input (m tonnes)	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
low estimate (no growth)	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**	**3.31**
Best estimate	**3.48**	**3.57**	**3.67**	**3.77**	**3.88**	**3.99**	**4.10**	**4.23**	**4.36**	**4.49**	**4.63**
high estimate (5% growth)	**3.65**	**3.84**	**4.03**	**4.23**	**4.44**	**4.66**	**4.90**	**5.14**	**5.40**	**5.67**	**5.95**

It is assumed that initial costs of sampling and monitoring will be in 2014, in order to comply with the policy in 2015. An assessment period of eleven years (rather than the standard ten) is used, as the regulations will now not come into force until 2014 and it is desirable to consider a full ten years with the policy in place, in order that this Impact Assessment is comparable to the Consultation Stage Impact Assessment. One-off costs to business are the acquisition of testing equipment and systems costs. Annual costs relate to the requirement to sample input and output material to a given frequency and are based on estimates from WRAP and the Environmental Services Association, calculated for three size bands of MRFs. Table 3 shows the numbers of MRFs undertaking sampling already, and the broad extents to which they do so. MRFs can also expect inspection visits from the Environment Agency /National Resource Wales every year, which will require resource to facilitate.

Introduction of this proposal and associated measures is expected to increase the availability of information about the quality of MRF output. Although there are initial costs to business of this measure, there are potentially greater benefits of higher quality recycling from avoided embedded GHG emissions, sales revenue from a greater tonnage of material being recycled (see Section 8), plus avoided landfill externalities. These greater benefits will be as a result of the measures proposed in the Quality Action Plan and require action by the whole supply chain.

6.1 One-off costs

In the consultation impact assessment**,** all businesses were expected to incur the cost of the annual audit. It is now estimated that MRFs are already implementing the requirements to varying extents.

WRAP and the Environmental Services Association (ESA) have provided estimates of costs related to sampling and adopting IT systems to measure the quality of outputs. Depending on the size of MRF it is expected there will be one off equipment costs such as weigh scale, mesh sorting table and input and sorting bins. Details are provided in Annex 1. The costs for equipment have been reduced following comments made on the consultation IA (see Table 17).

Compliance checking will be performed by the EA/NRW as part of their inspection regime under the Environmental Permitting Regulations. This has replaced the requirement for a 3rd party audit which would have been expected to be performed by the ESA, and costs have been altered to take this into account. Therefore a pre-entry audit is no longer required but it is expected that time will be required to train staff on sampling processes. It is estimated to take:

- for each small and medium MRF, 0.5 day for a technical operator to attend training course (to be run by WRAP) on sampling requirements, plus 0.5 day for technical operator to train 2 x manual workers back at the MRF; and
- for each large MRF, assuming the training will be done in-house as they will already have necessary knowledge on sampling techniques, 0.5 day for a technical operator to run training course for 3 x manual workers.

It may be necessary to install the required IT systems to ensure consistency across the sector. The figures in table 5 show ESA estimates of cost relating to installing IT systems.

Table 5: Estimate of maximum one off costs to business by size of MRF **(further detail in Annex 1)**

Size of plant	**Small**	**Medium**	**Large**
one off equipment costs (£)	3,150	4,150	5,850
management systems (£)	2,500	11,875	28,125
Training costs (£)	173	173	212
Total one off costs (£)	**5,823**	**16,025**	**33,975**

The policy is expected to be required from October 2014 (the regulations to be laid early in 2014 with a 6 month transition to allow MRF operators time to prepare) and one off costs are assumed to be incurred in 2014. The range of estimate takes into account new businesses over the period of analysis that are expected to incur the costs of this policy. The total one off costs of the policy in 2014 are in tables 6, 7 and 8 below. (underlying calculations are in Annex 1). It is assumed that all MRFs that are currently undertaking some sort of testing will already have the equipment, therefore only those MRFs not yet undertaking any testing face the cost of purchasing equipment. It is assumed that current management and training costs for auditing and enforcement purposes are borne in proportion to the amount of testing assumed to be already taking place; additional management and training costs are therefore only applied to

those portions of the requirement that are not yet being met (i.e. a MRF testing to 80% of the requirement would only face an additional 20% of the auditing and enforcement cost).

Table 6: Estimate of total one off equipment costs

Size of MRF	Small	Medium	Large	Total
one off equipment costs (£)	3,150	4,150	5,850	
number of MRFs not yet testing	57	12	1	70
total one off eqpt cost (£)	179,550	49,800	5,850	235,200

Table 7: One off management and training costs

Size of MRF		Small	Medium	Large	Total
One off management systems (£)		2,500	11,875	28,125	
Training costs (£)		173	173	212	
Total one off cost per site (£)		2,673	12,048	28,337	
number of sites	80% compliant	16	17	5	38
	50% compliant	24	15	1	40
	20% compliant	16	3	0	19
	0% compliant	57	12	1	70
Total one off costs (£)		227,247	304,827	70,843	602,917

Table 8: Estimate of total one off costs

Total one off costs	0% growth in tonnage	5% growth in tonnage	2.5% growth in tonnage (central estimate)
Total one off equipment costs (£)	235,200	315,113	275,157
Total one off systems and training costs (£)	602,917	746,928	674,923
Total one off costs (central estimate) (£)	838,117	1,062,041	950,079

6.2 Annual costs

Annual costs relate to the cost of taking input and output samples, sorting and recording data and performing the annual audit. The sampling frequency and associated costs are shown below. Annual sampling costs are estimated by WRAP and inspection/auditing costs are estimated by the EA. In response to the consultation process, the sampling requirements have been changed as outlined in Section 5 to take account of consultation responses.

Table 9: Annual sampling frequency for MRFs

Size of plant/sampling frequency	Small	Medium	Large
Inputs	100	450	1000
Outputs	374	1232	2737

The costs of sampling are calculated based on employee rates and estimated time taken to separate out and sort samples, sampling and recording of data. The increased frequency of sampling is expected to increase the annual labour costs. Some consultation responses indicated that the labour cost assumptions were too low. The figure in the consultation document of a £7 median wage, and an assumption of 25% overheads was based on WRAP estimates. An alternative figure, using the standard cost model, for a refuse and salvage operative is estimated at £7.25 (2005 prices, £8.47 in 2013 prices). Following the consultation, advice from industry suggested a more realistic figure of £7.75[8] should be used with a further 25% overheads added as estimated by industry experts[9]. Tables 10 and 11 below shows the expected annual labour costs and Table 12 shows the estimated total cost based on the current tonnage. A growth rate in tonnage of 5% is assumed for higher estimate and 2.5% growth for the central estimate. A detailed breakdown of sampling costs is in Annex 1.

Table 10: Central estimate of annual costs of sampling to business by size of MRF in first two years of policy (2014 and 2015)

Size of MRF	**Small**	**Medium**	**Large**
Annual labour costs (£)	2,137	9,599	21,313
Estimated average throughput (tonnes)	10,000	45,000	100,000
labour costs per tonne (£)	0.21	0.21	0.21

Table 11: Central estimate of annual costs of sampling to business by size of MRF in all subsequent years

Size of MRF	**Small**	**Medium**	**Large**
Annual labour costs (£)	2,664	12,000	26,664
Estimated average throughput (tonnes)	10,000	45,000	100,000
labour costs per tonne (£)	0.27	0.27	0.27

Table 12: Estimate of total annual labour costs for sampling, first two years of policy

		small	Medium	large	total
Annual labour costs (£)		2,137	9,599	21,313	
number of sites	80% compliant	16	17	5	38
	50% compliant	24	15	1	40
	20% compliant	16	3	0	19
	0% compliant	57	12	1	70
total cost (£)		181,634	242,856	53,281	477,771

[8] £9.69 including 25% overheads as estimated by industry.

