

The potential use of waste wood in the North East as an efficient biomass fuel source

A Report on Behalf of

Northwoods: The North East's Woodland Imitative

Northwoods
Cockle Park
Morpeth
Northumberland
NE61 3EB

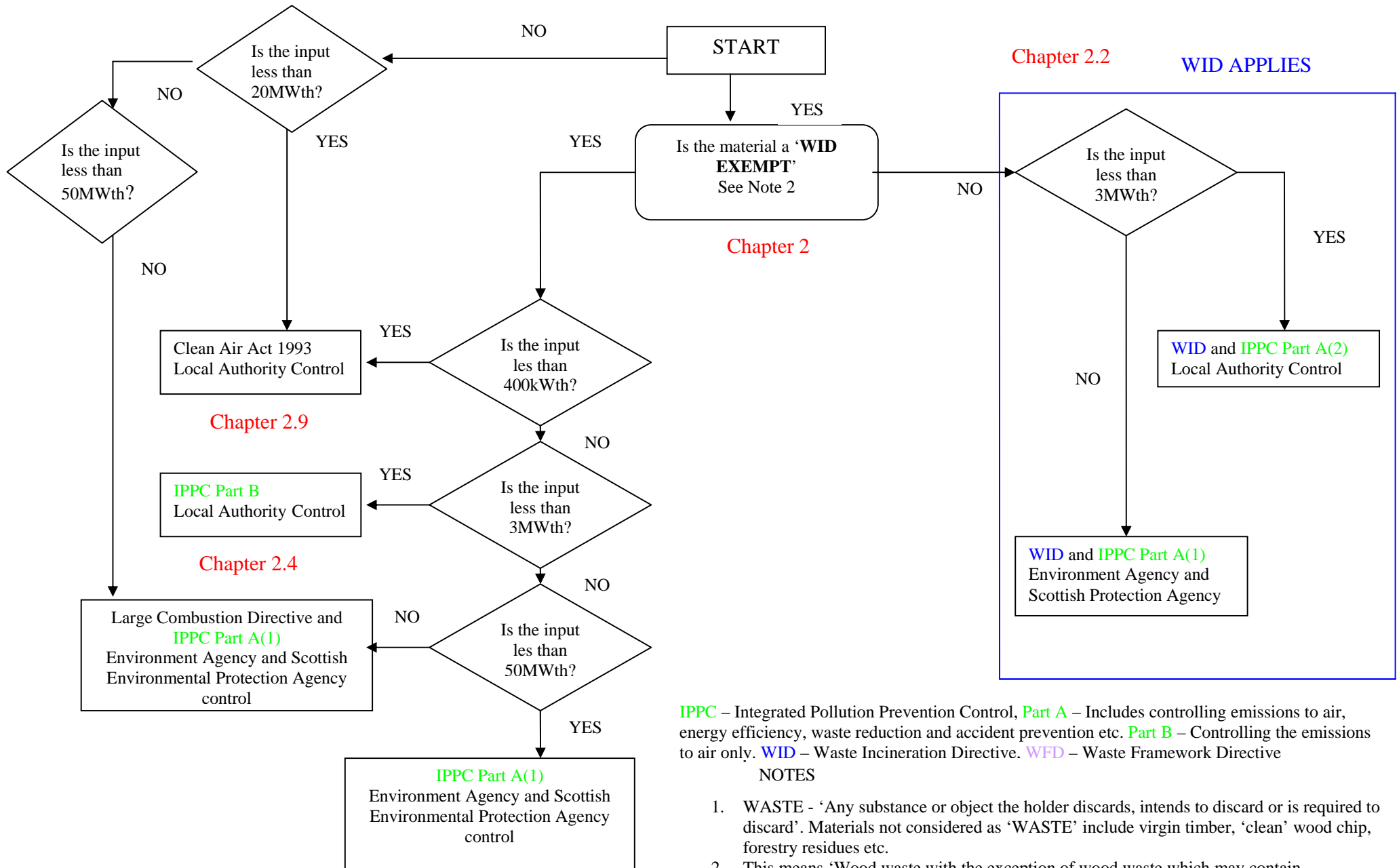
August 2008

CONTENTS PAGE

1.0 Chapter 1	1
1.2 What is Waste?	3
1.3 Work previously carried out on wood waste	4
1.3.1 'Waste Protocols Project'	5
1.3.2 'Regional Market Assessment for Wood Waste for North East England'	5
1.3.3 'Waste wood as a Biomass Fuel'	5
1.3.4 'UK Biomass Strategy'	5
2.0 Chapter 2	8
2.1 Legislation	8
2.2 Waste Incineration Directive	9
2.3 Environmental Permitting	12
2.4 IPPC	12
2.5 Landfill Directive	16
2.6 Renewable Obligation	16
2.7 EC Packaging and Packaging Waste Directive	18
2.8 UK Waste Protocol Project	19
2.9 Clean Air Act 1993	20
2.10 Smoke Control Areas	21
3.0 Chapter 3	22
3.1 Waste Wood	22
3.2 Grading of waste wood	23
4.0 Chapter 4	26
4.1 Sources of waste wood	26
4.2 Municipal Wood Waste	26
4.3 Construction and Demolition	28
4.4 Commercial and Industry	29
5.0 Chapter 5	30
5.1 Available wood in the North East	30
5.2 Major waste wood processors in the North East	33

6.0 Chapter 6	35
6.1 CEN Standards	35
7.0 Chapter 7	39
7.1 Segregating wood waste	39
7.2 An example of the sorting and segregation process of waste wood	40
8.0 Chapter 8	42
8.1 Contaminants in wood waste	42
9.0 Chapter 9	47
9.1 Boilers	47
	49
9.2 Modifications	
9.3 Emissions	52
9.4 Installing biomass boilers	53
9.5 Biomass boilers and Wood Fuel	53
10.0 Chapter 10	55
10.1 Conclusion	55
Annex	57

Fig 5.3. A Guide to the Environmental Regulation of Biomass Combustion



IPPC – Integrated Pollution Prevention Control, Part A – Includes controlling emissions to air, energy efficiency, waste reduction and accident prevention etc. Part B – Controlling the emissions to air only. WID – Waste Incineration Directive. WFD – Waste Framework Directive

NOTES

1. WASTE - 'Any substance or object the holder discards, intends to discard or is required to discard'. Materials not considered as 'WASTE' include virgin timber, 'clean' wood chip, forestry residues etc.
2. This means 'Wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coatings which includes in particular construction and demolition waste'

Summary

There is currently a lot of confusion about using waste wood for biomass, such as which materials are classed as 'waste' wood, which categories of waste can be used for fuel, and the legislation that applies to waste wood. The purpose of this report is to remove uncertainty from what is classed as 'waste', what can be used as a resource and the different requirements which need to be met in order for wood to be used as resource.

Waste wood offers huge potential as a clean alternative for energy generation and once any uncertainties have been clarified about its use, businesses should be more encouraged to use waste wood as a fuel helping to reduce material going to landfill, reduce carbon emissions and mitigate damage to the environment. The purpose of the study is to identify the current status of wood waste available in the North East, the current constraints on its use and how we can improve the process involved in wood recycling and its reuse.

CHAPTER 1

1.1 INTRODUCTION

The increasing worldwide demand for energy together with the over reliance of fossil fuels and increasing greenhouse gas emissions has led to global warming. In order to reduce the harmful effects of climate change the UK Government has signed and ratified legislation to reduce all greenhouse gas emissions to 1990 levels by 2012. Due to the damaging risks associated with climate change and increasing fuel costs the UK Government has recognized the need to develop greener fuels such as biomass and energy crops.

In 1997 the Kyoto Protocol was developed and has been ratified by Member States in order to reduce greenhouse gas emissions. Under this legislation member states including the UK, agreed to reduce their greenhouse emissions by 8% below 1990 levels by 2012. The UK has its own target to reduce its emissions by 12.5% compared to 1990 levels, and according to DEFRA the UK is on track to meet this target¹. It is important that once the Protocol comes to an end in 2012 an agreement is made by all countries which cause significant impacts on the environment to reduce emissions further to reduce the dangerous effects of global warming. It is important for businesses to lead the way and change their practices in order to save energy and thus carbon emissions. Unless significant measures are carried out, businesses will start to pay the price of fossil fuel

¹ BERR 2008. UK Renewable Energy Strategy

scarcity paying for more expensive energy supplies, and will find difficulties in meeting stricter legislations and requirements².

Biomass is a renewable energy source which is considered carbon neutral as it absorbs the same carbon dioxide during its growth as it releases when it is burnt for fuel. Biomass is a term used to cover a range of biologically derived resources including biodegradable municipal and commercial waste, forest wastes, agricultural residues, wood waste and high energy crops. The advantages of using biomass as a resource are that it is carbon neutral, sustainable, versatile and it can be easily used as a fuel to provide heat, electricity and liquid fuels³. The European Commission has proposed that the UK's contribution to EU targets should be to increase the share of renewables in our energy mix from around 1.5% in 2006 to 15% by 2020⁴. The European Commission calculates that its proposals will cut carbon dioxide emissions by 600-900 million tonnes a year and cut annual fossil fuel consumption by 200-300 million tonnes of oil equivalent⁵.

