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FORESTS FOR THE COMMUNITY THE MERSEY FOREST

Of Chips and Logs…

Making the most of Local Authority Arboricultural Arisings in the Mersey Belt

Report to Forestry Commission
North West England Conservancy

Forestry Commission England

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Executive Summary

The study examined the amounts, types and destination of arboricultural arisings generated in the Greater Manchester, Merseyside and north Cheshire areas together with the costs involved where local authorities rather than contractors were responsible for disposal.

Around 10,000 tonnes of arboricultural arisings are produced each year in the study area and the annual disposal costs amount to almost £170,000. While this amounts to an average cost of £17 per tonne, the amounts of arisings reported varied from authority to authority depending on the amount and type of work done by contractors together with the amount left on site. A further influential factor on arisings generated was felt to be whether tree management was reactive or proactive, the former generating more arisings, here again both approaches were found. Some local authorities managed to dispose of all their materials, chip typically being blown back on site or used on other sites such as allotments. Logs were put to a variety of end uses ranging from firewood to milled material. For many a considerable amount of material was sent to green waste recycling facilities where prices ranged from £5 to £60 per tonne. However, no material appeared to be going to landfill.

The case studies both within and outside the study area showed that both the amount of arisings and costs could be reduced by a variety of means ranging from cutting down double handling to greater control of the green waste disposal contract. In addition there appeared to be good support for the concept of some form of centralised infrastructure, such as a tree station, shared between authorities which could both agglomerate and process arboricultural arisings so as to remove them from the costly green waste stream.

The study exposed particular interest in using arboricultural arisings as a biomass fuel or high quality composted material. Both these areas are studied in further detail. While producing these products is relatively straightforward, space, training and capital expenditure is needed to ensure a consistent quality product.

Background

Trees are a vital part of any urban environment and they have environmental, social, aesthetic and economic values. However, urban trees exist in a harsh environment, in addition to the pests and diseases inherent in any woodland they can suffer from the effects of pollution, vandalism, construction and the installation and maintenance of utility services. Unlike trees in woodlands, those on the street can also cause nuisance, danger to people and above all damage to buildings.

Consequently, urban trees are invariably managed whether actively or reactively because there is little choice. Typically this management consists of either reducing the bulk of a living tree or removing diseased or dangerous trees altogether.

This intervention in turn produces a variety of material (arisings), typically chip, cordwood and brash which often are viewed as a disposal problem both in terms of cost and method. However, legislation derived tools such as landfill tax and recycling credits as well as market forces such as increasing fossil fuel costs, are pushing the better use of these materials which are increasingly viewed as a resource.

This study aims to:

- achieve an understanding of the amount and type of arisings in The Mersey, Red Rose and Pennine Edge Forest areas[1]
- assess their flows and final destinations
- quantify costs
- suggest improvements

The bulk of the technical information in this report has been compiled by Simon Levy with input on composting from Andrew Urquhart of ADAS. The brief, project management and compilation of this report was by Nigel Blandford (Red Rose Forest) and Gareth Mayhead (The Mersey Forest).

[1] ***The Mersey Forest***- The Boroughs of Ellesmere Port and Neston, Halton, Vale Royal, Warrington (and Cheshire County Council in north Cheshire), Knowsley, Sefton, St Helens and The City of Liverpool.

Red Rose Forest- The Metropolitan Boroughs of Bolton, Bury, Trafford and Wigan and The Cities of Manchester and Salford.

Pennine Edge Forest- The Metropolitan Boroughs of Oldham, Rochdale, Stockport and Tameside

Methods

To determine volumes of woody material generated from arboricultural arisings, a questionnaire (Appendix 1) was prepared and circulated to the authorities in the study area. These were followed up by telephone interviews based on the questionnaire with the staff identified as having an overview of tree surgery. In addition contractors working for the authorities were also questioned.

In the Merseyside and Manchester conurbations, responsibility for the disposal of arisings is split between the authorities, in cases where their own staff carry out tree care, and contractors, working on their behalf. In almost all cases disposal is a cost item whether actual in terms of paying gate fees at transfer stations or in terms of labour and transport costs. Most material is chipped on site to reduce the bulk of the load and number of disposal journeys with only the largest material being retained as logs, typically cut to a size for manual lifting. In addition if material can be left on site, normally chip as mulch, it will be.

In spite of being a cost item most authorities and contractors do not record volumes of material produced nor have an absolute idea of cost, especially as for contactors the expense is incorporated in the schedule of rates for each piece of work.

As a consequence the best indicator of volumes of arisings is number of vehicle journeys made to dispose of the material during a working week and this provided the main source of volume information except in cases where weighbridge details were kept. The problems with the accuracy of these measurements are that vehicle movements are "back of envelope calculations", vehicles may not always be full and capacity will vary according to make and type.

To standardise as much as possible the following conventions were applied to questionnaire responses. Most vehicle movements were either transit pickup size (1.5 tonnes) or ford cargo type (7.5 tonnes). Using figures obtained from a recent study[2] an average load volume of $4m^3$ was applied to all van sized vehicles and $10m^3$ per 7.5 tonne Ford Cargo. In addition a conversion factor of $2.86m^3$ per tonne used in the referenced and previous studies, was applied to chip and the same factor was used for logs to give a conservative figure to account for air space within piled logs as well as the average timber density being just lower than 1 tonne per cubic metre.

Where contractor's estimates of arisings differed from local authorities they were taken at face value as in many cases they were brought in to carry out heavy works such as removing Manchester Poplar rather than pruning.

In addition site visits were made to five authorities to see their operations and trace disposal routes. Selection for these authorities was based on several criteria including good record keeping, typical practice and examples of good practice or innovation.

[2] Biomass Fuel Assessment for Z squared: BioRegional Development Group 2006

The Current Situation

Almost 10,000 tonnes of arisings are produced in the study area each year with disposal costs of nearly £170,000.

*Table 1: Current situation in the study area**

Area	Chip arisings (t/yr)	Solid/log arisings (t/yr)	Brash arisings (t/yr)	Total (t/yr)	Total (£/yr)#
Red Rose Forest	3340	1208	0	4548	£62,500
Pennine Edge Forest	927	350	26	1303	£6,106
Greater Manchester sub total	**4267**	**1558**	**26**	**5851**	**£68,606**
The Mersey Forest	2463	733	0	3196	£100,918
Total*	**6730**	**2291**	**26**	**9047**	**£169,524**

*Figures exclude Wigan, Oldham and Knowsley.
#Note that not all local authorities are paying for disposal.