[9] The SCM recommends 30% but an industry workshop indicated 25% was more realistic for this type of wage.

Table 13: Estimate of total annual labour costs for sampling, all subsequent years

		small	Medium	large	total
Annual labour costs		2,664	12,000	26,664	
number of sites	80% compliant	16	17	5	38
	50% compliant	24	15	1	40
	20% compliant	16	3	0	19
	0% compliant	57	12	1	70
total cost		226,421	303,598	66,659	596,677

As described in Section 5, each MRF can expect an announced inspection visit from the EA/NRW each year Businesses will also incur labour costs to deal with the annual site inspection. It is assumed a manager will use approximately 1 hour of time and various staff spending 15 minutes to respond to auditor questions for the material testing element, incurring a total of 3 hours of technical operator time. The estimate of time taken is based on estimates from WRAP and is multiplied by the wages for a manager and a technical operator from the Standard Cost Model Annex, up-rated using the GDP deflator to 2013 prices[10].

The EA have estimated that inspection will cost them an annual £1,884 per site. This includes staff time for site visits, technical advice, planning and analysis of data, legal costs, administration costs, and financing costs. It is expected that costs may decrease in future as knowledge improves and practices bed in, but given the uncertainty over the extent of this it has not been monetised.

Table 14: Annual auditing and enforcement costs

	Number of Sites	Annual Cost per site (£)	Total cost (£)
Total costs for Environment Agency	167	1,884	314,664

For the total annual costs, we have placed a range of 25% around the lower and higher estimates of growth to provide a range to reflect uncertainty of actual costs incurred by business and the actual amount of sampling activity currently undertaken.

Table 15: Central estimate of total auditing cost incurred by all MRFs (Central estimate; 2.5% growth)

Auditing and enforcement (£)	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Site inspection auditing costs	322,531	330,594	338,859	347,331	356,014	364,914	374,037	383,388	392,973
Business costs of dealing with site inspection	7,607	7,797	7,992	8,192	8,396	8,606	8,822	9,042	9,268
Total auditing and enforcement costs	330,138	338,391	346,851	355,522	364,410	373,521	382,859	392,430	402,241
Of which costs to business	330,138	338,391	346,851	355,522	364,410	373,521	382,859	392,430	402,241

[10] Technical operator based on SCM81 process/plant and machinery operative wage of £10.27 in 2005 prices, £12.00 in 2013 prices using the GDP deflator.

Table 16: Summary of central estimate (2.5% growth) annual costs

Summary of central estimate of annual costs (£m)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Annual costs to business of sampling		0.49	0.50	0.66	0.68	0.70	0.72	0.74	0.76	0.78	6.03
Annual audit & enforcement costs to business		0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	3.35
Central annual cost estimate	-	0.82	0.84	1.01	1.04	1.07	1.10	1.13	1.16	1.20	9.38

6.3 Summary of costs

The impact on business is £0.95m initial costs (a range of £0.7m-£1.2m taking 25% in either direction; £0.90 in PV terms) of purchasing new equipment for sampling, installing IT systems and performing a pre-entry audit for existing businesses and new business entrants. Annual costs of sampling and an annual audit/inspection are assumed to impact on businesses directly and sum to an estimated £9.38m over 10 years of the policy as shown in table 16 (present value of £7.59m, with £4.9m - £10.7m range of 25% lower than the 0% growth estimate, and 25% higher than the 5% growth estimate). The total impact on businesses is £8.49m (£5.6m - £12.0m) PV over 10 years. This includes the costs to the public sector (EA) which are assumed to be passed on to business, and therefore represents the total cost of the policy. This is slightly higher than the estimate in the consultation IA and is due to the combination of a higher number of MRFs, higher sampling weights and frequencies, a reduction in sampling costs, and changes in auditing costs and monetisation of the cost of enforcement. The costs to business have increased correspondingly. These are the direct costs of the policy and are included in the summary sheets. The changes in costs following responses to consultation are detailed in Table 17 below.

Table 17: Summary of changes following consultation responses

Assumption	Consultation IA	Changes to final IA	Impact
Number of MRF	Assumes 74 MRFs	Assumes 167 MRFs	Increase in costs
Tonnage throughput	Assumes 2.375mt	Assumes 3.31Mt	Increase in costs
Auditing	Assumes initial audit then annual	Assumes no initial audit but annual inspections by EA/NRW.	Net increase in costs
Equipment costs	Input bin – £200 each Weigh scale - £5k each Sorted material bins - £20 each	Input Bin – Additional bins required to suit increased sample weights. Sample Bin Trolley – Weights in consultation could have been lifted by hand. This will not be the case with increased sample weights, therefore, a trolley is required. Weigh Scale – A consultation response suggested that weigh scales could be purchased at £1k. Sorted Material Bins – Cost of bins increased slightly	Reduction in costs
Number of samples taken per annum	Assumes 800 for a small MRF, 1650 for a medium MRF and 3600 for a large MRF	Using no glass targeted arrangement, assume 374 for a small MRF (10,000 TPA), 1683 for a medium MRF (45,000 TPA) and 3737 for a large MRF (100,000 TPA)[11]	Increase in costs
Hourly wage	Assumed £7 + 25% for overheads	Assume £9.69 for technical operator, £15.98 for manager (including overheads)	Increase in costs
Time taken to obtain and take a sample	0.52 hour	Varies according to sample size, however a datum has been taken at 0.67hour to capture, weigh, sort, weigh sorted, empty and record of a 40kg input sample	
Sampling requirements for residual stream	Assumed sampling was required.	Requirement removed following consultation responses.	Reduction in costs
Total impact			Increase in costs

6.4 Direct and indirect impact of the regulations

The costs of regulation could be passed on through the recycling supply chain to local authorities, who pay for the services from MRFs in the form of higher gate fees. The anticipated higher prices for recyclate paid by reprocessors, who purchase the output of MRFs, could also help cover the costs of regulation. A response to the consultation asked for a separate cost benefit analysis for MRFs and reprocessors. We do not have sufficient information to be able to construct a separate cost benefit analysis as the actual impact up and down the recycling chain is uncertain. This impact assessment identifies and quantifies direct impacts but is expected that there will be some pass through of costs and benefits though the recycling chain of this proposal. The impact is expected to be small as the costs per MRF are estimated to be very low relative to other costs and turnover.

[11] An error was made in the consultation IA when scaling up the required sampling frequencies set down in the draft Regulations into the total number of samples required per year for different sized MRFs; this meant sampling costs were overestimated in the consultation IA.

Some responses to consultation questioned whether higher quality recyclate would lead to higher prices as there is a lack of transparency and some cited a lack of willingness from reprocessors to pay in the current economic climate. The Resource Association report on the cost of contamination and our analysis indicate that there are economic drivers to reprocessors being willing to pay a higher price as higher quality is expected to reduce costs. It is expected that this additional cost will help drive an improvement in efficiency in the recycling supply chain which could be expected to improve efficiency. For example, if a MRF is receiving recovered material that has high contamination rates, it may be incentivised to communicate with LAs to try and reduce those rates. In turn, if a reprocessor is receiving material of lower quality, and has information about other material that is of the preferred quality, it may change contracts or try and negotiate for higher quality output. In some cases, there may be no change in the supply chain at all, but all the parts of the chain have better information to make decisions.