There are a number of factors which have encouraged the development of biomass but legislation appears to be the main driving factor. This includes the Landfill Tax, Renewables Obligation and the Waste Incineration Directive (WID). These regulations have largely been developed due to the fact that the government is under increasing pressure to reduce carbon emissions in order to tackle climate change. Through regulations such as the Renewables Obligation and DEFRA's Waste Strategy the

² Talbotts 2008. A practical guide to sourcing biomass heating

³ Defra 2008. Waste Wood as a Biomass Fuel

⁴ BERR 2008. UK Renewable Energy Strategy

⁵ ENDS Report 2008. Issue 399 'The need to regenerate a surge in renewables'

government is altering the UK's energy policy in order to produce clean, safe, secure energy whilst reducing carbon emissions. The Government has recently demonstrated an interest in waste wood; in April 2008 the Environment minister Joan Ruddock made a speech in the House of Commons promoting waste wood for biomass. It was stated that recovering energy from 2.5 million tonnes of waste wood could generate 2,600GWh and would save the equivalent of 1.5 million tonnes of carbon dioxide⁶.

1.2 What is 'Waste?'

Waste is an area which needs to be looked at and enough could potentially be recovered to supply the UK with large amounts of clean, safe energy. The Waste Framework Directive defines 'waste' as:

"Any substance or object the holder discards, intends to discard or is required to discard" (European Directive 2006/12/EC).

Currently on a national scale over 7.5 million tonnes of wood waste is produced every year and more than 6 million tonnes (80%) goes to landfill, 16% is recycled and reused and energy recovered from just 4%⁷. It has been estimated that approximately 7-10 million tonnes of waste wood is generated each year in the United Kingdom and could be recovered to provide energy⁸. The recovery and recycling of waste wood is becoming a much more attractive option for businesses as it avoids them having to pay the landfill tax currently set at £32/tonne rising by £8/tonne yearly until 2020. The EC Directive on Packaging and Packaging Waste in the UK adopts a 'producer responsibility' policy and

⁶ Edie News 2008

⁷ Environment Agency 2007. Your option for recovering waste

⁸ BERR 2008 UK Renewable Energy Strategy

the aim of it is to reduce waste going to landfill through reuse, recycling or recovery⁹. It does this by setting targets of recycling and recovery for UK businesses to meet.

‘Recycling’ refers to the reprocessing of a product in a production process of waste materials for the original purpose or for another purpose. ‘Recovery’ differs slightly as it essentially recycling waste but including energy recovery e.g. incinerating the waste with recovery of the heat¹⁰. Targets for recovery and recycling have been set for waste including the waste wood stream included in the Producer Waste Packaging Directive which applies to those businesses who turnover generate more than 2 million pounds per annum and handle more than 50 millions tonnes of packaging a year¹¹. The business targets exclude a number of smaller businesses who do not fall under the requirements. The national targets that the UK must meet in 2008 are; overall recovery 60%, overall recycling 55% material specific recycling, paper 60%, glass 60%, metals 50%, plastic 22.5%, wood 15%¹². JBT Services are one of the North East’s waste and recycling companies.

1.3 Work previously carried out on wood waste

For waste and recycled wood to make a significant contribution to biomass energy in the North East its availability, suitability and the barriers associated with it must be evaluated. There is a large amount of confusion over using waste wood for biomass such as which materials are classed as waste wood, which categories of waste can be used for fuel and the legislation which applies to waste wood.

⁹ Defra 2007. Waste Strategy for England

¹⁰ Waste Reduction and Recycling Ltd, 2007.

¹¹ Defra 2008. Waste Wood as a Biomass fuel

¹² JBT Waste Services 2008.

The following work has previously been carried out to help in an attempt to provide more detailed information on waste wood:

- **1.3.1 ‘Waste Protocols Project’** – Environment Agency, October 2007

The project tried to develop a Quality Protocol to help define the regulation on ‘waste’ wood and help remove the confusion over using waste wood as a resource. A Quality Protocol could not be established due to fact that there was too much variation in the standards of wood recovery and the quality of waste wood varied too much.

- **1.3.2 ‘Regional Market Assessment for Wood Waste for North East England’**
– WRAP, March 2007

The report carried out by the Waste and Resources Action Programme (WRAP) looked in detail at wood recycling in the North East and identified some of the barriers against using wood waste as a fuel. It identified that there needs to be more accurate figures on the type and volume of wood waste going to landfill.

- **1.3.3 ‘Waste wood as a Biomass Fuel’** – DEFRA, April 2008

This report was written in response to the Government’s ‘Waste Strategy’ report in 2007 where waste wood was identified as a priority material for the recovery of energy. The report provides information to help progress the development of wood waste as a resource.

- **1.3.4 ‘UK Biomass Strategy’** – DEFRA, May 2007

This is a strategy written by the government in response to the ‘2005 Biomass Task Force Report’ to try and bring together current UK Government Biomass policies for energy, transport and industry.

Due to increasing interest in the biomass sector the numbers of business and partnerships working within it have also had to expand. Northwoods is the North East's Initiative supporting woodland and forestry businesses. It is an organisation set up to help support timber and tree businesses of North East England. The support available includes business support programmes, research activities and training projects. Other large developments in the region include Wood pellet energy UK at Durham, Egger in Hexham and Sembcorp with a WID-compliant boiler at Wilton. Following the 2007 WRAP report of wood waste arisings in the North East of England there is evidence that the North East has huge potential to contribute to the rising demand on wood through waste, as demand for virgin timber and off-cuts continues to rise.

The Environment Agency has published a position statement¹³ helping to try and clarify which waste can be used for biomass, looking at virgin, treated and clean timber in particular. Virgin wood is no longer classed as 'waste' therefore waste regulatory controls no longer apply to it and producers can recover and sell-on virgin wood waste as cut-offs free from regulatory control¹⁴. In recent years the recycling and energy markets for clean, virgin wood has grown substantially and this is largely due to the deregulation of virgin wood in October 1997. Due to this deregulation virgin wood markets have grown whereas waste wood has not due to implications of it coming from a waste stream, the contaminants it contains and the difficulties with complying with legislation. Waste wood has the potential to become a valuable energy resource; however it has been identified that wide variability still exists in the specifications in waste wood markets. As

¹³ EA, 2008. Regulatory Position Statement

¹⁴ Environment Agency. Regulatory Position Statement http://www.environment-agency.gov.uk/commondata/acrobat/positionv7_1870672.pdf

the market for waste wood develops it may be possible for a legal standard to be developed so that waste wood can be widely marketed as a product.

CHAPTER 2

2.1 LEGISLATION

In order to address the need to reduce greenhouse gases in the UK Government released the '2007 Energy White Paper'¹⁵ addressing the Government's international and domestic energy challenges. The policy framework includes an international and domestic energy strategy to reduce greenhouse gas emissions and to ensure a clean, safe and secure supply of energy. The UK's electricity is a diverse mix; data from 2006 suggest that 36% of energy was generated from gas fired power stations, 37% from coal, 18% from nuclear and just 4% from renewable energy¹⁶. This mix of energy helps to reduce the risk of heavy dependence on a single fuel source; however in order for the government to meet its target of 20% renewable energy by 2020 considerable improvements need to be made.

Waste wood arises from a number of mixed streams and a significant problem is identifying where it came from and the possible contaminants it contains, therefore the use waste wood is heavily restricted by the Waste Incineration Directive (WID). Some of this legislation has been criticised for being 'too strict' and preventing wood waste being used as a fuel. The development of new legislation such as the Renewables Obligation should however encourage the support of energy generation from biomass.

¹⁵ BERR 2007. Meeting the Energy Challenge: a white paper on Energy'

¹⁶ BERR 2008. UK Renewable Energy Strategy

2.2 The Waste Incineration (England and Wales) Regulations 2002, Waste Incineration Directive (WID)

The use of waste wood is greatly restricted by requirements set in legislation. The Waste Incineration Directive (WID) is a European law aimed to limit and prevent the negative effects on the environment and human health from the incineration and co-incineration of waste¹⁷. The WID specifies what biomass waste can be burned for energy. Those materials which are exempt from the Directive are listed below:

- Vegetable waste from agriculture and forestry
- Vegetable waste from the food processing industry
- Fibrous vegetable waste from pulp making
- Fibrous vegetable material from pulp making
- Wood waste

Wood waste is excluded from the WID only if the substance does not contain contaminants, halogenated organic compounds or heavy metals. At present 'clean' (free from halogenated organics, CCA and heavy metals) waste wood can be burnt outside the restrictions of the WID but if the wood contains contaminants then it can only be burnt inside a WID compliant boiler. If accidental contamination occurs during its use e.g. pallets then the WID exemption should still apply because the contamination was not 'as a result of treatment with wood preservatives or coatings.' Wood waste arising from construction and demolition sites is usually heavily contaminated and unlikely to fall under the exemption list and will therefore be covered by the WID. Whether a waste is

¹⁷ NetRegs 'Waste Incineration Directive' <http://www.netregs.gov.uk/netregs/275207/1108823/1495391/>

'WID-exempt' can only be determined if the waste is non-hazardous, the use of hazardous waste as a fuel requires compliance with IPPC A(1) and WID in all cases.

A concern with the WID is that it does not specify at which point in the production the wood becomes contaminated e.g. if fibre board was already contaminated then the final product may also be contaminated so exclusion may not take place.

Another problem is how the operator demonstrates that the waste wood has not been treated and how they prove this to the WID regulators i.e. the EA.

In the North East 'Sembcorp' is one of the few wood processing sites which has a WID-compliant boiler on site. Sembcorp receives treated waste wood from all regions in the North East including civic amenity wood waste from UK Wood Pellet Energy Ltd.

It is important to try and resolve any ambiguity in legislation to promote and encourage waste wood for energy recovery. Table 2.1 has been constructed in order to try and solve any ambiguity with the WID. The government recognises that some manufactures producing for example, fibre board do not use halogenated substances or heavy metals. However if the fibreboard was made with already contaminated wood then the final product may also be contaminated. However a problem with this in WID is that WID does not state at what point contamination has to take place. You have to get round this by the operator or manufacture demonstrating that the wood is not contaminated; the only way really of doing this is to carrying out a series of scientific tests on the wood.