The amount of arisings generated by local authorities ranges from over a 1000 tonnes per year to just over 200 tonnes. Most figures were the result of the number of van/truck loads generated over a year and are at best rough estimates. A few councils had very accurate records from weighbridge tickets. St Helen's and Halton were in this category, and interestingly, both generated just under 500 tonnes per year. Figures may also be distorted by recent extensive felling of Manchester Poplar and Horse Chestnut as a result of disease.

Four councils are currently not paying anything to get rid of arisings whereas others are paying a considerable amount. The largest yearly disposal cost of any single authority was £40,000. Surprisingly, the rate per tonne for disposal through recyclers varied considerably from £5.00 to £60.00 per tonne. For reference Greater Manchester Waste charges £44.12 (+ VAT) per tonne for green waste and £61.14 (+ VAT) per tonne for trade waste.

Not all councils questioned had an exact idea of the costs of disposing of their arisings as often these costs were paid by someone else within the organisation. In these cases estimated volumes were multiplied by the known rate per tonne for green waste disposal. When contractors dispose of their arisings this is not a direct cost for the council as it is typically included within the schedule of rates for arboricultural work.

From this study it appears that no material generated by local authorities or indeed contractors is going to landfill.

There are some differences between Greater Manchester and Merseyside/Cheshire. Local authorities in the former area all have Direct Labour Organisations to carry out tree works and contractors are used less. In Merseyside some authorities such as Liverpool and Sefton carry out all their work via contract and therefore costs of disposal are included in the schedule of rates.

A significant amount of chip material is actually blown back on the area felled (see picture 3 (page 9) of Leverhulme Park), put on nearby shrub beds, paths or given to stables and golf courses before it gets back to a yard. Often when chip gets back to the yard it is then used in a similar way by landscape teams or again by stables etc. This is the case at Rochdale. Consequently councils such as Bolton and Sefton do not have any costs for chip disposal. Some authorities, such as Salford and Halton, do send chip in for recycling. Here the material is typically processed by private companies into mulch and sold on to a variety of markets from landscapers to land reclamation sites. Some companies also pass on material to farms where material is ploughed into land.

Logs and solid material present more of a problem as they can rarely be left on site but they do have a wider variety of end uses. For many councils, a small amount of logs may be taken as firewood, the majority are sent to green waste recyclers for shredding and composting. Tameside have a similar approach in that they pay for their logs to be shredded but use the resulting material themselves.

Other councils have cheaper or more innovative solutions, for example, Bolton (see case study) have all their logs collected by one of their arboricultural contractors who processes it all for firewood, most of which is sold to one merchant. Many contractors also sell firewood and some authorities, typically where there is a yard, let the public collect material. However, the latter approach is generally on a small scale.

In Bolton where a large number of Manchester Poplars were being felled through contractors, the logs were cut to standard length and were picked up from site at no cost for haulage to Kronospan at Chirk for particleboard production. At Sefton the contractors, Glendale, send all their logs to a farm in Warrington where it is used to produce heat and power from a small scale gasification unit. One of Trafford's contractors Frankland Tree Services is milling timber on a mobile sawmill and selling it successfully while another produces rustic items and chain saw sculptures. Liverpool City Council also indicated that better logs are sold into the timber market as is good beech from Bolton.

Brash is not a large component of the arisings generated in the study area as in most cases it is chipped to reduce its bulk. Some authorities such as Halton still produce brash as for financial reasons not all gangs have chippers. In all cases this material goes to green waste recyclers.

Case studies

Visits were made to five of the authorities in the study area to see how arisings were handled, which included visits to contractors dealing in green waste and one contractor with a firewood business. In all cases the common theme was the use of arisings as mulch with varying amounts put onto beds, used for paths or employed instead of herbicides for tree establishment. Chip was sent to green waste recyclers by two of the councils as am alternative.

Logs were dealt with in a variety of ways ranging from firewood to a potential source of heat and power. Only in one case were logs taken for milling which was the very specific use of beech for clogs.

Salford City Council
Salford are one of the authorities with the highest disposal spend in the study.

Whilst Salford do blow back some chip onto beds, most of their arisings are brought back to Buile Hill Park to a small yard where both the arboricultural and landscape gangs deposit material (picture 1).

Picture 1: Wood Chip Stored at Buile Hill Park

Here chip and logs are put in two bays approximately 10m x 10m. When these bays are full they are emptied by a JCB into skips and taken to JWS Waste and Recycling Services Ltd, nearby in Salford. The JWS site was visited and proved to be a sorting depot from which green waste material is taken to a composting facility, Whiteman's

Horticultural or a farm where the material is again composted and apparently ploughed in.

Salford have also secured a small yard 30m x 100m (picture 2) adjacent to their office at Buile Hill which in turn is next to a council nursery with public access.

The site is small and relatively narrow which is a limiting factor as regards producing their own mulch as the ability to windrow and turn large piles of arisings is limited. This could be solved by using vertical composting but additional organic material such as chicken manure will be required to achieve the required working temperatures. However, there is the opportunity to use the site to add value to timber, producing items such as charcoal and firewood for sale through the nursery and also offering opportunities for work experience for people with learning difficulties etc. The arboricultural officer is keen to encourage this approach.

Picture 2: Future Tree Station Site at Salford

Bolton

Bolton is an authority who currently has few direct disposal costs. A large amount of material is blown back on site where it is felled as picture 3, below, of Manchester Poplar felling at Leverhulme Park shows.

It is interesting to note that the timber from this particular job (carried out through contractors) was cut to 9ft (~2.7m) lengths and collected by a timber haulier at no cost who subsequently sold it to Kronospan for use in particleboard manufacture.

Arisings not utilised on the felling site are brought back to a yard where the chip pile is used for mulching beds and paths.

Picture 3: Poplar Felling at Leverhulme Park with chip blown back on site and logs stacked for Kronospan

Logs deposited here are all collected by one of Bolton's contractors, Tree Care, who pick up the logs by hand and process it all in to firewood at their nearby yard (picture 4).

Here the wood is cut by chain saw and split by machine. The unseasoned firewood is typically collected by a merchant who pays £35 for a transit load. Four loads can be processed in a day which, Tree Care indicated, with current labour rates is profitable. Tree Care also sells seasoned transit loads for £80.00 and have a bulk bag system using a small transit mounted crane. It is interesting to note that all types of wood from leylandii to sycamore are used and that a reasonable price is achieved for this material in unseasoned condition.