7. Non monetised costs

Previously non monetised costs such as costs to the Environment Agency of monitoring and management of information have now been monetised.

8. Potential wider impacts of measuring quality

Following consultation, this section has been updated to take into account the higher number of MRFs and tonnage throughput. Material prices have been updated to May 2013 prices which are lower than at the time of consultation. The net impact is a higher level of potential benefits than had been previously estimated.

The Wales Quality Thresholds Scoping Study – Background Report states 'there was general consensus from stakeholders that, by introducing more transparent testing and reporting systems within the supply chain, the quality of recyclates would improve, even if thresholds were not set'. It goes on to state that increased quality and pricing could be expected, but could not be quantified. The analysis set out below attempts to consider a scenario of behaviour change resulting from the proposed regulations. The costs and benefits analysed here are not included in the summary sheets of the impact assessment due to the uncertainty of the scale of behaviour change.

The availability of robust information on quality and associated measures could drive behaviour change in reprocessors. Those reprocessors receiving low quality recyclate, would now have robust, readily available information on the range of quality of feedstock available to them and may seek to change some supplier contracts. This analysis does not assume there will be a significant shift of customers at this stage, but that the threat and actual shift by a small number of customers could drive behaviour change. It assumes a small shift by these customers can trigger lower quality MRFs to take measures to improve quality or face a potential loss of customers. This analysis assumes there will still be a range of quality of recyclate, but those customers unhappy with receiving the lowest quality will have sufficient information to confidently shift to other MRFs.

One potential scenario of an improvement in quality is analysed here, and in further detail in Annex 2.

As a result of the proposed amendment and additional measures, a small proportion of lowest quartile MRF customers (10% assumed) could be expected to shift to the upper quartile in terms of quality, as they can directly benefit from such a move through higher yield and reduced

landfill costs of the contaminated percentage that cannot be used. This shift (2.5% of total output) is assumed to occur relatively rapidly as there are a proportion of reprocessors with flexible contracts and who deal on the spot market. Contracts between collection bodies and MRFs are long term (between 6-20 years) but there is a proportion of the market that is not fixed into these contracts. This actual or potential loss of customers gives an incentive for lower quality MRFs to increase the quality of their outputs, either by improving input quality or investing to improve sorting processes/slowing down plant throughput. It is assumed there will be a shift by the remainder of MRFs in this quality segment (22.5% of total output) to the average quality of the sector. This should reduce the overall amount of MRF input that ends up in landfill be that in England or overseas, (assuming the higher quality MRFs have a lower non-target and non-recyclable rate) and also increase the total amount of value (both environmental and economic) gained from recycling the material for the industry as a whole (prices are assumed to reflect the reduction in non-target and non-recyclable rate). A greater amount of material recycled also benefits society through reduced greenhouse gas emissions from landfill and avoided embedded emissions. An increase in total production of recyclate is assumed to be absorbed by the reprocessing market without an impact on material prices as there is anecdotal evidence of a shortage of supply and prices are influenced by global conditions and production activity.

The methodology for the cost benefit analysis from an improvement in quality of recyclate is taken from Porter (Waste Economics Ch 9, citing Ackermann 1997) and calculates the net impact of a shift of material from landfill to recycling as:

Table 18: Impact of a shift of material from landfill to recycling

Benefits	Costs	Source
Additional revenue from recyclate, calculated using the differential in material compositional analysis in lower, and upper quartiles and average quality and applying the relevant material price to calculate the aggregate improvement in recovered material revenue		Tonnage estimated using WRAP MRF Quality Assessment mid point of quartile ranges. Material prices: Let's Recycle 2013
Avoided gate fee and haulage of sending less material to landfill	**Costs of collection of material for recycling** (in this case zero if the increased quality results from better sorting at MRFs)	WRAP Gate Fees report 2011, estimate of haulage costs (WRAP)
Additional carbon benefit of avoided virgin material extraction, calculated applying carbon factors to the avoided production for each material	**Carbon cost of recycling material** calculated by applying the carbon factor for recycling activity	Scottish Carbon Metric, DECC traded and non traded carbon prices

The lack of disclosure on contractual arrangements between MRF and reprocessors results in a lack of detailed evidence of the relationship between price and quality of recyclate. Anecdotal evidence from reprocessors indicates they are willing to, and do pay for higher quality. In addition, given a higher quality material will have a higher output yield for the reprocessor, theoretically the reprocessor should be willing to pay more for higher quality when it is clearly identifiable. The evidence from WRAP shows there is a range of quality. The existing voluntary RRS should have been an opportunity for businesses in the higher quartile to distinguish themselves and achieve a higher price. As mentioned above, it is unclear why those who did measure quality did not reveal it, but it is possible that uncertainty due to imperfect information across the whole sector was an impediment to this. By requiring consistent information, these proposed regulations should remedy this.

In markets where there is quality measurement and a grading system, such as in some scrap metal markets, publicly available data (e.g. London Metal Exchange) shows a relationship between price and quality. The relationship between price and quality can be undermined by lack of consistent information on quality. It is assumed that only the marginal increase in recovered material received by those customers that switch MRF receives a higher price. Some consultation responses questioned the relationship between quality and price. As detailed previously, there are economic drivers to support an assumed relationship between quality and price as high rates of contamination can incur higher costs. It is estimated that a small shift of buyers from the lower quartile to the upper quartile of producer of quality generates benefits both from more revenue for higher quality material and a reduced contamination rate that sends less material to landfill. This scenario assumes that the supply chain can adjust to changes in demand, which given the small percentage change and existence of some flexible contracts may be a reasonable assumption. As the total volume through the sector is not expected to change, costs of increasing throughput for the high quality MRFs is assumed to offset the reduction in costs related to lower throughput at the lower quality MRFs. It is possible the high quality MRF will face higher costs of operation, but given the small amount of volume that is assumed to shift (2.5% of total) and the high proportion of fixed costs at a MRF, it is difficult to estimate the specific cost differential.

At this stage, it is expected that reprocessors will benefit from the reduced cost of landfill gate fees and also benefit from improved plant efficiencies related to having higher quality throughput. This benefit has not been monetised, but it is expected that the benefit of reduced landfill costs and improved efficiencies are more than paying for higher quality material.

Table 19: Potential benefit from a shift of 2.5% of customers from the lower quartile to the upper quartile of quality (further detail in Annex 3, Table n)

Benefits of shift of 10% of lower quartile customers to higher quartile (2.5% of total)	Benefits to business: avoided landfill gate fees[12]	Benefits to business: increased material revenue	Benefits to society: reduced greenhouse gas impacts	Total benefit
(11 year NPV)	£1.2m-£2.0m	£4.2m-£6.5m	£1.6-£2.3m	£7.0m-£10.8m

Table 20: Potential benefit of a further shift by 22.5% of total capacity from lower quartile to average quality of sector (further detail in Annex 3, Table p).