Although WID clearly states that if the wood waste has been contaminated with halogenated materials or heavy materials then it is not exempt from the WID; the Directive differs/changes when talking about wood pallets and contamination. Wood

pallets are still excluded from WID if ‘accidental or unintentional’ contamination (DEFRA, WID).

Another the difficulty with WID is identifying whether the waste wood has been treated or not and what specific chemicals and substances the wood may contain. It indicates that ‘clean’ waste wood is acceptable for energy recovery however there could be ambiguity as what is classed as ‘clean’ wood waste. The EA describes ‘clean’ waste wood as wood which has not been treated and therefore does contain the chemicals and treatments such as preservatives, oils, tar and halogenated flame retardants (EA, 2008). In order to make sure only clean waste wood used a common standard should be developed and the potential effects of the contaminants of human health and the environment should be analysed.

Legislation	Ambiguity	Interpretation
WID	The term ‘waste’?	Defined by the Waste Framework Directive (See Fig 1, Note 1)
	Which types of waste are classed ‘exempt’ in the WID?	See Note 2 in Fig 1
	What is class as ‘waste wood’?	No true definition – see Objective 2 in report
	Clean’ non-virgin timber	Non-virgin timber which does not contain halogenated compounds or heavy metals
	Accidental contamination	No specific compounds are listed so difficult to determine
IPPC and Environmental Permitting	Applies to installations burning more than 0.4 megawatts	Applies to those boilers with a thermal heat input >400kWth

Table 2.1 Examples of some of the ambiguity and confusion associated with WID

2.3 Environmental Permitting (England and Wales) Regulations 2007 SI 2007

No.3538

Environmental permitting is a useful tool often used as part of the compliance system to meet the requirements set the European Environmental Directives (Directives). The environmental Permitting Regime requires operators to obtain permits for some facilities; all waste wood processing sites must hold an Environmental Permit (EP). Environmental permitting came into force in the UK in April 2008 under DEFRA and the EA and combines IPPC and Waste Management License. EP was developed by DEFRA, Environment Agency and the Welsh Assembly Government as a process to make existing legislation more efficient and to help deliver permitting and compliance effectively.

2.4 Integrated Pollution Prevention and Control Directive (96/61/EC)

An IPPC permit is required by wood-based panel industries under Schedule I of the Environmental Permitting Regulations¹⁸. If the site is covered by IPPC or Waste Managing License (WML) then an EP applies. Where IPPC applies then there must be evidence of using the Best Available Technology (BAT) which is a requirement set by the EA under IPPC.

An Environmental Permit is required in:

- 1) Installations which carry out schedule 1 activities which are the most polluting IPPC sites e.g. chemical industry, mining industry, waste management etc.
- 2) A waste operation

¹⁸ Defra 2008. Integrated Pollution Prevention and Control Directive (96/61/EC)

- 3) A mobile plant (carrying out either one of the Schedule 1 activities or waste operation

The industrial activities included in the IPPC element of Environmental Permitting Regulations are split into three categories and regulated by two different bodies. (See Table 2.2);

- Part A(1) – The Environment Agency

The Environment Agency regulates what it considers to be the most polluting industries, A(1). These are regulated for emissions to land, air, water and other environmental considerations.

- Part A(2) and Part B – Local Authorities

Local Authorities regulate the less polluting industries Part A(2) for emissions to land, air and water and lesser polluting Part B activities which are regulated for emissions to air only.

Regulatory Body	Installation	Site Activities
Environment Agency	Part A (1) installations	Part A (1) - Most polluting sites
	Part A (1) mobile plant	
	Waste operations	Emissions to land, air and water.
Local Authority	Part A (2) installations	Part 1 (2) - Less Polluting sites, emissions to land, air and water.
	Part B regime	
	Part A (2) and Part B	Part B - Emissions to air only

Table 2.2 – IPPC Regulatory controls

This legislation applies to the burning of waste wood under the second bullet point ‘a waste operation’. A waste operation is defined as the disposal and recovery of waste as defined by the Waste Framework Directive¹⁹ and therefore requires an EP.

Some installations in the UK do not need an Environmental Permit but they do have to be registered by the Environment Agency within the UK. The exemption requirements set by the Environment Agency are as follows:

- ‘Burning waste as a fuel in an appliance if the total net input is less than 0.4 megawatts or if the appliance is used together with or (whether or not it is

¹⁹ Defra 2007. Waste Strategy for England

operated simultaneously with other appliances) and the aggregate net rated thermal input of all the appliances is less than 0.4 megawatts.²⁰

Therefore wood waste can be used as a fuel if the application is rated as than 0.4 megawatts; if the total net input is greater than 0.4 megawatts then an Environmental Permit is required (Table 2.3). If two appliances are used and the total thermal input exceeds 0.4 megawatts then an EP is still required. ('The 'total net input' refers to the maximum rate at which waste can be burned on a continuous basis in an appliance multiplied by the calorific value of the fuel and expressed as megawatts thermal'). The waste being burned must be clean and contains no contaminants in order to qualify for exemption otherwise the waste would have to be burnt in a WID-compliant boiler.

Total thermal input	Legislation that applies to the application
<0.4MW	Clean Air Act 1993 Local Authority Control
0.4MW – 3MW	IPPC Part B Local Authority Control
3MW – 50 MW	IPPC Part A(1) Environment Agency and Scottish Protection Agency
>50MW	Large Combustion Plant Directive and IPPC Part A(1) Environment Agency and Scottish Protection Agency

Table 2.3 Environmental Regulation of Biomass

²⁰ NetRegs 2008. Waste Incineration Directive

2.5 Landfill Directive (1999/31/EC)

The Landfill Directive has a significant influence on the recovery and re-use of waste wood. Since October 2007 the implementation of the EU Landfill Directive 1991/31/EC has required all non-hazardous waste to be treated before it is sent to landfill²¹. Sorting the waste and extracting recyclable waste is included in the treatment process as it reduces the volume of waste and this therefore helps facilitate to segregate wood from ending up in landfill. The landfill tax in 2008 is £32/tonne and continually increasing until the year 2010 so reduction in the tonnage of waste is desirable.

2.6 Renewables Obligation

The Renewables Obligation (RO) came into force in the UK in 2002 and requires all licensed electricity suppliers to source a percentage of the electricity supplied from eligible renewable sources, including both dedicated and co-fire biomass²². The percentage set under the RO increases each year and is 6.7% for 2006/2007, rising to 15.4% by 2015/16 and 20% in 2020²³. The 'Renewable Strategy' released in 2008 proposes increasing the RO to encourage up to 30-35% of electricity generation from renewable sources by 2020. It was developed as an incentive to encourage the development of renewables in the UK. The RO has increased the profitability of renewable energy; however there has been some criticism of the legislation. According to BERR the RO was not offering enough support for the development of renewable technologies and as a result amendments were made to the RO which came into action on the 1st April 2006 so that energy could be recovered from mixed wastes including waste

²¹ Defra 2008. Landfill Directive (1999/31/EC)

²² Ignite 2008.

²³ BERR 2008 UK Renewable Strategy

wood whilst still being eligible under the ROC. As a result of the RO electricity costs are increased to provide funding for electricity generation from renewable projects.

Compliance with the RO can be achieved by acquiring ROCs from generation or purchase, or paying a buy-out price (£33.24/MWh 2006/7)¹⁹. By providing ROCs a market value is provided for electricity generation from renewable sources. On the 20th July 2006 the average price for ROCs was £40.62/MWh. UK Authorities have expanded ROC to allow plants to burn mixed waste without losing eligibility for ROC as well as amending the definition of 'pure biomass' so that waste wood and other biomass fuels can be included.

The Renewable Obligation has received criticism from some organisations involved with waste wood and its use. An issue which has been raised is the long term effectiveness of ROCs as prices of ROC are volatile²⁴ (Greenpeace report, 2005). A report written by an environmental reuse and recycling company, 'Green-Works' has criticised ROCs as acting as a barrier in trying to improve waste wood as a resource. The main points highlighted in the report were the difficulties in meeting the requirements set by ROC measuring the biogenic content in the fuel that the power plant wishes to burn on a continuous basis. They suggest that through the Producer Responsibility Obligation Regulation a simplified procedure could be developed so that a responsibility is placed on the fuel blenders to produce a compliant fuel rather than power stations who do not have the time or space to measure incoming fuel²⁵. The ROCs are only awarded to those companies who produce electricity from CHP, the idea of a 'heat ROC' should be

²⁴ Greenpeace 2005

²⁵ BERR 2007 'Green Works' 'Reform of the RO: Response from Green Works'

considered and would mean that additional income would be supplied and encouraging the expansion of heat supply from waste wood. The RO policy cannot help reach the target for 20% renewable generation alone, additional policies are needed which build on the work and principles carried out by the RO.

2.7 EC Packaging and Packaging Waste Directive 94/62/EC

In the UK the 'Packing Directive' was implemented in 2007 through the Producer Responsibility Obligations (Packaging Waste) Regulations 2007 aimed at energy recovery, re-use and recycling of packaging²⁶.