Picture 4: Bolton's Logs Cut and Split for Fire Wood

Rochdale

Rochdale is another council who currently do not pay directly for disposal and like Bolton much material is put back on beds. Other material comes back to a yard at the council nursery where it is put into bays prior to the chip is being taken away for mulching.

Logs are used for firewood on a small scale, large beech when felled goes to a clog manufacturer and some timber has been used on a very occasional basis for sculpture.

Perhaps the most interesting development for Rochdale is the proposed purchase of a Talbot's wood chip boiler to heat a nursery. The current intention is to use wood chip from Rochdale's arboricultural works, however this may need to be thought through as smaller wood chip boilers are much more sensitive to moisture content and chip quality than larger mass burn units (see section on chip for fuel, page 23). Given the high existing use of chip in Rochdale current practices may have to change in order that enough is provided for the boiler and consideration will have to be given to achieving suitable moisture content and quality.

Picture 5: Logs stacked for chipping for the proposed wood chip boiler at Rochdale nursery

Halton

Halton produce both chip, brash and logs from their arboricultural operations. Due to financial constraints not all gangs have chippers therefore meaning that brash arisings have to be dealt with. Again where possible, chips are left on site. Material brought back to the yard at present is not stored except for a small amount of logs which the public can pick up although the loner term intention is to build bays. Material is put into a trailer which when full is taken to either Widnes Skip and Reclaim (for logs) or Mersey Waste's Haddocks Wood composting facility for brash and chip. There was in addition a large pile of logs quietly rotting at another yard located at Runcorn Hill.

It transpired that Widnes Skip and Reclaim now run Haddocks Wood (picture 6) as sub contractors to Mersey Waste. Widnes Skip and Reclaim shred logs and then take them to Haddocks Wood. Haddocks Wood was a well run composting site with incoming material controlled to reduce contaminants such as plastics.

The site received 12,000 tonnes of material per annum with 8,777 tonnes of material being sold and 631 tonnes being rejected largely due to contamination. It was felt that the 2592 tonnes that are unaccounted for could have been lost as the result of the composting process although it was not felt any definitive statement could be made as regards percentages lost. Arisings are shredded and windrowed with mulch being produced to PAS 100 standard for which accreditation was pending. Now run by three staff the mulch is sold at £1.50 per tonne to large companies with bulk orders and from £5 to £8 per tonne to small landscapers.

Picture 6: Composting at Haddock Wood

Sefton
Sefton's arboricultural work is currently carried out by Glendale. Chip is disposed of either on beds or via local stables and it rarely comes back to the yard.

Logs are taken to Jepsom Brothers at Little Woolden Hall Farm, Warrington where they are currently being used in a small scale 85kW gasifier for the production of heat and power. Currently the gasifier is installed and ready but is waiting for the connection to the grid. In addition the Jepsoms are currently working out the best system for producing the fist size chip which is ideal for this particular machine. Estimated chip consumption is some 800 tonnes per annum.

Reducing Arisings

This study demonstrates a wide difference in the cost of dealing with arboricultural arisings as well as the ability of many authorities and contractors to avoid the need for secondary processing of their material. As may be seen from the preceding section there are also numerous examples of good practice as regards creating products from arboricultural arisings. However, before examining "end of pipe" solutions there are several ways of reducing the amount of waste generated in the first place.

Planned, Regular Inspections and Pruning

It is generally accepted that proactive management of urban trees via such means as regular inspection and pruning cycle generates less arisings and is cheaper to run as:

- Tree work tends to be more severe if there is a problem requiring reactive work than the pruning carried out under a planned maintenance;
- Lack of management can mean that trees become unfit for their original purpose e.g. trees growing too large for their location;
- Costs will be less if tree surgeons are progressively moving through an area on a proactive pruning cycle rather than rushing here and there for reactively managed tree work.

Case Study: Elmbridge Borough Council, Surrey

Formerly managed on a reactive basis only as problems arose, Tree work was more severe than under a planned maintenance regime and the tree gang would have to move from area to area rather than remaining in one, wasting time and resources.

This situation was stopped by a new tree officer who implemented a planned maintenance system putting highway trees on a cyclical programme completed every four years. This after an initial period where more arisings were generated has now significantly reduced the amount of tree work and the arisings generated. Maintenance has become quicker and the area covered in a given time larger. Reactive work is still and will always be necessary but it is diminishing and has been reduced to some 20% of work carried out. Using a database management system has also been a useful tool in the pro-active management of Elmbridge's highway trees.

Case Study: Milton Keynes Parks Trust

The Trust was set up to manage parks and road sides of the new town and their tree and landscape management is an exemplar of good practice. In addition to a proactive pruning regime, all contracts are managed via a system of related schedules, maps and diagrams which define the exact nature of the work to be carried out, how it should be done and also form the tender for pricing. Thus as opposed to different tree gangs interpreting crown reduction or pollarding in their own way the exact method is prescribed and consequently the amount of arisings controlled.

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Selecting the Right Species

Many authorities have a legacy of large high maintenance street trees. Partly due to inappropriate species selection in the first place and partly because pruning cycles were more regular in the past with a fashion for smaller or pollarded crowns. These trees are often now so large that it is creating problems with pavement surfaces due to root growth. Most agree that where these inappropriate trees occur they should be removed and replaced with a variety of tree which is compact, requires less maintenance, gives less arisings and is suited to a highway environment. However, the removal of the larger trees is considered costly. Basic economics however tell us that if the tree is at a stage where it needs to be removed it is better to do it now than at an unknown point in the future. In addition there would be less need for costly pruning during the intervening time period.

All trees that need to be replaced should be replaced as soon as possible but care should be taken to ensure replacement is phased to allow for consistency in future work programming.

New varieties of compact trees require less maintenance and generate less arisings. Care needs to be taken to ensure a range of species is planted and this is particularly the case where clonal trees are used. As we have seen with Manchester Poplar, clones are particularly susceptible to diseases and their removal generates a large amount of material over a short timescale.

Case Study: Bury

Bury Council has around 3500 highway trees. Some of these trees can be found in terraced streets, such as the one featured below (picture 7), comprising of large specimens such as ash and maple. While they form a dominant feature in the street, they do require regular pruning. Pruned every four years each tree can generate up to 1m^3 each visit. New compact varieties require little maintenance after an establishment period and generate little or no arisings in the first 20-30 years. Over 24 years that would account for a saving of up to 6m^3 or around 2 tonnes or £88. While it might seem like a good idea to replace the larger tree the frequent response is that it is too expensive to do this. However, as noted in the main text this isn't actually the case when you realise the tree will have to be removed and replaced at some time anyway and it is cheaper to do it now than leave it until later. The figures (table 2) show a 24 year period and assumes a 2.5 % inflation rate.