Benefits of shift of 22.5% of tonnage from average of lowest quartile to average quality	Benefits to business: avoided landfill gate fees	Benefits to business: increased material revenue	Benefits to society: reduced greenhouse gas impacts	Total benefit
(11 year NPV)	£5.9m-£8.9m	£19.0m-£26.7m	£6.5m-£8.6m	£31.7m-£44.0m

Taking into account the initial and on-going costs to business of sampling and testing the net benefit to society of this scenario over 10 years is £25.7m (£11.1m - £39.8m) PV. This breaks down into initial cost to business of £0.9m (£0.6m-£1.2m) and £16.1m (£10.9m-£21.9m) PV annual costs to business over 10 years of the policy for sampling and investment to improve quality. The costs to business are expected to impact directly on MRFs, but the costs could be expected to be passed on partially through gate fees and also incorporated in prices for recyclate sold to reprocessors. To the extent that the Packaging Recovery Note system acts as a 'top up' between the cost of sending material to landfill and the cost of recycling, this cost may

[12] Landfill gate fees are estimated £20 per tonne and haulage £10 per tonne (source WRAP)

affect PRN prices. Total benefits over 10 years are estimated as £37.2m (£30.6m-£43.9m) PV to business and £9.5m (£8.1m-£10.9m) PV of lower greenhouse gas emissions resulting in a net benefit of £25.7m (£11.1m-£39.8m) PV over 10 years of the policy being active. As there is uncertainty on the scale of benefits calculated, they have not been included in the summary sheets, although the intended impact of the measures in the revised Waste Framework Directive are to deliver the benefits of high quality recycling. See Annex 2 for a detailed breakdown of costs and benefits.

The potential impact of better feedback of information back through the recycling chain to Local Authorities and householders has not been monetised. Better information may lead to higher quality of inputs into the sorting process. The greater availability of information on outputs and therefore potential revenue could result in more revenue sharing contracts between local authorities and MRF operators which will help to align incentives to improve both the quality of input material and the efficiency of MRF operations. This could have a temporary impact of reducing reported recycling rates as the amount of output from MRFs may initially fall. However better communication through the recycling chain should lead to getting a better return from material intended for recycling. It is also assumed that higher prices paid for higher quality material reflect the improvement in efficiency at reprocessors from having better feedstock. It is possible there are wider benefits to reprocessors such as reduced front end costs that have also not been monetised here. A report on the costs of contamination by the Resource Association indicates that there could be significant reductions in costs. Reprocessors have commented that the lack of availability of high quality feedstock has been one of the barriers to future investment in the sector. The actual balance of costs and benefits through the recycling chain is difficult to identify, but the market driven nature of the recycling sector could be expected to result in any costs or benefit being passed on through the recycling chain.

8.1 Sensitivity analysis

The composition of MRFs input was from the sampling in the WRAP study in 2009. This is now 4 years old, but is still the most recent robust evidence on composition. Anecdotal evidence combined with responses from a recent questionnaire survey (2012/13) reported composition figures from a selection of MRFs and indicates that the composition may have changed over the period. The composition is reported below in table 21. The table indicates the percentage of glass, newspaper and plastics may have changed over the period. The actual impact on the analysis is not significant as the improvement in quality has a more significant impact than the composition of the recovered material and average material price. Under the assumptions used in this analysis it is estimated that the impact of this alternative composition compared to that used in the main analysis is to reduce the total benefits of the policy by around 1% on average and reduce the total costs by around 4% on average. The overall impact on the net benefit of the policy is a change of less than 1% and is considered insignificant.

Table 21: Recent anecdotal composition of input to MRFs

	MRF input (robust sampling 2009)	MRF input reported 2012/13
	%	%
alu	4.031	1
card	14.572	6
glass	2.45	22
HDPEcol	2.653	0.4
HDPENat	6.026	1.6
MxPa	5.105	32
MxPl	3.794	2
MxPlbott		2
NP	31.698	17
PETclr	6.552	2.5
PETcol	1.297	0.5
PlFlm	2.208	2
Steel	11.23	3
	91.616	**92**

The future growth of tonnage throughput at MRFs is uncertain, and the sensitivity of the policy to this uncertainty is tested by considering lower and upper bounds of 25% below and above the 0% and 5% growth scenarios respectively. These figures are used to give the low and high NPV figures on the summary sheet.

9. Equivalent Annual Net cost to Business

The Equivalent Annual Net Cost to Business (EANCB) calculated according to RPC guidance (see table 22) produces a figure of **£0.80m**. The EANCB is applicable from the implementation date, therefore a 10 year period from 2014 is applicable.

Table 22: Equivalent Annual Net Cost to Business

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Total costs to business (£m):			0	0.81	0.82	0.84	1.01	1.04	1.07	1.10	1.13	1.16	1.20
in 2009 prices (£m):			0	0.74	0.75	0.77	0.92	0.95	0.98	1.00	1.03	1.06	1.10
Discount factors:													
1	*0.9662*	*0.9335*	*0.9019*	*0.8714*	*0.8420*	*0.8135*	*0.7860*	*0.7594*	*0.7337*	*0.7089*	*0.6849*	*0.6618*	*0.6394*
		Discounted value (£m)		0.64	0.63	0.63	0.73	0.72	0.72	0.71	0.71	0.70	0.70
												PVNCB (£m)	6.89
2009 prices												Annuity rate	8.6077
2010 PV base year												**EANCB (£m)**	**0.80**

10. One in Two Out

The MRF Regulation is the minimum necessary to comply with the separate collection requirement of the rWFD (see Section 4.1 for further information). Therefore it is not gold-plating and is not within the scope of OITO.

11. Unintended Consequences

The measures outlined above could result in unintended consequences in the recycling supply chain. Better information on contamination rates could lead to a drop in the reported recycling rate. The current measure of recycling rate is based on information in Waste Data Flow. The figures are based on data reported by local authorities which identifies MRFs and reject rates. This information is not currently based on consistent robust sampling and therefore these regulations could result in a higher reject rate than previously reported. It is expected that the

better information flow between MRFs and local authorities should provide an opportunity for working through the recycling supply chain to improve yield and quality.

A response to the consultation highlighted a concern that the proposal could result in an increase in refuse derived fuel. However, we expect collecting and sorting co-mingled waste for recycling to remain more attractive economically than producing RDF as the costs per MRF are estimated to be very low relative to other costs and turnover.

12. Small firms impact test

- In developing the regulatory proposals, the Government took steps to ensure that SMEs would not incur disproportionate costs. These included:
  - limiting the scope of the requirements to just those permitted MRFs with an output of more than 1000 tonnes per annum, the effect of which is to exempt 25% of MRFs in England and Wales but less than 0.5% of the total tonnage of dry recyclate handled every year.
  - linking the sampling frequency to the tonnage throughput, with smaller MRFs required to sample less often which reduces their operational costs.

- Costs to business are considered and presented according to their size in a number of places within this IA (e.g. Tables 6-8 and 10-13)

- The Government engaged with representatives of SMEs, and operators of small MRFs, during the development of the regulatory proposals in particular those aspects which are intended to ensure SMEs will not incur disproportionate costs. In light of consultation responses, the Government has removed the time-based sampling frequency as it was felt this disproportionately impacted small businesses – the result is that annual costs per tonne are identical across the different sized MRFs considered in the IA (Table 10).