The 'Biomass Strategy' has estimated that 4.5 million tonnes of waste wood is produced every year which could be recovered for energy generation²⁷. Most of this waste is disposed to landfill showing poor management of resources as much of the discarded waste could potentially be recovered and recycled. The Government's intention in reducing waste to landfill was encouraged further by the adoption of the 'Packaging Directive' in 2007 which aimed to re-use and recycle packaging. The recycling targets have been revised annually since 2004 and increased so that 60% of overall packaging waste should be recovered and 50% minimum and 80% maximum recycled by 2008²⁸. The 2008 targets requires member states to recycle 60% of glass and board, 55% of metals, 22.5% of plastics and 15% of wood packaging by 2008.

Under the Directive there is some confusion as to what wood waste classes as 'reclaimed' and 'recovered'. For wood pallets it has been suggested by the European Commission that wooden pallets with very small repairs could be considered as being

²⁶ BERR 2008 EC Packaging and Packaging Waste Directive 94/62/EC

²⁷ Defra 2007. UK Biomass Strategy

²⁸ BERR 'Packaging in the EU'

<http://www.berr.gov.uk/sectors/sustainability/packaging/Packaging%20in%20the%20EU/page38919.html>

reused whereas those in need to major repairs should be considered as recycled, for example, 3 broken pallets into 2. In order to meet the 15% recycling waste wood an agreement needs to be made on the criteria of what is considered as 'recycled' and 'reclaimed'.

2.8 UK Waste Protocol Project, Environment Agency

This project was developed in 2007 and commissioned by the Technical Advisory Group (TAG) made up by representatives from the Environment Agency, the Waste and Resources Action Programme (WRAP) and industry to try and help provide more certainty as to what actually constitutes 'waste' wood and how it can be fully recovered in order to reduce waste to landfill. The Protocol had two aims; to clarify the steps needed for waste wood to be used as a resource by industry and to produce a regulatory position statement explaining the regulations industry has to comply with to use waste wood²⁹. Producing a Quality Protocol for a particular waste stream would define the point at which waste may become a non-waste product and could be re-used by business or industry. Unfortunately a Quality Protocol could not be produced for clean waste wood because the EA recognised that there was still wide variability in the specifications of waste wood markets.

The Protocol, however, has proved successful for other waste products, for example it produced the first Quality Protocol for compost allowing producers to create a type of compost which was no longer classed as a waste³⁰. The protocol is currently running for a second year until 2009 and if more research is undertaken a Quality

²⁹ EA, 2007 Regulatory Position Statement

³⁰ EA 'Year Two for the Waste Protocol Project'

Protocol may be produced for wood waste making it a marketable product and helping to develop the wood recycling industry.

2.9 Clean Air Act 1993

The Clean Air Act aims to control domestic and industrial emissions to improve air quality by creating regulations to control smoke emissions, chimney heights and the content and composition of motor fuels³¹.

It is important that the burning of waste wood complies with this Act through the necessary contaminant removal processes and the biomass boiler selection. If units of over 400kW net rated thermal input are used to burn wood fuel then approval for the installation must be obtained under IPPC. Chimney height may be required under Section 14 under the Clean Air Act 1993 for furnaces ‘under local authority authorisation.’ Those installations which have a net thermal input below 400kW will still be required to comply with the regulations outlined under the Clean Air Act, for example prohibiting the emissions of dark smoke into the atmosphere.

Under the Clean Air Act Regulations the emissions of dark smoke caused by the burning of timber and any other waste matter which ‘results from the demolition of a building or clearance of a site in connection with any building operation is exempt from Section 1 of the Clean Air Act’ provided that dark smoke emissions are minimised and that there is no other reasonable safe manner of disposing the waste. Trying to identify ‘no other reasonable safe manner of disposing the waste’ may be difficult as landfill is an easy and viable option for disposal.

³¹‘Clean Air Act 1993’ c.11 http://www.opsi.gov.uk/ACTS/acts1993/Ukpga_19930011_en_1.htm

2.10 Smoke Control Areas

This legislation and changes in fuel usage has helped UK meet the air quality standards for sulphur dioxide and particulates set by EU Directive 80/779/EEC.

There are some parts of the North East which have ‘Smoke Control Areas’ which makes it is an offense to emit smoke from a chimney, furnace or boiler in these areas. This regulation rarely applies to the burning of woodfuels as ovens, wood burners and stoves have been made exempt by Statutory Instruments under the Clean Air Act. These have passed tests showing that they are able to burn woodfuel without emitting smoke³². Waste wood will only be exempt from the act if it does not contain halogenated organic compounds or heavy metals as a result of wood treatment, expressing particular concern with waste wood originating from construction and demolition sites.

CHAPTER 3

³² UK Smoke Control Areas <http://www.uksmokecontrolareas.co.uk/index>.

3.1 WASTE WOOD

In order for waste wood to become a valuable resource and a marketable product it needs to be made clear to businesses and industry how it can be used as a resource, how it can be recycled and the regulations which apply. A large problem with classifying wood waste is that there is no clear definition of what falls under 'waste' wood. Under the WID directive only 'clean' waste wood may be allowed to be burnt and used as a fuel. With no clear definition of what waste wood is and how it can be used as a resource this may

- restrict its use as a fuel
- encourage businesses to dispose their wood waste by sending it to landfill
- promote treated waste wood finding itself into the clean waste recycling stream and therefore affecting the quality of the end product.

Developing a clear definition would help to encourage and enable businesses to increase the use of waste wood for fuel by removing uncertainty of what classes as 'waste' and what can be used as a resource.

The UK Waste Strategy defines and outlines what is considered 'waste'. The Strategy developed by Defra is a new strategy built on the 2000 Waste Strategy but has improved its aims further to help increase the likelihood of meeting the targets set by Government. The main aim of the strategy is to promote sustainable waste management producing less waste and using it as a resource wherever possible³³. The UK Waste Strategy defines 'waste' as being:

³³ Defra, 2007 'Waste Strategy 2007'

‘ubiquitous material which appears in a number of waste streams, including construction and demolition of waste, agricultural waste, municipal waste, bulky household waste, packaging waste and other commercial and industrial waste’.

Under the WID directive only ‘clean’ waste wood can be used for fuel. The WID defines ‘clean’ wood waste by exclusion:

‘Wood waste is excluded from the WID only if the wood waste does not contain contaminants, halogenated organic compounds or heavy metals’. Waste wood that may contain halogenated organic compounds or heavy metals comes under WID and means that in order for it to be burnt for fuel it must be combusted in a WID boiler with pollution abatement technology in the form of scrubbers, filters and emission monitoring and would then be eligible for Renewable Obligation Certificates under the Renewable Obligation (ADA).

3.2 Grading of wood waste

Waste wood can be classed as being ‘low grade’ or ‘high grade’ depending on the quality of the wood. Low grade waste wood includes MDF, melamine, chipboard and other non-hazardous waste wood and suitable for biomass boilers whereas the higher grade waste wood is generally recycled for the wood industry e.g. panel board.

The lack of standards on waste wood is currently preventing its use as a fuel source and therefore a Government funded project needs to be established to develop standards and categories which could be adopted by the EA and SEPA. The Wood Recyclers Association (WRA) has recommended a grading system to make it easier for businesses

to understand what wood waste they can use as a biomass and which legislation applies to it. It would also prevent clean wood waste becoming contaminated and helping clean wood waste to become free from regulation.

From gathering information from previous reports such as WRAP, DEFRA and the Technical Advisory Group (TAG) waste wood can be graded into the following categories:

- 1) Clean Wood Waste
- 2) Mixed Grade e.g. chipboard. NOT panel board.
- 3) Fuel Grade – Non-WID compliant
- 4) Hazardous

It was discovered that the quality and how ‘clean’ the waste wood was varied depended on which waste category it came from; for example, a large proportion of waste wood from the Demolition and Construction stream had been treated and therefore contained contaminants. Table 3.1 has been compiled to demonstrate how waste wood from different categories can affect potential energy recovery and its potential use as a fuel source.

The CEN standards would have to be applied to this grading system of wood waste to improve its use as a biomass resource.

Grade	Wood Waste Category	Examples of wood waste	Energy Recovery Potential	Legislation
Clean	Municipal Waste	E.g. packaging, pallets, clean off-cuts with no contaminants.	High	Exempt from WID legislation
Mixed	Commercial and Industry	Chipboard. May contain some % contaminants. Panelboard can take 66% clean grade and 33% mixed waste (check)	Medium	Non-WID fuel grade
Fuel	Commercial and Industry	Contains resins Non-Hazardous resins Panelboard products	Medium	Covered by WID. Can only be burnt in WID-compliant boilers only.
Hazardous	Construction and Demolition	Creosoted treated wood waste CCA treated wood waste	Low	WID-complaint boiler IPPC required

Table 3.1 - Summary of the Grading of waste wood

CHAPTER 4

4.1 SOURCES OF WASTE WOOD

A number of studies carried out previously have shown that waste wood arises from several different waste streams and can be categorized into different waste streams. It is important to try and categorize wood waste as it arises from a wide variety of sources and therefore the amount of contaminants it contains varies also. Approximately 7-10 million tonnes of waste wood are generated each year by construction, demolition, commercial and industrial sectors³⁴. Waste wood can therefore be categorized as coming from the following waste streams:

- 1) Municipal waste stream
- 2) Commercial and Demolition waste stream
- 3) Commercial and Industry waste stream

4.3 Municipal Wood Waste

Municipal waste comprises of all waste collected by the Local Authority and includes civic amenity site waste, skips, street litter, garden waste and council recycling points. Municipal waste wood consists of disposal by households e.g. furniture, fencing, decking, wood cuts from DIY, arboriculture arisings and wood packaging e.g. pallets. The two main categories of waste wood collected are from civic amenity sites and packaging suppliers. It is normal practice for Local Authorities provide skips at civic amenity sites for the public to leave their municipal wood waste which is then collected by waste

³⁴ BERR 2008. UK Renewable Strategy

handlers such as Premier Waste where it is then taken to recycling facilities or disposed to landfill depending on its quality.