Picture 7: Large trees in terraced street

Table 2: Costs of replacing a tree now vs keeping it for 24 years

Option 1: Retain existing large tree and replace at Year 24	
6x Prunings @ £68 each current value	£570
12x inspections @ £20 each current value	£329
Remove at year 24 @ £370 current value	£683
Replace with new compact tree year 24 @ £275 current value	£485
Total cost	**£2067**

Option 2: Remove large tree and replace now	
Remove large tree at £370 current value	£370
Replace with new compact tree at £275 current value	£275
3 X watering years 1-3 @ £10 current value	£30
Remove stake at ties at year 5 @ £10 current value	£10
12x inspections @ £10 each current value	£163
Total cost	**£848**

Saving by replacing tree now rather than in 24 years	**£1219**

Case Study: Milton Keynes Parks Trust
The Trust go one step further in the greenspace environment in the selection of appropriate species and deliberately plant and maintain high value species in order to generate timber income amongst which are cricket bat willow, 170 of which generated some £16,000 and hybrid poplar 38 tonnes of which was sold for £755.

All these approaches serve to reduce the amount of arisings which require disposal.

How to Reduce Disposal Costs

While arisings can be reduced some will always be generated and there is usually a cost associated with disposal.

Taking Control

Whilst cheaper disposal costs can be available these may not always be in the control of tree officers and authorities may be locked into contracts. Without direct control most officers spoken to did not have a clear idea of the amount of arisings produced. More efficiency both in cost and disposal may be realised by tree officers being given control of arboricultural arisings and their disposal as they are best positioned to set targets, make improvements and changes as indicated. It is not the case that the tree officer should take direct control of processing the arisings but be in the position to divert the arisings towards the most appropriate use or disposal option. Those authorities with little or no disposal costs are those where the arboricultural manager has control over disposal. Those authorities with the largest disposal cost were those where the arboricultural manager had no control over the disposal of the arisings.

Educate Operatives

Good training of operatives to recognise opportunities for products and recognise the best means of preventing material requiring to be disposed of as a cost item. This can be seen with the approach undertaken by Frankland Tree Services (case study, page 36).

Keep Main Trunk in One Piece

Where whole trees have to be removed, particularly where a number are taken down in the same day/week a decision needs to be taken about whether to cut them into easy to handle rings to go back to the yard or leave them in length for collection. Trunks left in suitable lengths can provide an income from planking, particleboard or firewood markets, but a reduction in length diminishes this opportunity.

Chip Less

For ease of working, it is typical that most material less than 8 inches in diameter is fed through a chipper. Any logs over 3 inches diameter and longer than 2 metres may reach a specification for firewood or particle board markets. If you can meet the specification, volumes and secure a market, then it will be possible to maximise cost savings (or income) by chipping less. There may also be a capital saving on a smaller chipper if this market is available in the long term.

Spray Back Where Possible

The most noticeable method of reducing costs is blowing the chip back where work is taking place or retaining it in-house for use as mulch for bedding. Where appropriate this approach should be encouraged bearing in mind issues such as disease and over absorption of nutrients.

Where Does the Material Go First?

Try to reduce double handling wherever possible. It may be possible to take the material straight from the job to the recyclers not to the yard. However, is it really is cheaper? For example sending it from site to a distant allotment in the back of the arboricultural gang truck complete with crew may be more expensive than taking it straight back to the yard and incurring the commercial recycling costs.

Store Chip and Solid Separately

There is a clear quality and price differential between chip and log material. Log at worst costs less to dispose of and at best may actually earn some money. Therefore a basic two bin/bay storage system should be initiated at the yard. Even if you can't find a firewood contractor to take your solid material away for an income or free, companies like Hadfield Wood Recyclers, Boden's or Armstrongs can offer a lower cost option for solid, log type material as compared to chipped green material.

Shop Around For Disposal

Ensure that if material is sent to green waste recyclers that the best value is obtained. Figures for this type of disposal range from between £5 per tonne to £60 per tonne. A big single authority contract run by operational services should offer good value for money and be run efficiently. However, this isn't always the case.

Issues to Consider

The Waste Issue

An increasing issue is legally defining what the arisings actually are. They may be a product. If not they may be considered a waste and this opens up a whole raft of legislation that may have to be complied with.

From the Environmental Protection Act 1990 waste includes any substance which constitutes a scrap material, an effluent or other unwanted surplus arising from the application of any process or any substance or article which requires to be disposed of which has been broken, worn out, contaminated or otherwise spoiled; this is supplemented with anything which is discarded otherwise dealt with as if it were waste shall be presumed to be waste unless the contrary is proved. This definition was amended by the Waste Management Licensing Regulations 1994 defining waste as 'any substance or object which the producer or the person in possession of it, discards or intends or is required to discard but with exception of anything excluded from the scope of the Waste Directive.'

The Environment Agency at Warrington recognises that this is a difficult area to assess as there will be individual cases that fall either side. However, considering that arboricultural arisings can be classified as a waste in many situations it is best to treat them as such for any licensing requirements. The Environment Agency cannot say what European Waste Catalogue Code arboricultural arisings best fit without inspecting an individual sample in relation to an individual issue. However, previous discussions have indicated that code “20 02 01 Municipal Waste/Gardens and Parks Waste/Biodegradable Waste” may be a catch all, safe bet code although equally in terms of physical characteristics it is almost identical to “02 01 03 Forestry Waste/Plant Tissue Waste”. What code it comes under has some bearing on licensing requirements and exemptions. Firstly a Carriers License from the Environment Agency is needed. This costs £140 for 3 years and then a £90 renewal fee every 3 years. It is only needed for the whole organisation/company therefore the local authority arboricultural team will be covered by the general local authority license. It would be prudent for the arboricultural team manager to know the contact details of the person in the authority who deals with this license. Secondly any arboricultural yard where arisings are stored will need a “Paragraph 21 Exemption” under Schedule 3 of the 1994 Waste Management Regulation from the Environment Agency. There is no fee for this and it also allows for chipping, shredding, cutting and pulverising at the specified site for the purposes of recovery or reuse. Finally no waste transfer notes are needed where a local authority team bring back arisings to the yard but if a contractor working on behalf of the council brings back arisings to the yard then waste transfer notes are needed.