- Microbusiness Exemption Rule: Under the microbusiness exemption rule whereby regulation exempts organisations of 10 or fewer employees and start-ups, this measure is out of scope because it relates to implementation of an EU Directive.

Annex 1: Detailed estimate of costs

Table a: One off equipment costs (source: WRAP estimates)

ITEM	Small MRF	Medium MRF	Large MRF
Input Bin	2 x £200 = £400	4 x £200 = £800	6 x £200 = £1200
Sample bin trolley	1 x £200 = £200	1 x £200 = £200	2 x £200 = £400
Weigh Scale	1 x £1000	1 x £1000	1 x £1000
Mesh Sorting Table	1 x £500	1 x £500	2 x £500 = £1000
Sorting Tables	1 x £300	2 x £300 = £600	3 x £300 = £900
Sorted Material Bins	25 x £30 = £750	35 x £30 = £1050	45 x £30 = £1350
TOTAL £	**£3,150**	**£4,150**	**£5,850**

Table b: annual labour costs for sampling, first two years (source: WRAP estimates)

	Largest Sample Weight (kg)	Small MRF 10,000 TPH No of Samples	Rate (£/h)	Time per Sample (hr)	Cost (£)
Capture, weigh, sort, weigh, record input sample	60	63	7.75	0.91	444.31
Grab/l shovel operator for input samples		63	7.75	0.25	122.06
Capture, weigh, sort, weigh, record ouput PAPER sample	50	70	7.75	0.69	374.33
Capture, weigh, sort, weigh, record ouput GLASS sample	10	40	7.75	0.51	158.10
Capture, weigh, sort, weigh, record ouput METAL sample	10	20	7.75	0.51	79.05
Capture, weigh, sort, weigh, record ouput PLASTIC sample	20	60	7.75	0.51	237.15
L shovel operator for output		190	7.75	0.2	294.50
overhead					427.37
TOTAL		253		£	**2136.87**

	Largest Sample Weight (kg)	Medium MRF 45,000 TPH No of Samples	Rate (£/h)	Time per Sample (hr)	Cost (£)
Capture, weigh, sort, weigh, record input sample	60	282	7.75	0.91	1988.81
Grab/l shovel operator for input samples		282	7.75	0.25	546.38
Capture, weigh, sort, weigh, record ouput PAPER sample	50	315	7.75	0.69	1684.46
Capture, weigh, sort, weigh, record ouput GLASS sample	10	180	7.75	0.51	711.45
Capture, weigh, sort, weigh, record ouput METAL sample	10	90	7.75	0.51	355.73
Capture, weigh, sort, weigh, record ouput PLASTIC sample	20	270	7.75	0.51	1067.18
L shovel operator for output		855	7.75	0.2	1325.25
overhead					1919.81
TOTAL		1137		£	**9599.05**

	Largest Sample	Large MRF 100,000 TPH No of	Rate	Time per	Cost

	Weight (kg)	Samples	(£/h)	Sample (hr)	(£)
Capture, weigh, sort, weigh, record input sample	60	625	7.75	0.91	8060.00
Grab/l shovel operator for input samples		625	7.75	0.25	2015.00
Capture, weigh, sort, weigh, record ouput PAPER sample	50	700	7.75	0.69	7455.50
Capture, weigh, sort, weigh, record ouput GLASS sample	10	400	7.75	0.51	474.30
Capture, weigh, sort, weigh, record ouput METAL sample	10	200	7.75	0.51	988.13
Capture, weigh, sort, weigh, record ouput PLASTIC sample	20	600	7.75	0.51	4217.32
L shovel operator for output		1900	7.75	0.2	4242.35
overhead					6863.15
TOTAL		2525		£	**21312.50**

Table c: annual labour costs for sampling, subsequent years (source: WRAP estimates)

	Largest Sample Weight (kg)	Small MRF 10,000 TPH No of Samples	Rate (£/h)	Time per Sample (hr)	Cost (£)
Capture, weigh, sort, weigh, record input sample	60	80	7.75	0.91	564.20
Grab/l shovel operator for input samples		80	7.75	0.25	155.00
Capture, weigh, sort, weigh, record ouput PAPER sample	50	93	7.75	0.69	497.32
Capture, weigh, sort, weigh, record ouput GLASS sample	10	40	7.75	0.51	158.10
Capture, weigh, sort, weigh, record ouput METAL sample	10	20	7.75	0.51	79.05
Capture, weigh, sort, weigh, record ouput PLASTIC sample	20	80	7.75	0.51	316.20
L shovel operator for output		233	7.75	0.2	361.15
overhead					532.75
TOTAL		313		£	**2663.77**

	Largest Sample Weight (kg)	Medium MRF 45,000 TPH No of Samples	Rate (£/h)	Time per Sample (hr)	Cost (£)
Capture, weigh, sort, weigh, record input sample	60	360	7.75	0.91	2538.90
Grab/l shovel operator for input samples		360	7.75	0.25	697.50
Capture, weigh, sort, weigh, record ouput PAPER sample	50	420	7.75	0.69	2245.95
Capture, weigh, sort, weigh, record ouput GLASS sample	10	180	7.75	0.51	711.45
Capture, weigh, sort, weigh, record ouput METAL sample	10	90	7.75	0.51	355.73
Capture, weigh, sort, weigh, record ouput PLASTIC sample	20	360	7.75	0.51	1422.90
L shovel operator for output		1050	7.75	0.2	1627.50
overhead					2399.98
TOTAL		1410		£	**11999.91**

	Largest Sample Weight (kg)	Large MRF 100,000 TPH No of Samples	Rate (£/h)	Time per Sample (hr)	Cost (£)
Capture, weigh, sort, weigh, record input sample	60	800	7.75	0.91	5642.00
Grab/l shovel operator for input samples		800	7.75	0.25	1550.00
Capture, weigh, sort, weigh, record ouput PAPER sample	50	933	7.75	0.69	4989.22

Capture, weigh, sort, weigh, record ouput GLASS sample	10	400	7.75	0.51	1581.00
Capture, weigh, sort, weigh, record ouput METAL sample	10	200	7.75	0.51	790.50
Capture, weigh, sort, weigh, record ouput PLASTIC sample	20	800	7.75	0.51	3162.00
L shovel operator for output		2333	7.75	0.2	3616.15
overhead					5332.72
TOTAL		3133		£	**26663.58**

Above costs assume the following sampling methodology is implemented at the MRF:

- Create a sampling plan based on assumed throughput.
- Take representative samples according to the sampling guidance and sampling plan.
- Safely transport sample to a designated testing area which must be under cover.
- Each sample is to be weighed and then tipped over a 45mm x 45mm square steel mesh (12mm x 12mm for glass). Material falling through the mesh is to be classed as fines and this weight recorded.
- Material retained by the mesh is to be hand sorted for target material(s) and the five main non-target materials with the remaining non-target materials combined. Each sorted material weight to be recorded.
- An individual sample sheet is to be completed at least electronically. Contamination is to be classed as the combined weights, for each granular material, of non-target material and non-recyclable material.
- At end of each quarter calculate the total contamination mean & standard deviation for input and each targeted output material at granular level and calculate upper & lower confidence interval at 95% confidence level. An electronic sample sheet, with integral formulae to calculate the mean, SD and upper and lower confidence intervals, is to be recorded.
- Report the contamination percentage every quarter for input and each targeted material to the Regulator. For example; contamination of N&P this quarter at 95% confidence is (say) 6% +/-2%.
- Regulator will publish all permitted MRF testing results each quarter.
- If operator feels, after a qualifying period of one year, that testing results are consistent they can apply to the Regulator (at the cost of permit variation) to reduce the sampling/testing frequency. The statistical criteria required to allow a sampling/testing frequency reduction and the criteria that would trigger a reversion to the standard sampling/testing frequencies have yet to be developed.