The waste wood is usually collected through the following:

- Civic amenity sites (CA sites or Household Waste Recycling Centres)
- Kerbside collection of household waste
- Special collections by council (bulky waste)

In the past sorting and segregating wood waste was made difficult due to the fact that the municipal waste stream contains mixed waste varying in its nature and composition. In recent years Local Authorities have improved the recycling facilities offering separate skips for wood waste such as pallets etc. Wood Pellet Energy UK in County Durham is a major wood reprocessor in the North East which collects wood waste from business and households in the region. They convert waste wood which would otherwise go to board manufacturing to fuel pellets, currently approximately 12,000 tonnes of pellets are produced annually with the output expected to increase in the future with the installation of a new pellet processor. The pellets produced from 'clean' waste wood are then used by Durham County Council to heat twelve of its schools, schools in Northumberland and North Yorkshire and parts of Leeds University. Pellets which have been produced from treated wood can only be used in boilers which are WID compliant such as at Sembcorp Biomass Power Station at Teeside.

The WRAP report ³⁵ has estimated figures for the amount of municipal waste which is recycled in the North East and for the make up of the recycled waste. The figures reveal that in 2005/06, 27, 000 tonnes of waste and 71, 000 tonnes of non-household waste were recycled, however these figures are not entirely accurate nor do they give recycled waste wood figures. There is no individual figure for the recycling rates of waste wood therefore it is included in the 'Other' or the 'Co-mingled' category which could include waste such as electrical goods and hence not giving a true representation. Due to these gaps of information further research needs to be carried out in order to find out how much of the 'Other' and 'Co-mingled' municipal waste sent for recycling was wood.

4.3 Construction and Demolition

It is estimated that 4 million tonnes of waste wood arises from the construction industry every year.³⁶ The construction and demolition waste stream is usually classed as one category; however it produces different waste streams such as:

- Construction - Includes off-cuts from structural timbers, timber packaging, scaffolding, cladding etc.
- Demolition - Used structural timber, floorboards, joists, doors and frames etc.

These different waste streams cause a number of problems because it makes hard for the recycling industry to segregate the wood waste into different categories and therefore separate wood containing contaminants. In order to tackle the issue of mixed waste streams and sorting difficulties the Government have introduced a new requirement

³⁵ WRAP 2007. Regional Market Assessment for Wood Waste for North East England

³⁶ DEFRA 'Waste Wood for Biomass'.

called 'Site Waste Management Plans'³⁷ in April 2008. Construction sites costing over £300,000 the employers are encouraged to segregate and recycle their waste whilst reducing project costs. If a SWP is not carried out then penalty notices are awarded out and if they are not paid then further legal action is taken. Segregation of wood waste from smaller construction sites is more difficult as they often lack the time and resources to carry it out. Figures obtained from DEFRA for 2007 show large construction sites produced 20ktpa of waste wood whereas smaller businesses produced 4,000ktpa of wood waste from construction. This demonstrates that greater support and recycling facilities are needed for smaller businesses to efficiently recover and re use wood waste from construction sites. There seems to be a need for small sorting and segregation sites to which smaller industries could off load their waste so that the sorting process was carried out for them. This may be a practical solution to help reduce the amount of wood ending up in landfill sites as well as reducing charges from Landfill Tax. However, the problem of unidentified contaminants that may be present on the waste wood would still need to be addressed.

4.4 Commercial and Industry

Some of the main sources of wood waste that come from this sector include:

- Furniture manufacture, Wood waste during manufacture of packaging, Wood waste from wooden packaging

A large proportion of waste wood under this category is likely to be wood packaging such as wood pallets producing the highest grade of waste wood. According to figures from the Environment Agency in 2004 for a report published by WRAP (2007) the North

³⁷ Defra 2008. Non-statutory guidance for site waste management plans

East is producing 4.6 million tonnes of waste every year, 63% of this comes from wood manufacturing industries³⁸. This suggests that from the 4.6 million wood waste makes up 3.2% of Commercial and Industrial arisings in the North East estimating that the amount of waste wood available for recycling and energy recovery is approximately 100,000-200, 000 tonnes.

The table below represents the figures collected by MEL Research Ltd on behalf of WRAP estimating the commercial and industrial wood arisings in the North East. It highlights that approximately 300,000 tonnes of commercial and industrial arisings are produced in the North East every year. Although the report gives an estimate of the quantity of arisings produced in this sector, it does not indicate how much of the 300, 000 tonnes is recovered or recycled and not making it into the waste stream.

Table 3.2.3 - Estimates of Commercial & Industrial Wood Waste	SIC Code(s)	000 tns pa	Area	Yr of estimate	NE employment	UK/ E&W employment	NE Wood C&I 000 tns pa
Furniture manufacture	36.11-36.14	531	UK	2001	4982	99004	26.72
Panel board mnfg	20.2	1,107	UK	2003	733	5805	139.78
Mnfr construction products	20.3	201	E&W	1998	1,626	40190	8.13
Mnfr packaging	20.4	40	UK	2001	272	6588	1.65
Other C&I wood wastes	20.51	2,552	E&W	1998	405	8455	122.24
Railway sleepers		26	UK	2005	5.10%	... base on popn	1.33
Utility poles		23.5	UK	2003	5.10%	... base on popn	1.20
		4480.5					301.05

Table 4.1. 'Commercial and Industrial wood arisings in the North East'

³⁸ WRAP 2007 Regional Market Assessment for Wood Waste in North England

CHAPTER 5

5.1 AVAILABLE WASTE WOOD IN THE NORTH EAST

In order for waste wood to become a viable and feasible fuel source there needs to be a sufficient number of wood industries in the North East to ensure a secure supply chain in the North East. Wood arises from a variety of sources during timber processing as wood residues can be generated at each of the processing stages³⁹.

Attempting to quantify the volume of waste wood generated in the North East is a complex and lengthy process, which would involve collecting data from every wood producer in the North East region. In June 2005 MEL Research was commissioned by WRAP to identify data on the available waste wood available for fuel from the municipal waste stream in the North East in the UK and its management. WRAP identified the difficulties with this calculation as the data they received for the municipal waste included all household waste and did not singly identify waste wood in the waste stream.

A number of site investigations in the North East have highlighted that a large percentage of the wood waste collected from around the region largely consisted of wood packaging such as wood pallets. This may be due to the fact that wooden packaging is included within the Packaging Waste Regulations and so many businesses are trying to meet the

³⁹ The Environmental Industries Federation (2004) 'The Use of Waste and Recycled wood for Biomass Energy Generation in the North East of England' ADA

15% target of recycling their wood waste set by UK Government. A report written by ‘The Environmental Industries Federation’ in 2004 estimated the available wood waste in the North East. A table showing this data and the recent data collected from the site visits shows the estimated waste wood generated in the North East (Table 5.1 and Chart 5.1). The graph clearly shows that the largest quantity of waste wood comes from the Demolition and Construction sector. However, a large volume of this wood waste will not be eligible as a fuel source due to the restrictions under the WID. Waste wood deriving from demolition and construction sites contain large volumes of contaminants therefore this wood can only burnt in a WID compliant boiler.

Source of biomass	Quantity in the NE tonnes
Forestry	82, 956
Sawmills	52, 288
Construction and demolition	500, 000
Packaging and pallets	72, 195
Furniture	17, 000
Fencing	3, 820

Table 5.1 The estimated amounts of waste wood generated from various sources in the North East per annum.

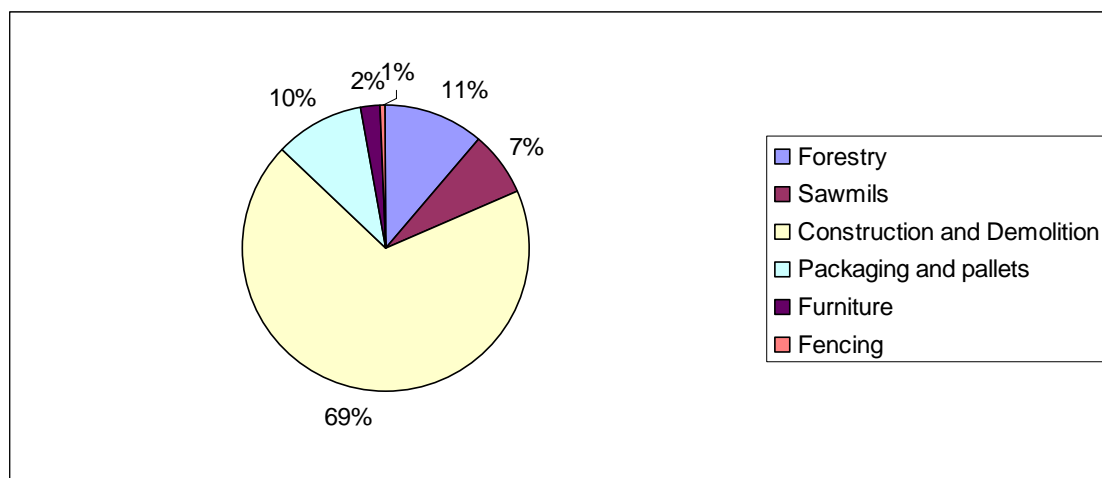


Chart 5.2 The estimated amounts of waste wood generated from various sources in the North East per annum.