This is mirrored by the experience within the study area. Where arisings have been diverted to a central depot which may deal with other wastes, issues have arisen. Where private contractors have a yard drawing in material from a wider area there have been issues. Where a council team have a separate yard dealing with only tree arising from council land there have been very few issues.

It is also worth noting that few private contractors questioned had any exemptions or licenses. Therefore it is important that where a local authority tenders work they should be stipulating that the contractor has the above paperwork in place.

The open burning of tree waste material as a disposal method is frowned upon due to the nuisance it can cause and conflict with the Environmental Protection Act 1990 and Clean Air Act 1993. It would also need a "Paragraph 30 Exemption" under Schedule 3 of the 1994 Waste Management Regulation from the Environment Agency. These are difficult to come by, for example, anecdotal evidence suggests that they are often refused in the Manchester area. It also only applies to an area where the waste was generated so while it might be possible to burn in the arboricultural yard you would only be able to burn material from the park or open space where that yard is situated.

However, there are fewer restrictions if the material is burnt in an appliance as a fuel to generate heat or is burnt to produce a product. In this manner arising can be burnt to produce heat for drying firewood or fuel chip or burnt in kiln or retort to produce charcoal. It would require a "Paragraph 5 Exemption" under Schedule 3 of the 1994 Waste Management Regulation from the Environment Agency. Compliance would still have to be made with the Clean Air Act (smoke emissions)[3].

Compliance will also have to be made with the Waste Incineration Directive (WID) as implemented through the Pollution Prevention and Control Regulations 2000 (PPC 2000). Charcoal production is excluded from PPC 2000 through Section 5.5 Production of Fuel from Waste , Part A(1) (a) Making solid fuel (other than charcoal) from waste by any process involving the use of heat. Therefore there are no PPC 2000 regulations to be met with relation to charcoal production. With regard to heat generation, for example fuel drying or office or greenhouse heating this would come under Section 1.1 Combustion Activities rather than Section 5.1 Incineration. In nearly all circumstances the thermal rated input of the fuel is unlikely to be over 400kW/hr. In such circumstances it is not subject to control under PPC 2000. There may be a rare occasion whereby an installation is rated at greater than 400kW/hr but less than 3Mw/hr in this situation it falls under Part B (c) (i) / (ii) and it is controlled via the local authority.

However there are a few exemptions in WID. Firstly Vegetable waste from agriculture and forestry (Article 2(2)(a)(i) and Wood Waste (Article 2(2)(a)(iv)) provided it does not contain halogenated organic chemicals/heavy metals from wood preservative treatment/coating. While this may be seem acceptable, the Environment Agency may consider that tree surgery arisings best fit biodegradable park and gardens municipal waste and not the above categories. Further clarification should be sought from the Environment Agency if you are unclear on any of the above.

[3] DEFRA (2004) *Guidance on: Directive 2000/76/EC on the Incineration of Waste Edition 2* available on the DEFRA website at http://www.defra.gov.uk/corporate/consult/ppc-wid/guidance.pdf accessed on 23/08/05.

Healthy Chip?

Whilst both authorities and contractors are resourceful in their handling of arboricultural arisings, the main procedure of utilising chip straight back on the felling site, shrub beds etc does have several issues as well as benefits.

The first is the spread of disease. Forest Research[4] indicates that in the case of bleeding canker of horse chestnut "chipping of infected material is not recommended in case it creates aerosols and leads to disease spread". Burning or burial are recommended in this case as being the best disposal method for diseased wood.

Secondly whilst wood chip as mulch maintains soil moisture, fresh wood chip as it decomposes uses nutrients that would otherwise be available for plant growth and unless composted is likely to tie up nitrogen during early stages of decomposition.[5]

Creating Markets

It is important that if products are made that there is a market for them. Consequently one of the main drivers for the better use of arisings should be the wider application of chip for energy especially as with higher fossil fuel prices the economics look increasingly good. In addition to the Rochdale nursery proposal, a new leisure centre in Southport will have a biomass boiler and Liverpool Royal Hospital who already have a gas Combined Heat and Power Unit have investigated the use of biomass. Consequently if chip for heat could be encouraged in tandem with a quality supply from arboricultural waste there are real possibilities.

This point also applies to milled products and provided supply is viable local authorities should be encouraged to buy items made from their own arisings.

Certification

Linked into all the markets above is forest certification[6]. Forest certification offers an independently audited verification that woodlands and street trees are being well managed accounting for economic, social and environmental criteria. Standards are assessed against the UK Woodland Assurance Standard (UKWAS). The majority of large woodland estates in the UK are certified and increasingly local authorities are achieving certification for their woodlands and street trees. Reasons that local authorities choose to certify include realising non-timber benefits; proving that woodlands are sustainably managed; justifying spending public money on woodlands; corporate protection; links to "green" purchasing policies and access to grants and assistance. With respect to street trees good records are required as is a good element of pro-active management and certification helps to achieve this.

[4] http://www.forestresearch.gov.uk/fr/IND-6L4ET9
[5] http://www.ces.ncsu.edu/depts/hort/consumer/factsheets.html
[6] http://www.ukwas.org.uk/index.php

The link into markets is a major point and was the principal reason that the London Borough of Croydon obtained certification. The main charcoal market, two of the firewood suppliers listed above and Kronospan (see wood specification, Appendix 2) all require certified timber either as a preference or mandatory requirement. Certification consequently gives access to markets and is also worth considering from a management and political perspective.

Within the project area Sefton have recently attained certification for their woodlands which is a great achievement.

Urban Forestry Products

Chip for Fuel

Currently there are only a small number of heating installations planned for the study area. These are relatively small and there is no equivalent to Slough Heat and Power.

Inevitably the smaller the installation the higher its chip specifications and for a reliable operation and low running costs a consistent supply of high quality wood chip is essential. Wood chip quality is determined by:

- The size assortment of the chips including slivers and fines matching the specification of the boiler or CHP system. This typically needs to be regular and between specified sizes and for many systems long stringy pieces can jam the auger feeds.
- Moisture content in the range 15–30% is optimal for most boilers. Wood chip made from freshly cut material has a moisture content of 60% (figure 1, below).
- No green content.
- No contaminants, including ferrous & non-ferrous metals, paints, varnishes, chemical treatment, stones and grit.