Table d: One off training costs for non RRS members

Training costs for non RRS members		Small		Medium		Large	
	wage per hour £	number of hours	total	number of hours	total	number of hours	total
Technical operator training from WRAP	12.00	4.00	48.00	4.00	48.00	4.00	48.00
Technical operator's time to train others	12.00	4.00	48.00	4.00	48.00	4.00	48.00
Time for trainees (2 for small and medium MRFs, 3 for large MRFs)	9.69	8.00	77.50	8.00	77.50	12.00	116.25
			173.50		173.50		212.25

Table e: Initial annual staff costs to business of site inspections

Site inspection staff cost	Wage per hour £	Hours per site visit	Number of sites visited	Business costs £
Annual auditing site inspection - managerial time	15.38	1	167	2,568
Annual auditing site inspection - technical operator time	9.69	3	167	4,853
6 hour site inspection and follow up visits - managerial	15.38	0.5	167	1,284
6 hour site inspection and follow up visits - technical	9.69	2	167	3,236
Total costs to business				11,941

Detailed estimate of annual costs

Table f: One off costs

	Low estimate (-25% with 0% growth) £	Central estimate £	High estimate (+25% with 5% growth) £
one off equipment	176,400	275,157	393,892
one off systems and auditing costs	452,188	674,923	933,660
total one off costs	628,588	950,079	1,327,551
PV total one off costs	607,331	917,951	1,282,658

Table g: Annual impact of central estimate for costs for 0% growth scenario, all values £m

growth in sector	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
one off costs												
one off equipment	-	0.24	-	-	-	-	-	-	-	-	-	0.24
one off systems and auditing costs	-	0.60	-	-	-	-	-	-	-	-	-	0.60
total one off costs	-	0.84	-	-	-	-	-	-	-	-	-	0.84
PV total one off costs	-	0.81	-	-	-	-	-	-	-	-	-	0.81
Annual costs to business	-	-	-	-	-	-	-	-	-	-	-	-
annual labour costs	-	-	0.48	0.48	0.60	0.60	0.60	0.60	0.60	0.60	0.60	5.13
annual audit costs	-	-	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	2.97
total annual costs to business	-	-	0.81	0.81	0.93	0.93	0.93	0.93	0.93	0.93	0.93	8.10
PV annual costs to business	-	-	0.75	0.73	0.81	0.78	0.75	0.73	0.70	0.68	0.66	6.59
Annual costs to government	-	-	-	-	-	-	-	-	-	-	-	-
annual audit costs to government	-	-	-	-	-	-	-	-	-	-	-	-
PV annual costs to government	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Total annual costs	-	-	0.81	0.81	0.93	0.93	0.93	0.93	0.93	0.93	0.93	8.10
PV annual costs	-	-	0.75	0.73	0.81	0.78	0.75	0.73	0.70	0.68	0.66	6.59
Total costs	-	0.84	0.81	0.81	0.93	0.93	0.93	0.93	0.93	0.93	0.93	8.94
PV total costs	-	0.81	0.75	0.73	0.81	0.78	0.75	0.73	0.70	0.68	0.66	7.40

Table h: Total impact of central estimate of costs for 5% growth scenario

Growth rate	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
one off costs												
one off equipment	-	0.24	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.32
one off systems and auditing costs	-	0.60	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.75
total one off costs	-	0.84	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	1.06
PV total one off costs	-	0.81	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.99
Annual costs	-	-	-	-	-	-	-	-	-	-	-	-
annual labour costs	-	-	0.50	0.53	0.73	0.76	0.80	0.84	0.88	0.93	0.97	6.93
annual audit costs	-	-	0.34	0.36	0.37	0.39	0.41	0.43	0.45	0.48	0.50	3.73
total annual costs	-	-	0.84	0.88	1.10	1.15	1.21	1.27	1.33	1.40	1.47	10.66
PV annual costs	-	-	0.78	0.80	0.96	0.97	0.98	1.00	1.01	1.03	1.04	8.58
Annual costs to government	-	-	-	-	-	-	-	-	-	-	-	-
annual audit costs	-	-	-	-	-	-	-	-	-	-	-	-
PV annual costs	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-
Total annual costs	-	-	0.84	0.88	1.10	1.15	1.21	1.27	1.33	1.40	1.47	10.66
PV annual costs	-	-	0.78	0.80	0.96	0.97	0.98	1.00	1.01	1.03	1.04	8.58
Total costs	-	0.84	0.86	0.91	1.12	1.18	1.24	1.30	1.36	1.43	1.50	11.72
PV total costs	-	0.81	0.81	0.82	0.98	0.99	1.01	1.02	1.03	1.05	1.06	9.57

The best estimate is the mid-point of these 2 ranges.

Annex 2: Detailed analysis of wider impacts of MRF Regulation

This scenario analysis was conducted on the basis of assumptions made below. It is possible that the measures proposed do not deliver the exact benefits as described and therefore are not included in the summary sheets of this IA.

Quality of output material from MRFs

WRAP undertook a material testing exercise at around 20% of UK municipal MRFs in 2009 – the results of this exercise are shown in Table h. The percentages shown in the table indicate contamination levels. To note, contamination:

- for 'input material' will consist of material not accepted by the MRF (e.g. material the householder should not have put in the recycling bin);
- for 'output material' will consist of material not accepted by the MRF (i.e. the MRF has failed to sort and remove those materials the householder should not have put in the recycling bin) and material that is non-target but may still be recyclable (e.g. metal cans are recyclable but the MRF has failed to fully sort them from an output of paper);
- for 'residual output' will consist of target material that the MRF failed to identify.

In all instances, the lower the percentage the better. The best performing 25% of MRFs, in terms of material quality, are in the lower level quartile column.

The results suggest there is a wide range of quality and that few MRFs are currently able to meet the highest level of quality demanded by industry standards, particularly for paper and plastics.

Table h: Contamination levels in the input, output and residual material streams of MRFs

Material Stream	Lower Level Quartile	Median Level Quartile[why are there only 3 quartiles?]	Upper Level Quartile
Input Material			
All	< 6.4%	6.4% to 17.5%	> 17.5%
Single-stream	< 8.4%	8.4% to 17.5%	> 17.5%
Two-stream – Fibre based	< 2.9%	2.9% to 9.0%	> 9.0%
Two-stream – Container based	< 4.9%	4.9% to 22.6%	> 22.6%
Output Material			
Aluminium	< 0.9%	0.9% to 4.6%	> 4.6%
Steel	< 2.8%	2.8% to 7.1%	> 7.1%
News and PAM	<4.6%	4.6% to 15.0%	> 15.0%
Mixed Paper	< 3.2%	3.2% to 25.3%	> 25.3%
Card	< 4.8%	4.8% to 12.0%	> 12.0%
Mixed Plastic	< 6.9%	6.9% to 26.6%	> 26.6%
Mixed Plastic bottles	< 8.3%	8.3% to 16.2%	> 16.2%
HDPE Coloured Plastic Bottles	< 6.9%	6.9% to 11.3%	> 11.3%
HDPE Natural Plastic Bottles	< 1.9%	1.9% to 4.0%	> 4.0%
PET Clear	<2.6%	2.6% to 9.5%	> 9.5%
PET Coloured	< 5.6%	5.6% to 10.7%	> 10.7%
Residual			
All	< 28.3%	28.3% to 80.9%	> 80.9%
Single-stream	< 24.7%	24.7% to 61.7%	> 61.7%
Two-stream – Fibre based	< 33.0%	33.0% to 59.2%	> 59.2%
Two-stream – Container based	< 72.2%	72.2% to 88.0%	> 88.0%

For the purposes of this analysis, the data above is taken for the baseline of quality at MRFs. The study also showed that there is not a consistent relationship between quality and size nor technology. The baseline is assumed to be no change in the range of quality without intervention.