5.2 Major waste wood processors in the North East

- SempCorp, Teeside

The two largest wood processors in the North East are Egger UK located at Hexham and SembCorp at Teeside. SembCorp is the first wood burning power station to be built generating 30MW of electricity and steam which helps contribute to the electricity demand of 30,000 homes in the area. SembCorp receive the wood waste from UK Wood Recycling in Manchester who handle 13 different kinds of wood waste ranging from animal bedding to panel board. UK Wood Recycling is investing in a new £4 million recycling facility at the Wilton 10 site which will supply Wilton 10 with 100, 000 tonnes of clean wood waste and 80,000 tonnes of lower grade waste wood every year helping to create a stronger market for lower grades of waste wood.

- Egger UK, Hexham

Egger UK is one of the largest wood producing suppliers in the UK supplying 25% of the UK's chipboard. The plant has an efficient process system for manufacturing chipboard, for example by recycling and re-using energy and resources and reintroducing them back into the production process. Egger UK has recently invested in new efficient technology in able to use and process parts of timber, such as the tops of the trees and off-cuts which otherwise could not be used by the sawmill industry. The £100 million investment

programme has helped the plant have a more efficient environmental process and produce very little waste wood during the chipboard manufacturing process. Only 40% of waste wood is produced during the manufacturing processes; however this is recycled back into the processing system. The waste wood is processed into sawdust, which is then used to fuel the biomass boiler to generate heat.

As well as Egger and SembCorp the other main wood reprocessing sites in the region are UK Wood Recycling Ltd, Wood Pellet Energy Ltd and Reivers Processing Ltd

- Wood Recycling Ltd, Wilton

The wood waste recycling facility is located at Wilton in Teeside to supply wood for SembCorp's biomass boiler. The site can recycle all grades of wood waste, clean and treated as long as it is non-hazardous.

- Reivers Processing Ltd – Gateshead

Reivers Reprocessing is a recycling facility located in Gateshead. Unlike Eggers and Wood Pallet Energy, Reveirs has stricter requirements on the types of material it can process, MDF and hardboard cannot be recycled on site.

- Wood Pellet Energy Ltd – County Durham

UK Pellet Energy receives approximately 16, 000 tonnes of waste wood yearly from the Local Authority and civic amenity sites in County Durham and Darlington. The wood waste is then sorted into 'clean' and 'treated' waste and reprocessed into wood pellets, producing approximately 12,000 tonnes of wood pellets in one month. The majority of the wood pellets produced are supplied to Egger as well as supplying pellets to local schools in Durham.

CHAPTER 6

6.1 CEN STANDARDS

Currently there are no standard specifications in place for wood recycling, however many timber recyclers will generally accept all softwood and hardwood materials⁴⁰. There are certain restrictions put in place restricting the re-use of waste wood such as if the wood has been treated, railway sleepers and MDF.

Any metals in the waste wood can be categorised into two groups; ferrous and non-ferrous metals. Ferrous metals such as nails and screws can usually be removed relatively easily by using magnets for extraction. Non-ferrous metals such as metal fixings are less easy to recycle and often need to be removed before recycling.

The waste management sector has developed over the last few years on ways to make solid recovered fuels a more environmental and economically viable option. As already highlighted the recovery of waste is not optimised due to the uncertainty on the reliable qualities of some SRF, obtaining permits to use SRF as a fuel source and the unclear classification of SRF under the European Commission's waste list.

⁴⁰ Letsrecycle.com 'recycling Wood' www.recycleitall.com/textonly.html

The British Standards Institution (BSI) has developed a draft standard CEN/TC DD CEN/TS 15357:2006 ‘Solid recovered fuels – Terminology, definitions and descriptions’⁴¹. The BSI is the independent national body responsible for preparing British Standards and presents the UK view on standards in Europe and at the international level. The objective of these standards is to provide ‘unambiguous and clear classification and specification’ for Solid Recovered Fuels. The document CEN/TR 15508:2006 has been drafted on request of CEN/TC 343 Working Group 2 ‘Fuel Specification and Classes’. The Working Group wanted a classification system using practical data.

The BSI defines a Solid Recovered Fuel as ‘solid fuel prepared from non-hazardous waste to be utilised for energy recovery in incineration or co-incinerations plants and meeting the classification and specification requirements laid down in CEN/TS 15359’. This definition covers the category ‘waste wood’ and can therefore be applied for its use as a recovered fuel.

➤ Classification of CEN 343

The classification for solid recovered fuels is based on the limit values on the following properties of the waste wood:

- 1) The mean value for the net calorific value
- 2) The mean value for the chlorine content
- 3) The median and 80th percentile values for the mercury content

Each property is divided into 5 classes with limit values and the SRF will then be assigned to class number from 1-5 (BSI CEN 343).

⁴¹ BSI ‘DD CEN/TS 15357:2006 ‘Solid recovered

Table 1 - Classification system for solid recovered fuels

Classification property	Statistical measure	Unit	Classes				
			1	2	3	4	5
Net calorific value (NCV)	Mean	MJ/kg (ar)	>25	>20	>15	>10	>3
Chlorine (Cl)	Mean	% (d)	<0.2	<0.6	<1.0	<1.5	<3
Mercury (Hg)	Mean	mg/MJ (ar)	<0.02	<0.03	<0.08	<0.15	<0.05
	80 th percentile	mg/MJ (ar)	<0.04	<0.06	<0.16	<0.30	<1.00

For example, the classification code of waste wood having a mean net calorific value of 19MJ/kg (ar), a mean chlorine content of 0.5% (d) and a median mercury content of 0.016mg/MJ (ar) with a 80th percentile value of 0.05mg/MJ (ar) would be:

The classification code would be: NVC 3, Cl 2, Hg 2.

Compliance with the classification system will be established for each SRF by demonstrating that the measured properties comply with limit values defined for that class.

➤ Specification

The SRF specification shall be agreed between the supplier and the user (lot size and compliance rules). The specification for the SRF shall be defined according to the template (See Annex 1). The template is divided into two parts; Part 1 consists of properties that are obligatory and Part 2 is properties which can voluntarily be specified.

Once the CEN standards are published the classification system should help local authorities submit permits, help provide clarity to businesses involved in the wood industry and help increase the positive perception to the public on the use of waste wood as a resource⁴². The CEN Standards will also help to achieve an objective recommended by the EA in producing a classification system which can be used by industry to help encourage its use as a fuel. The only drawback with the CEN standard is that it is not legally binding and therefore does not have to be adopted by all wood industry and businesses, however in practice most businesses will end up adopting it.

⁴² BSI 'DD CEN/TS 15357:2006 'Solid recovered

CHAPTER 7

7.1 SEGREGATING AND SORTING WASTE WOOD

The Waste Strategy sets out a policy framework for recycling and reusing waste wood through energy recovery from waste biomass⁴³. When waste wood enters a site, it usually undergoes some sort of sorting and segregation process; which entails a physical and visual process. A spray can be applied to detect chemical contaminants such as copper and zinc. The level of segregation and sorting varies from site to site as there is no standard requirement put in place. The level of unwanted contaminated material entering the process cannot be defined; physical is easily identified, for example metal nails can be removed using a large magnetic head during the shredding process.

The sorting and segregating process used as UK Energy Pellets Limited is a relatively simple and straight forward process. The wood waste was sorted into two piles. One pile contained 'clean' wood waste packaging e.g. pallets and another pile contained wood waste collected from civic amenity sites located across the north east. The waste collected from civic amenity sites contained a mixture of wood waste including clean and treated wood waste but due to time and cost constraints the clean wood was not separated from this pile. As already mentioned the quality of wood waste and the contaminants it contains determines the end market for the wood pellets.

⁴³ Defra 2007. Waste Strategy for England

7.2 An example of the sorting and segregation process of waste wood

A wood recycling company 'Timberpak' in Leeds recycles waste wood into chipboard and is part of Egger UK; one of the largest waste wood producers in the North East.

Timberpak is able to dispose of any wood waste that is free from halogenated chemicals and heavy metals which may have been applied during its treatment process. Before any processing can take place the waste wood collected has to go through a segregation process where contaminants such as paper, plastics and metals are removed. Once these contaminants have been removed then the wood is sorted into different wood types and placed in bays ready for processing.

The typical processing procedures include:

1. Collection of wood from skips, civic amenity sites and delivery from customers to the site
2. The wood is weighed on site and recorded
3. The wood is then inspected by personnel to see if it is acceptable for processing.
4. Shredding of the waste, usually by Hammermills. Large magnetic heads remove metal contaminants.
5. Shredded material is usually re-examined to identify further contaminants or further shredding may be necessary to shred the wood into smaller pieces.
6. The shredded material is transported to the customer.

It should be highlighted that the efficiency of the sorting and segregation of wood waste may vary at different recycling facilities as there is no set standard in place. This is a particular problem as waste wood can derive from a variety of sources and therefore the level of contaminants it contains may vary also. It is therefore important that a quality standard is set so that quality management procedures such as visual inspections and laboratory tests are carried out to ensure a standardised quality of the end product. This quality standard would therefore help strength the market of lower grades of waste wood.

CHAPTER 8

8.1 CONTAMINANTS IN WOOD WASTE

There is little information made available to the public on the contamination levels found in waste wood by industry. There are no maximum permissible levels set for the amount of contaminants found waste wood however with rising concern of contaminants entering the environment and causing harm to both the environment and human health⁴⁴. Some wood waste derived from the processing, construction and demolition industry has often been treated, e.g. with a preservative or a type of varnish. Most timber species in the UK have a low durability and are therefore vulnerable to attack by destructive biological organisms such as fungi and insects. The treatment process of timber is therefore designed to prevent the chemical and physical changes affecting timber such as weather and organisms to prolong its use and durability.