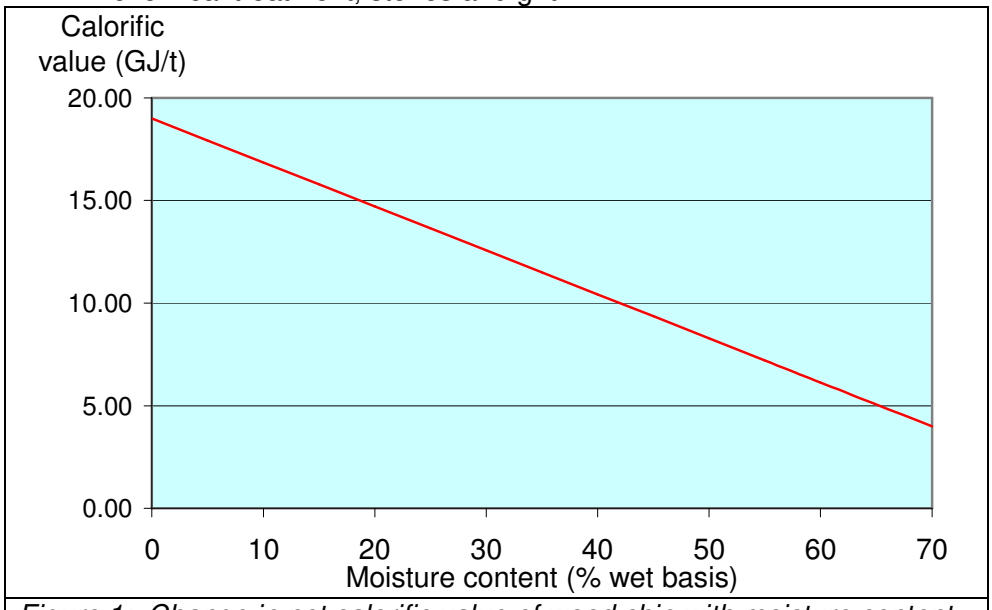


Figure 1: Change in net calorific value of wood chip with moisture content

These points are reflected in the British Biogen (now part of the Renewable Energy Association) classification for woodchip (Appendix 3). However, it can be seen that the chip received in the yards of Merseyside and Manchester will not meet the specification for small heating units without an investment to improve its quality as fuel. It is a mistake that has been made time and time again with small installations being erected and remaining at best partly functional due to the lack of adequate quality fuel. This is particularly pertinent point with respect to Rochdale's new wood chip boiler.

It must also be remembered that an investment needs to cover the following:

- Space and concrete hard-standing with good access for large vehicles.
- Covered storage for finished product which will allow further drying.
- Screening facilities to remove oversize chip and other contaminants.
- A chipper capable of chipping large diameter logs.
- Simple, low cost drying facilities.
- Materials handling equipment for logs and chip.

At the Croydon tree station (case study, below) the above equipment cost £190,000 using second hand plant with the drying shed and hard standing costing £60,000.

Additionally if the site is to receive other organisations waste then a weighbridge for incoming and outgoing chip measurement may also be advisable.

Some equipment, such as the chipper can be bought in mobile configuration and shared between several sites, moving from one to another as logs accumulate and can also be hired out for this purpose.

As can be seen in the Croydon example, below, a vital part of a tree station which can produce a quality chip is the ability to collect a gate fee together with economies of scale.

Case Study: London borough of Croydon and Slough Heat and Power

In London the market for arboricultural chip as fuel has developed over the past 5 years with the emergence of Slough Heat and Power as a significant customer. This market is likely to develop as other installations come on line, for example, the biomass CHP system for Bracknell town centre.

The drivers for this are:

- The policy changes to promote renewable energy in the capital through the 10% on-site renewables requirement for larger new developments.
- The increasing cost of fossil fuel. With wood chip at 1.2p/kWh compared to gas prices approaching 2p/kWh the lifetime costs for a biomass heating system are now often below mains gas whose price is predicted to rise in the long term with demand rising and extraction not keeping pace with demand.

Picture 8: Wood Chip Production for Slough Heat & Power at Croydon's tree station

Slough Heat and Power[7], is a combined heat and power plant using around 180,000 tonnes a year of biomass. The plant is a large mass burn installation which consequently has a very broad specification for chip supply (see Appendix 4) allowing material between 5mm and 50mm in size with a moisture content of 50% (freshly cut wood is normally at 60%) but no contaminants such as plastic, metal and stones.

A good example of an operation supplying arboricultural arisings to Slough Heat and Power is at the London Borough of Croydon's tree station. Formerly Croydon used to dispose of its arisings through composting, charcoal, firewood, sawmilling and burning which still left a small mountain of logs at their site. In partnership with a local NGO, BioRegional Development Group, the council's arboricultural contractor has set up a supply system for wood chip which is currently supplying Slough Heat and Power.

Feed is both log and chips. Logs are either put through the chipper or if oversized split using a horizontal Posch splitter mounted on the back of a tractor with a timber grab. The chip is then discharged into a covered barn. Chips from tree work are tipped off the back of trucks and fed with a front loader into reciprocating screens into the covered barn. Undersized chip is then put into the green waste for mulching and oversized is chipped again.

The saleable material is then loaded onto 25 tonne bulkers and is collected by Slough Heat and Power. The economics of the site are that Slough Heat and Power pay £10 per tonne loaded ex yard and in addition the arboricultural contractor collects £22 of the sites £25 per tonne gate fee in addition getting £10 per tonne for arisings from his own

[7] charlotte.bruton@tvenergy.org

contract. Current production costs discounting any capital investment are estimated to be in the order of £6-£7 per tonne. The chip side of the site which is part of a larger composting site is typically manned by one person. As well as a small front loader the site has a JCB and an MB Trac used for moving the chipper. All machinery was bought second hand which has proved sustainable for a site which receives some 2000 tonnes of material per annum

Picture 9: Logs awaiting chipping at the Croydon Tree Station

The type of chipper used is crucial. Originally the hand fed Laimet chipper used produced good chip but required too much splitting to convert sufficient material. The second chipper a large Bandit could not cope with rounds and short lengths of wood typically produced by tree surgery and jammed. The third chipper a Rudnick and Enyrs was again more suited to forestry waste and could only produce 30 tonnes a day, but the fourth chipper a Jenz 35 can produce 20 tonnes an hour. Here the important lesson was to identify the appropriate machine by an on site inspection of it working with similar material and to not necessarily trust the salesman's patter. Machines suitable for most situations are available and a wide range of second hand equipment can be bought in Europe where the production of wood chip fuel is more common.

BioRegional Development Group have identified[8] that the drum chipper is ideal for a tree station processing arboricultural waste with inputs of 2000 tonnes per annum. These chippers are able to process both arboricultural arisings and, provided the correct blades are fitted, are equally capable of chipping waste pallets and clean timber from demolition

[8] Biomass Fuel Assessment Op Cit

sites. Drum units can take larger diameter timber as they can chip material across the full width of the drum, and can therefore incorporate a larger in-feed 'throat' than equivalent sized disc machines, whose intake is limited by the radius of the disc.