It is estimated there are 167 permitted MRFs in England and Wales with tonnage throughput over 1,000tpa (tonnes per annum). It is further assumed that 38 MRFs already undertake sampling to 80% of the specification required, a further 40 MRFs undertake sampling to 50% of the specification, a further 19 MRFs do so to 20% of the specification, with the remaining 70 MRFs assumed not to undertake any sampling.

Output of those MRFs in scope is estimated at 3.31m tonnes in 2011. The growth rate is estimated to range between 0-5% (2.5% best estimate). Waste arisings, household recycling rate and collection method (kerbside sort or co-mingled) all interact to influence the amount of co-mingled municipal waste requiring sorting by a MRF.

Table i: Estimate of total MRF throughput

Total MRF input (m tonnes)	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
low estimate (no growth)	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31	3.31
Best estimate	3.48	3.57	3.67	3.77	3.88	3.99	4.10	4.23	4.36	4.49	4.63
high estimate (5% growth)	3.65	3.84	4.03	4.23	4.44	4.66	4.90	5.14	5.40	5.67	5.95

Scenario of benefits of an improvement in quality of recyclate

The scenario assumes benefits from an initial shift in customers are expected to accrue from July 2014. Further costs to increase quality of recyclates are not expected to occur until 2015 and benefits are expected to impact at the same time.

It is expected that customers will ask for information on quality of output as current measures of quality, such as visual inspection, are less accurate. Should the information reveal that a MRF is consistently producing lower quality output, the customer is expected to require the MRF to improve quality or change contract to another MRF producing higher quality output. Higher quality output is of higher value to the customer, so it would be reasonable to 'shop around'. Given the high fixed cost and low variable costs of operating MRFs, in most cases it is more efficient to do better sorting at a MRF rather than sorting again at a reprocessor.

This scenario is modelled by assuming that 10% of those customers who are receiving recovered material in the lower quartile of output quality (i.e. 2.5% of total customers) will shift to those MRFs that are in the upper quartile. Given the short term and fluid nature of existing contracts, these changes are not expected to incur additional cost to normal contracting activity. Anecdotal evidence suggests there is spare capacity in the MRF sector. Further, the cost of the increase in output at the high quality MRFs is expected to offset a change in costs at the more inefficient operations that have now lost a proportion of sales.

The benefits of a shift of 2.5% of total customers of MRF output from the lower quartile to the upper quartile quality thresholds is expected to deliver higher material revenues and reduced residual material to landfill. The actual shift could be greater, given the wide divergence in quality. The higher quality material is expected to gain a higher price, corresponding to the increase in volume of recovered, non-contaminated material, illustrated in Table j below. There will be an avoidance of tonnage of material sent to landfill, corresponding to the increase in material recovered. Finally society will benefit from a reduction in embedded emissions associated with virgin material extraction, net of the carbon impacts of reprocessing recovered material. The estimated material benefit is calculated by taking the difference between the materials recovered in higher and lower quartile MRFs in the WRAP MRF Quality assessment study and applying the prices for recovered material types (May 2013, source: Let's Recycle). We have assumed a 25% range around those prices to take account of volatility. The total volume for the sector is assumed at 3.3Mt in 2011. Estimates of growth in the sector are difficult as they are dependent on many factors including household waste arisings, household recycling rate and type of waste collection. We have estimated growth in the sector ranging between 0 and 5% over the period of analysis.

Table j: Estimation of increase in recyclate resulting from a shift in customer from low to high quality MRF operators

Input and contamination rates based on the MRF Quality Assessment Study					**Impact of shift of 2.5% capacity from low to high based on yields and typical input on annual throughput of 3.31m tonnes**
	MRF input %	Upper quartile threshold contamination rate%	Lower quartile threshold contamination rate%	Yield improvement of shift from low to high	Annual increase in tonnes of recyclate output (% of MRF input x yield improvement x total annual tonnage)
aluminium	4.031	0.9	4.6	3.7	124
card	14.572	4.8	12	7.2	869
glass	2.45	1.5	1.5	0	-
HDPE coloured	2.653	6.9	11.3	4.4	97
HDPE Natural	6.026	1.9	4	2.1	105
Mixed Paper	5.105	3.2	25.3	22.1	935
Mixed plastic	3.794	6.9	26.6	19.7	619
Mixed Plastic bottles		8.3	16.2	7.9	-
Newspaper	31.698	4.6	15	10.4	2,731
PET clear	6.552	2.6	9.5	6.9	375
PET coloured	1.297	5.6	10.7	5.1	55
Plastic Film	2.208	39.5	39.5	0	-
Steel	11.23	2.8	7.1	4.3	124
	91.616				**6,032**

This increase in annual tonnage is applied to the material prices in Table k taken from Let's Recycle May 2013 (see assumptions) and then a 25% range applied to take account of volatility in price over the 10 year period.

Table k: Material revenue per extra tonne of material

Material	material price April 2012 £	low estimate £	high estimate £
Aluminium	775	581	969
Card	70	53	88
Glass		0	0
HDPE coloured	135	101	169
HDPE Natural	295	221	369
Mixed Paper	55	41	69
Mixed plastic	15	11	19
Mixed Plastic bottles	60	45	75
Newspaper	87	65	109
PET clear	230	173	288
PET coloured	42	32	53
Plastic Film	77	58	96
Steel	140	105	175

The carbon impacts are calculated using the carbon factors from Scottish Carbon Metric in Table l. Carbon prices in Table m apply the central estimate of the traded price of carbon to the carbon impact of recycling and the non traded price of carbon is applied to the avoided impacts from landfill.