According to WRAP⁴⁵, 5 million tonnes of treated waste wood arises from the construction sector in the UK every year. Contaminants can be found in all types of waste wood however it is treated waste wood which contains large volumes of contaminants such as; copper chromium arsenic (CCA), creosote, copper organics and light organic

⁴⁴ WRAP 'Identification and Assessment of Types and Levels of Chemical Contamination in Wood

⁴⁵ WRAP 'Identification and Assessment of Types and Levels of Chemical Contamination in Wood

solvent preservatives (LOSP). The British Wood Preserving and Damp Proofing Association (BWDPA) (Biomass Energy, 2008) identified creosote and CCA as being hazardous according to the EC Hazardous Waste Directive 91/689/EEC. CCA is a water-borne combined fungicide and insecticide that includes arsenic which when burnt produces dangerous emissions. Creosote is used as a wood preservative obtained by the distillation of coal tar and therefore it also has the potential to produce dangerous emissions. Further information on the toxicity of wood preservatives is provided in 'Toxicity assessment of wood preservatives'⁴⁶. A list of some of the active ingredients most frequently found in timber treatment chemicals which generally have the most serious toxic effects is outlined below⁴⁷ (Table 8.1). Table 8.2 demonstrates the contaminants usually found in the sorting process in both 'clean' and treated waste wood at recycling facilities.

⁴⁶ Lebkowska M.; Zaleska-Radziwill M.; Rutkowska-Narozniak A.; Kobiela S. (2003) 'Toxicity assessment of wood preservatives' *Environment International*, **28** Number 8, pp. 801-802(2)

⁴⁷ PAN UK: (1999) Pesticide Action Network: *Pesticides News No. 4, p18-19*

Chemical	Toxicity	Symptoms
2-phenylphenol	LD50 = 2480	mild skin irritant, endocrine disruptor, toxic to fish
3-iodo-2-propynyl-n-butyl carbamate	LD50 = 1470	cholinesterase inhibitor
cypermethrin	LD50 = 250	endocrine disruptor, mild skin and eye irritant, possible skin sensitizer
lindane	LD50 = 76	toxic orally, skin, eye and respiratory tract irritant, evidence of chronic disease, carcinogenicity and mutagenicity
pentachlorophenol	LD50 = 80	foetotoxic, skin and eye irritant
tributyltin oxide	LD50 = 224	irritating to skin, eyes and respiratory tract, considered to be teratogenic

Table 8.1 Toxic chemicals frequently found in timber treatment chemicals

* The LD50 shows the dose of chemical that will kill 50% of a sample group of animals; in this case it applies to rats dosed orally.

Mechanically separated	Physically & Chemically separated
Dirt, soil, stones	Creosote
Laminates, veneers	Waxes, oils
Asphalt shingles	Paints
Aggregates, bricks, glass, concrete	Glues, adhesives
Plastic compounds	Fire retardant
Metallic compounds	

Table 8.2 Potential contaminants and separation techniques (ADA, 2004)

It could be argued that an alternative wood treatment process could be implemented, so that less harmful substances are used to treat wood. Such theories have already been suggested; Lande *et al* (2004)⁴⁸ identified using Furfurylated wood as an alternative to traditional wood preservative which is a non-toxic alternative. New wood treatments must be proved to be effective however if they are to replace existing products. Such a move could help some wood waste to become exempt from restrictive legislation and also have environmental advantages.

⁴⁸ Lande. S., Westin. M., Schneider. H.M. (2004) Eco-efficient on wood protection. Furfurylated wood as alternative to traditional wood preservative. *Management of Environmental Quality*. 15, 529-5540

Parameter	Typical range	Recommendation for quality sorted waste wood
Ash	1.5-100	<4.0
Cl [(mg/kg (d.b))]	300-4000	<1000
Cd	0.3-3.0	<1.0
S	300-2000	<1000
Zn	200-1200	<200
Pb	50-400	<100

Table 8.3 Parameters affecting the combustion behaviour of waste wood, their typical ranges and recommended guiding values

The EA recommends that in order for a Quality Protocol to be drawn up for clean non-virgin waste wood an approved standard needs to be developed which identifies the point at which waste wood is free from contaminants. At present the level of contamination entering processing, included treated waste wood removed by sorting cannot be defined. Clean wood waste is acceptable for virtually all markets whereas treated wood waste containing CCA is unsuitable for most markets and therefore ends up in landfill. One of the largest problems the waste recycling industry face is trying to produce an end product

which is 'non toxic' as it is difficult to identify toxins present and the harm they can do to human health and the environment. Therefore it is necessary for more research to be carried out on what can pass as a 'safe' level of contamination in waste wood and its effect on human health and the environment.

CHAPTER 9

9.1 BOILERS

Modern biomass boilers are designed so that they now have an efficiency rate between 80-90% and vary very little to conventional wood burners. Table 9.1 has been constructed to demonstrate the type of boilers and constraints needed for different grades of waste wood, for example:

1. Clean – e.g. pallets, clean cut-offs
2. Mixed – Chipboard, panel board can take 66% clean grade and 33% mixed grade
3. Fuel – Non-hazardous resins e.g. panel board
4. Hazardous – CCA treated wood, creosote wood .

Table 9.2. demonstrates the boiler requirements needed for each category of waste wood; waste wood from the municipal, commercial and industrial and construction and demolition waste stream. Municipal waste wood may cause problems as it may contain large volumes of arboriculture waste and 'green' material such as leaves, branches and needles. As well as making chipping difficult arboriculture waste also causes

complications inside the boiler as green material contains a large percentage of chlorine which builds up inside the boiler and corrodes the heat exchangers.

Type of Waste Wood	Constraints/ Modifications	Suggested boiler type	Legislation
1. Clean - pallets, clean off-cuts	Pallets produce 'shreddy' chips, reduces the quality of chip	100-200kW boilers. Not suitable for small hand-fed boilers	Clean Air Act Local Authority Control
2. Mixed - Chipboard, MDF - Panel board	'Shreddy' chips - Waste wood may contain glues, resins, therefore to comply with WID must be burnt for a min at 850°C for 2 seconds. - Filters/scrubbers are needed	- Residence chamber required - Needs to be burnt at 850°C for min 2 seconds	WID - Partial WID, e.g. Eggers - Fully WID, Sembcorp
3. Fuel - Panel board	Resins burn to release carbon without the release of toxins.	- Residence chamber required - Needs to be burnt at 850°C for min 2 seconds	WIC license required, as waste wood not guaranteed to be 'clean'
4. Hazardous	Creosote CCA	Needs to be burnt at 1200°C for at least 4 seconds	Has to be burnt in a WID compliant boiler

Table 9.1 The boilers required for each fuel type and any constraints /modifications needed with boiler.

Category of wood waste	Types of wood waste	Type of boiler/ Modification to boiler
Municipal	Municipal green waste waste, small furniture off-cuts	Burn at 850°C for 2 seconds
Commercial and Industrial	Furniture, wood packaging, pallets	Burn at 850°C for 2 seconds
Construction and Demolition	Timber structures, scaffolding, floor boards, joists,	<ul style="list-style-type: none"> - Wood likely to be contaminated - WID compliant boiler - Needs to burn at 1100°C for 2 seconds

Table 9.2 Requirements of boilers according to waste type

9.2 Modifications

According to the Ignite training course in ‘Wood Fuel Management’ it has been highlighted that many conventional wood boilers are perfectly acceptable for burning waste wood. There used to be a concern that biomass boilers were very inefficient during their use and caused high emissions, however using information collect from site investigations it was understood that the boilers were 80-90% efficient, the boiler at Egger in particular had an efficiency of 95%.

The only requirement every boiler needs to comply with is the regulation set under IPPC. IPPC requires all biomass boilers need to have a combustion or residence chamber, which reaches a temperature of 850°C for at least 2 seconds. If hazardous substances such as hydrocarbons are burnt in a WID compliant boiler then the temperature must meet 1200°C for at least 2 seconds.

The 40MW boiler at Egger has a modification to make it more efficient in removing particulates and impurities from the hot gas. The ‘Wet Electricity Static Precipitator’ (W.E.S.P) (See fig 9.1) prevents any direct emissions into the atmosphere and monitoring of emissions can easily be obtained from the WESP. The Environment Agency has the right to monitor the emissions of any biomass plant at any time in order to ensure compliance with IPPC.