Table 3: Estimated cost of wood chip fuel delivered from Croydon tree station

			Ex-site, loaded on truck		Delivery	Estimated delivered cost		
	mc%	£/t	£/odt	p/kWh	£/t	£/t	£/odt	p/kWh
Slough (current price)	45.00	13.00	23.64	0.49	8.00	21.00	38.18	0.80
small local delivery (undried)	45.00	25.00	45.45	0.95	14.00	39.00	70.91	1.48
small local delivery (dried)	30.00	34.00	48.57	0.96	17.00	51.00	72.86	1.44
small local delivery (extra dry)	25.00	37.50	50.00	0.98	19.00	56.50	75.33	1.48
large delivery (undried)	45.00	25.00	45.45	0.95	9.50	34.50	62.73	1.31
large delivery (dried)	30.00	34.00	48.57	0.96	12.00	46.00	65.71	1.30
large delivery (extra dry)	25.00	37.50	50.00	0.98	12.00	49.50	66.00	1.29
Please note: these are budget figures only and although they are intended to give a realistic estimate of the likely cost of supply, they should not be taken as an offer to supply at a particular price. Delivery costs per tonne vary because it is volume rather than weight based								

Contacts: Nigel Blandford, Red Rose Forest, 0161 872 1660
Gareth Mayhead, The Mersey Forest, 01925 816 217
Mike Ingoldby, Bowland Biomass, 01995 61 829
Andrew Tolfts, Bioregional Development Group 0208 4404 2300

Further information:
"Woodfuel heating in the north of England: a practical guide" available from The Mersey or Red Rose Forests.

Firewood logs

As can be seen from the Bolton example firewood may be a good potential market. Firewood, like most low value wood products, has fairly low profit margins and to make a viable business case relatively large quantities need to be produced efficiently.

Typical firewood production is based on forestry cord wood typically two metre poles from 3" to 15" diameter depending on the firewood processor used. Picture 10, below, shows a typical firewood processor with nearby feedstock run by contractors at Croydon's tree station. It shows a self powered Pallax firewood processor which can be towed. Seasoned wood (one year old) is processed into the back of a trailer and delivered directly to customers. One man with a good quality supply of timber (straight,

clean and of the right diameter) can produce and deliver about six loads a day (each load about half a tonne) with each load selling for £55. This gives a gross income of £330 less timber costs of £84 (£28 a tonne delivered) and fuel costs/depreciation (£30) leaving £216.

Picture 10: Firewood processor and feedstock at the Croydon Tree Station

Using Tree Care's price of £80 per transit load of seasoned logs and assuming about 2m^3 of timber this would equate to £40 in Bolton per Croydon equivalent load giving a net profit of £126 if forestry timber was used.

The other firewood market accessed from the Croydon timber station is firewood nets with 10kg nets selling at £1.74 to B&Q and a similar price to other customers such as nurseries. One man can cut and bag 150 10kg nets per day which equals £261 less expenses of £42 for wood plus £20 for fuel/depreciation leaving £199. The B&Q price is fixed nationally but requires delivery. All the above prices are for seasoned hardwood excluding willow and poplar and in the case of B&Q the wood needs to be FSC certified. In the south east firewood is a fast growing market with cord wood prices rising year on year. The recent collapse of St Regis, a paper mill, at Sudbrook on the Welsh border may change this situation with the potential for over supply of hardwood timber.

Other larger suppliers such as CPL also buy nets and they tend to pay less, typically around £1.00 per bag collected but also accept unseasoned wood of any description.

The production levels above are based on the use of forestry cordwood which can go straight through a firewood processor. However, arboricultural arisings are not so easy to process, they often have rot or other defects, they arrive in various shapes and sizes which make it harder to process uniformly and much of the material will not go through a processor due to being too large. This makes the splitter and chainsaw used by Tree Care the best solution for processing but this is a slower method of production. However, the arisings cost nothing and if a gate fee is charged can bring in money, which makes firewood an attractive proposition.

This situation would be improved by cutting material to pulp lengths where viable and not putting smaller diameter material (3" plus) through the chipper. This would give more material for a firewood processor or direct firewood sale (firewood is currently from £-£20 a tonne at roadside depending on quality).

E&S Fuels, a bulk firewood/fuel supplier, were contacted and were interested in new sources of firewood as supply can be problem for them. Their specification includes softwoods and they are currently importing bagged firewood from Northern Ireland to supplement supply. They buy bagged 10kg logs at around £0.90p per bag for an articulated lorry load.

Like chip a quality product will require some investment. A self powered Pallax firewood processor will be around £5500 and machines which take a wider diameter log cost up to £30,000. Splitters are cheaper and tractor mounted units can be bought for £1200. Smaller cheaper chippers such as the Wessex self powered unit are often not up to the job especially with knotty trees. An ideal set up has a machine processing logs into one side of an open barn and being loaded on the other side via conveyor or front loader. This provides a bank of material which is also drying out prior to delivery but presents other cost items.

Contacts: BioRegional Charcoal Company – Sarah Mooney 020 8942 2414
E&S fuels – Steve Talbot 01524 814214
CPL – Graham Wilson 01246 277001

Lump wood Charcoal

Charcoal has for some years been presented as a panacea for small woodland management as well as arboricultural arisings. The only local authority to have produced charcoal on a commercial basis from arboricultural arisings on a commercial basis is the London Borough of Croydon. At the height of production 30 tonnes of charcoal was made and sold principally to B&Q for use in barbeques. This used 300 tonnes of logs at a conversion rate of 10-1 and earned £20,000. The "technology" used was ring kilns.

As with firewood, using arboricultural arisings is less efficient than forestry cord wood due to the difficulties of processing irregular shapes and packing kilns densely. It was found the most efficient way to load kilns was via a front loader rather than manual packing. Wood was also loaded unseasoned. This gave a lower conversion rate 10-1 rather 6-1 with forestry seasoned. Again in this context production was financially viable only with the assistance of a gate fee or grant.

At Croydon production was shut down largely because of emissions which led to complaint not from neighbours but from council staff working in the adjacent nursery. The ring kiln system whilst cheap and simple is not appropriate for the urban tree station and modern retorts such as the Webster are much cleaner and more efficient but cost approximately £7000. Other systems such as the Hutchinson Viper whose prototype was trialled at Croydon have been too expensive and low on actual productivity to be commercially viable.