Table l: Carbon factors for impact of shift from landfill to recycling (source: Scottish Carbon Metric)

	carbon factor of avoided landfill on CO2e kg/tonne	carbon factor of benefit of recycling in CO2e kg/tonne
Aluminium	21	9245
Card	580	219
Glass	26	366
HDPE coloured	34	1901
HDPE Natural	34	1901
Mixed Paper	580	219
Mixed plastic	34	2100
Mixed Plastic bottles	34	2148
Newspaper	580	157
PET clear	34	2974
PET coloured	34	2974
Plastic Film	34	1450
Steel	21	1702

Table m: Carbon prices

Carbon value £ per tonne CO2e	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
carbon value - traded	3.49	3.59	3.67	3.79	3.92	4.22	4.53	4.87	12.01	19.14	26.28
carbon value - nontraded	59.20	60.09	60.99	61.91	62.83	63.78	64.73	65.71	66.80	67.90	68.99

Source: DECC 2013

Table n: Potential benefit from a shift of 2.5% of customers from the lower quartile to the upper quartile of quality

Benefits 10 year present value	**Costs 10 year present value**
£5.4m (£4.2m - £6.5m) Additional revenue from more recyclate being sorted and sold to reprocessors (6,600-10,000 tonnes of material per year multiplied by prevailing price for each recyclate, averaging £90 per extra tonne with a 25% range for price volatility)	
£1.6m (£1.2m - £2.0m) Avoided gate fee and haulage of sending less material to landfill (6,600-10,000 tonnes per year, multiplied by £20 gate fee and £10 haulage (WRAP estimates))	**£ estimated low and not monetised** Costs of collection of material for recycling (in this case zero if the increased quality results from an equal reduction in costs at low quality MRFs and an increase in costs at high quality MRFs)
£2.0m (£1.7m - £2.3m) Additional carbon benefit of avoided virgin material extraction, net of carbon cost of recycling calculated applying carbon prices to carbon factors	**£ netted off the carbon benefit** Carbon cost of recycling material calculated by applying the carbon factor for recycling activity
Total £8.9m (£7.1m - £10.8m)	

This shift of a small proportion of customers in the industry could act as a strong incentive for the lower quality MRFs to improve output or face a significant reduction in revenues. For the purposes of modelling here, we have assumed the lowest quartile of MRFs will invest to improve the quality of their output to the average of the sector in the MRF Quality Assessment Study. The benefit of a shift from this lowest quartile to the average of the sector is calculated using the same methodology as with the initial shift of customers.

The investment cost is estimated on the basis of advice from WRAP, using labour costs as the primary resource, although MRFs may invest in technology, or demand higher quality inputs. Estimates of the cost of increasing labour (sorters) to achieve the improvement in yield for each material range from 2-10% according to material, and average 7% across the industry. MRFs may alternatively choose to invest in technology, slow down the speed of plants or influence input requirements through engagement with local authorities. Costs of technology or influencing collection will also incur costs, but is difficult to quantify, so a range of 25% is applied. These are assumed to be in the same range as increasing labour. There is no assumption on an improvement in quality for the rest of the sector (75%), nor of an improvement in price, although this may occur. There is a risk access to finance may impede investment in which case influencing the quality of input may occur. Benefits of a shift from the average of lower quality to average quality and are calculated in the same way as above.

These costs are applied to the estimate of the improvement in quality required to improve the tonnage throughput to the yields in Table o. A range of 25% is used around the estimates as there is limited evidence on the exact costs that may be incurred. Costs to increase quality for

the MRFs accounting for 22.5% of the lowest quartile of output quality is estimated as £9.4m-15.7m NPV over 10 years.

The total tonnage increase from an improvement in sorting following increased investment to increase throughput yields is around 30,000 tonnes per year (assuming 3.31m total tonnage throughput) which is a 0.9% increase in overall amount of recovered material.

Table o: Estimation of increase in recyclate resulting from lower quality MRFs investing to improve quality to the average yield for each material

Input and contamination rates based on the MRF Quality Assessment Study					**shift of 22.5% capacity from low to high based on yields and typical input on annual throughput of 3.31m tonnes**
Material	MRF input %	average contamination rate %	bottom quartile contamination rate %	improvement in yield from shift from low quality quartile to average	Annual increase in tonnes of recyclate output (% of MRF input x yield improvement x total annual tonnage)
aluminium	4.031	2.5	0.9	2.1	2,805
card	14.572	12	4.8	0	-
glass	2.45	1.5	1.5	0	-
HDPE coloured	2.653	8.7	6.9	2.6	2,286
HDPE Natural	6.026	4.5	1.9	-0.5	- 998
Mixed Paper	5.105	15.8	3.2	9.5	16,071
Mixed plastic	3.794	12.2	6.9	14.4	18,104
Mixed Plastic bottles		18.2	8.3	-2	-
Newspaper	31.698	9.8	4.6	5.2	54,621
PET clear	6.552	7.5	2.6	2	4,342
PET coloured	1.297	8.1	5.6	2.6	1,117
Plastic Film	2.208	9.5	39.5	30	21,950
Steel	11.23	6.2	2.8	0.9	3,349

The avoided GHG emissions benefits and material revenue benefits are applied to the tonnage above, taking into account the different growth scenarios. The summary is in the Table p below.

Table p: Estimated impact of an improvement in quality by MRFs accounting for 22.5% of total output in the lowest quartile

Benefits 11 year PV	Costs
£22.9m (£19.0m - £26.7m) Additional revenue to MRFs from more recyclate being sorted and sold to reprocessors (30,000-50,000 average tonnes per year multiplied by prevailing price for each recyclate, averaging £93 per extra tonne with a 25% range for price volatility)	£11.0m (£8.2m - £13.7m) Increase in labour/investment costs/slower operation of machinery, assuming 25% range (averages £1.0m - £1.7m per year).
£7.4m (£6.2m – £8.6m) Avoided gate fee and haulage of sending less material to landfill (30,000-50,000 average tonnes per year multiplied by £20 gate fee and £10 haulage (WRAP estimates))	Costs of collection of material for recycling - this is an alternative to improving quality through sorting and therefore assumed to be covered in the costs above. In reality, there may be a mix of improved sorting and other measures to improve quality of output.
£7.7m (£6.6m - £8.8m) Additional carbon benefit of avoided virgin material extraction, calculated applying carbon factors to the avoided production for each material	£ netted off the carbon benefit Carbon cost of recycling material calculated by applying the carbon factor for recycling activity
Total £38.0m (£31.8m - £44.2m)	Total £11.0m (£8.2m - £13.7m)
Total net benefit of investment stage: £25.3m (£16.0m - £34.6m)	

Table q: Total estimated impacts of this scenario (incorporating costs of the regulations from the main body of the IA, benefits of the shift of 2.5% of customers, and costs and benefits of improvement of 22.5% of MRFs):

Costs of implementing measuring and sampling	Costs of investment to improve quality	Total costs	Benefits to business: increased material revenue	Benefits to business: avoided landfill gate fees[13]	Benefits to society: reduced greenhouse gas impacts	Total benefit	**Net benefit**
11 year PV basis							
£8.49m (£5.6 - £12.0m)	£11.0m (£8.2m - £13.7m)	£21.0m (£15.0m - £27.7m)	£28.2m (£23.2m - £33.3m)	£9.0m (£7.4m - £10.6m)	£9.7m (£8.3m - £11.1m)	£46.9m (£38.9m - £55.0m)	**£27.5m (£13.2m – £41.2m)**

Key assumptions:

The greenhouse gas impacts have been calculated using the central non traded price of carbon for avoided landfill emissions and the traded price of carbon (DECC, September 2013) for impacts related to the benefit of recycling over using virgin material (source: Scottish Carbon Metric).

It is assumed up to half of MRFs are engaging in some sort of quality monitoring and may be incurring half of the costs estimated for sampling. Material prices are based on May 2013 figures for recovered material from Let's Recycle. A range of 25% around these figures is assumed to take account of cyclicality in prices over the period of analysis.

Landfill tax is not included in these calculations as it is a transfer and not included in CBA. However, businesses may be considered to benefit from this reduction.

[13] Landfill gate fees are estimated £20 per tonne and haulage £10 per tonne (source WRAP)