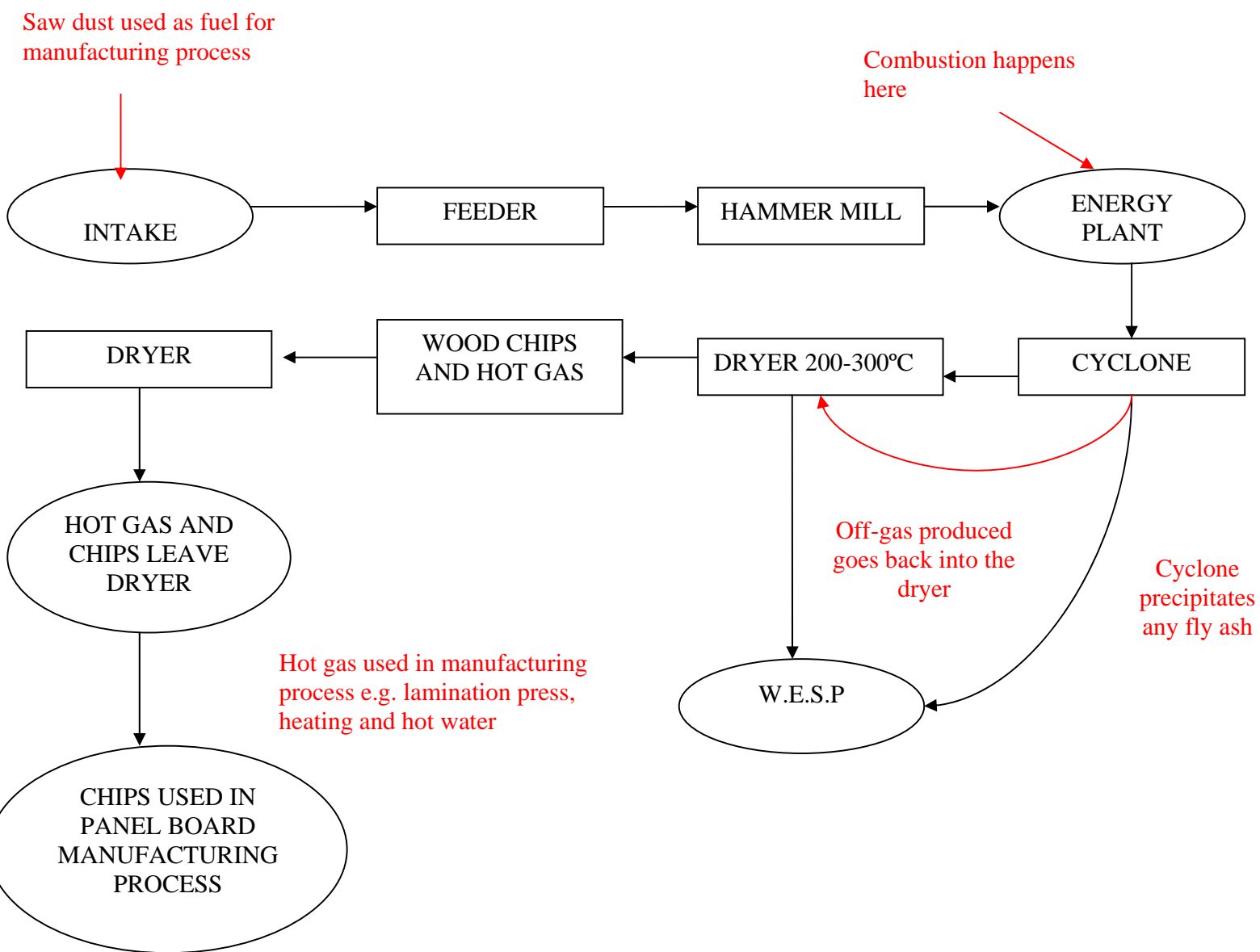


Fig 9.1. Example of the boiler process at Egger UK

9.3 Emissions

Burning treated waste wood can result in significant increase of pollutants in the smoke and ash. The WID Directive 2000/76/EC requires waste wood to be burnt for at least 2 seconds at a minimum temperature of 850°C and any halogenated waste wood must be burnt for 2 seconds at 1100°C.

In order to comply with WID need to demonstrate the following 3 things:

1. Residence time
2. Temperature
3. Monitoring of emissions

Cyclones and flue chambers can be used to remove small particulates and hydro carbon emissions in order to comply with the emission limits set under IPPC. From the filter, the clean off gases escape to atmosphere up a standard stack or flue. The Environment Agency will insist that constant electronic monitoring of the off-gases takes place, this usually happens annually. A piece of equipment called a spectrometre is oftern used to measure Carbon Monoxide (CO), Oxygen (O²) Volatile Organic Compounds (VOCs) Nitrogen Oxides (NO_x) and Sulphur Oxides (SO_x). The emissions levels are monitored on a half-hour moving average basis.

9.6 Installing biomass boilers

There are a number of considerations which need to be taken into account before installing a biomass boiler such as the suitable fuel type, installation space and the storage and delivery of the fuel supply⁴⁹. Other factors which affect the viability and feasibility of a woodfuel system include the ease of access routes for the delivery of woodfuel, the storage space of the woodfuel and how often the biomass system will be used.

Using biomass fuels in efficient heating systems is a well established technique used in individual buildings and regional district heating schemes throughout Europe and Scandinavia. In the UK there are a number of biomass manufactures offering biomass boiler systems such as Talbotts, Asgard etc. The European CEN standards can be applied to the design of the biomass system and the specification of the fuel used.

9.7 Biomass boilers and Wood Fuel

In order for biomass to be efficient and effective for energy production there are a number of requirements which must be met. Firstly, it is important that the correct wood fuel is used, whether wood chips or wood pellets and applying it to the suitable technology. High quality, proven biomass technology should be used, there is currently a number of biomass boiler technology available on the market for example Talbotts, Asgard, Froling, Gejs all supply biomass boilers. The wood fuel to be used must meet the CEN specifications required by the boiler manufacturer.

⁴⁹ Biomass Energy Centre 2008 Installing biomass systems

The woodfuel used in a biomass system whether virgin timber or waste wood should ideally have a moisture content of at least 35%, above this then the calorific value of the wood decreases. Wood fuel with a 25% moisture content is going to have a calorific value of approximately 3800kW/tonne compared to a wood fuel with a moisture content of 35% having a calorific value of approximately 3000kW/tonnes (ignite). As well as affecting the calorific value of the wood fuel the moisture content is also important when selecting a biomass boiler as different boilers are able to burn wood with different moisture contents. Selecting a biomass boiler that can burn woodfuel with a low moisture content has several advantages including: a physically smaller system is required, which in turn mean less storage space, cheaper transport costs and less chance of the fuel composting during storage (BMC).

CHAPTER 10

10.1 CONCLUSION

From carrying out this report it has become obvious that waste wood still faces some barriers in recovering energy from waste wood. Legislation appears to have the largest impact on waste wood; WID in particular is complex and difficult to comply to especially when there is considerable ambiguity regarding what should be classed as waste wood.

Another issue is trying to calculate the quantity of available waste wood in the North East as some figures given by the Government, for example, the municipal waste stream contain all types of waste not specifically waste wood. Little real data gathering occurs across timber industries and so there needs to be an improvement in the volumes of waste wood produced in order to represent an accurate figure.

From the report it was highlighted that a large volume of waste wood derives from the construction and demolition waste stream. Unfortunately the vast majority of this waste wood cannot be used for energy recovery due to the contaminants it contains, therefore a set standard needs to be developed during the sorting and segregating stage to try and remove these contaminants in order for waste wood to be classed as safe to use as a fuel source. A standard should also be developed during the recycling process to ensure the waste wood end product meets a certain quality. This would help strengthen the wood waste market as wood waste users would be guaranteed a wood chip/pellet of a certain quality.

The UK Waste Strategy (DEFRA, 2006) sets out a policy framework for recycling and reusing waste wood through energy recovery from waste biomass. Other wood recycling facilities, such as UK Reclamation and Recycling Ltd in Sunderland and UK Wood Recycling Ltd at Teeside, agreed that the majority of the sorting is done by a simple visual process e.g. identifying nails, paints, varnished wood, however, samples of the wood waste are sent off monthly to third parties for chemical testing. In this study the problem of unknown contaminants appeared to be a recurring problem in the processing of waste woods as biomass.

Although the Environment Agency has tried to produce a Quality Protocol on waste wood they have unfortunately been unsuccessful in trying to do so. Gaps of information concerning the quality controls put in place and what standards are in place has meant that a Quality Protocol could not be produced. The Quality Protocol is going to be reviewed in 2009 and it is hoped that clean non-virgin timber will be declassified as waste so that it can become a successful and highly marketable fuel source.

Annex

Annex 1. Template for the specification system of Solid Recovered Fuels.

Part 1 – Properties obligatory to specify

- Class Code The class code is the net calorific value, chlorine and mercury content.
- Origin Origin of the in the waste used for preparation of the SRF shall be specified. Can be done according to the European waste List (EWC)
- Particle Form Particle form of the SRF shall be specified. E.g. pellets, bales, briquettes, chips, flakes and powder.
- Particle Size This shall be specified be sieving or equivalent techniques and expressed as dx, where d is the particle size in the distribution curve where x % passes according to prCEN/TS 15415, solid recovered fuels.
- Ash Content The ash content shall be specified on a dry bases according to prCEN/TS 15403.
- Moisture Content This shall be specified as received according to pr CEN/TS 15414
- Net Calorific Value The NVC shall be specified as received and on dry bases according to pr CEN/TS 15400
- Chemical Properties The chlorine content shall be specified based on dry basis according to prCEN/TS 15408. the content of each heavy metal separately as well as the sum thereof as mentioned in WUD shall be specified on dry basis according to prCEN/TS 15411. The heavy metals are antimony, arsenic, cadmium, chromium, cobalt, copper, lead, magnesium, mercury, nickel, thallium and vanadium. Cadmium, mercury and thallium are not included in the sum.

Part 2 - Properties voluntary to specify

- Biomass Content The biomass content of the SRF should be specified and shall then be measured according to prCEN/TS 15440

- **Composition** This is the weight % of the mean fractions of wood, paper, plastics, rubber, textiles etc. The basis (dry or wet) should be specified.
- **Fuel Preparation** Fuel preparation depends on the input waste and the field of application. Since the preparation effects the properties of the fuel it should be described. The description also gives valuable information to the end-user how to store transport and handle the fuel. Common fuel preparation techniques are given
- **Physical properties** Examples of other parameters that may be used for specifications to the SRF are bulk density, volatile content and ash melting behaviour.

There are several other properties that may be used for defining SRF. Such properties like dusting, odour lignin temperature may be added to the list of information parameters in the template.

Also = Rough draft of grading/classification of waste wood table.