Picture 11: Abandoned Viper kiln at Croydon

There is a demand for certified charcoal from BioRegional Charcoal Company who are interested in suppliers in the Red Rose and Mersey Forest areas. Current prices are around £750 a tonne bagged and delivered to local B&Qs.

Charcoal requires a lot of work that is dirty and hard for what is a low return. It also requires long and sometimes irregular hours. Retorts have to be monitored to prevent too much heat building up and generally run over a thirteen to fourteen hour working day with seasoned wood, which may cause difficulties in a salaried environment where overtime has to be paid.

There are currently plans for a charcoal plant accepting FSC certified timber being installed in the Burnley area. If this development goes forward then any authority with FSC certification and correctly specified roundwood in lorry load quantities will be able to send material to this plant.

Contacts: BioRegional Charcoal Company – Sarah Mooney 020 8942 2414

Particleboard Feedstock

Whilst it is hard to specify pulp lengths of timber for much arboricultural work, there are opportunities to produce such material, especially from timber of 3" top diameter and above, which currently is chipped. If such material is accumulated in a central yard or enough is generated on one site the opportunity to put the timber into Kronospan or similar is available. This material can also be used as a feedstock to easily produce chip, charcoal, firewood and other products. From the figures, below, it may be seen that even for Kronospan, pulp specification wood commands a higher value than chip.

Currently Kronospan are offering £21 per tonne for softwood and £20 for hardwood (white wood) from the study area at the mill gate. Wood chip (not including dark wood species) between 12 and 50 mm with a maximum of 15% bark content is £15 per tonne delivered in and £8 per tonne ex yard which is £2 per tonne less than Slough Heat and Power. Specifications are attached in Appendix 2 but softwood is preferred and only white wood hardwood is acceptable. These prices do fluctuate and are currently relatively high.

Some tree surgeons in Bolton, when felling sufficient material to fill a timber wagon (22 tonnes), have cut the wood to regular lengths have had the arisings picked up for free by timber hauliers who sell it to Kronospan.

Contacts; Mark Price (round wood) and Richard Coulson (chip) Kronospan, 01691 773361.

Milled Timber and Niche Markets

It is not uncommon in yards of tree surgeons and local authorities to find usable lengths of round wood. Typically the lack of regular supply, the inability to recognise the potential of many species and other issues such as storage space have resulted in potentially useful timber being shredded or burnt. However some organisations in the study area have tried to reverse this trend. The Mersey and Red Rose Forests Timber Stations Project Report[9] demonstrates that quality saleable products can be made from locally sourced low quality timber.

Milling is an excellent way to add value to timber that would otherwise incur a disposal cost. However, there may be problems such as lack of storage space and poor consistency of quality as noted in the above report. One vital issue is the ability sell the products and, if this is the case, to meet market demands on a consistent basis. The London Borough of Croydon have a sawmill (picture 12) and have a consistent internal demand for posts, benches and fencing. However, it was very difficult to supply demand on a regular basis as there was not always enough appropriate raw material available and when there was as may be seen from the photo there was not enough space to store it. This situation can be overcome by a well thought out site with the ability to agglomerate material from across more than one local authority.

[9] The Mersey and Red Rose Forests Timber Stations Project September 2003 –March 2004, Report to the Countryside Agency and Forestry Commission North west England Conservancy March 30th 2004.

Picture 12: Sawmill at Croydon's Tree Station. Picture shows nearly full extent of site which has little storage

Niche markets are also available. Many urban trees may be of unique species and particularly rare. Even small pieces may interest local wood turners and command a high price. Contractors at Rochdale also have a small market for beech going for clog making.

Other markets include chainsaw carving or temporary barriers to restrict vehicular access to green space and derelict land.

Case Study: Frankland Tree Services

The best example of utilisation of arboricultural arisings to produce saleable milled products in the study area is Frankland Tree Services of Altringham. The company aims to find uses for as much timber as they can recover and for ten years have been building up a market for milled timber from arboricultural arisings. This is now profitable. Creating the link between a finished item and a tree in your garden has become a good selling point for their services. The company also tries to demonstrate to other enterprises that the timber they have seen as useless, often through traditional convention, is in fact still useful.

A mobile saw is hired on a regular basis to cut logs and the timber is used in a wide range of applications from cabinet making to floor boards. Use is also made of items such as yew root balls as table bases and the staff have been trained to see the potential in trees and will fell and cut up trees accordingly.

Case Study: Local authorities

There are also several mobile saw mills in public ownership in the study area, Mersey Valley Warden Service not only have a mill but also a kiln and a planer thicknesser. St Helens MBC and Liverpool CC are both good at finding a use for their better logs. Both Sefton and St Helens are currently investigating investing in mobile saws to add value to timber.

Composting and Mulch

This is already the major destination for arboricultural arisings in the study area. Fresh or semi composted chip is either used as a mulch in-house or sent off to a specialist green waste composter. There is also the potential to produce a better product that is free of potential pathogens.

Before any of the technical aspects of composting are discussed it must be pointed out that while not a difficult process to carry out, it has to be done correctly and you have to be assured you have a market for the material even if it is in-house. This means staff must understand why there is a change in current working practice. It also needs to be carried out in an economic environment of gate fees and sales even if this is only an internal market and no physical cash changes hands. There has to be a demonstrable advantage either economically, in quality terms or a strong policy or political driver to sustain the enterprise.

Composting is a natural process where micro-organisms aerobically (in the presence of oxygen) convert waste organic materials into a mixture of stable humic substances and inorganic plant nutrients to form *'compost'* (The Composting Association, 2004). The micro-organisms primarily associated with composting are bacteria (which include a specific group called *'actinomycetes'*) and fungi (which include both *'moulds'* and *'yeasts'*). By-products of the composting process include the release of carbon dioxide, water and heat energy. The heat energy, combined with the insulating properties of bulk quantities of organic matter increases the temperature of the composting material often to above 70°C. For the composting process to take place efficiently, five key factors need to be controlled. These are; the carbon to nitrogen ratio (C:N), temperature, oxygen, moisture and the bulk density of the material.

The ideal C:N ratio of compost feedstock is between 25:1 and 30:1. Winter woodchip with no green material may have a ration of 300:1 while very green summer material resembling shrub trimmings may be 53:1. At these ratios pure woodchip will break down very slowly and this doesn't take into account the large size particle of woodchip and the high lignin content which will further slow the process considerably. To balance this out you would need to add a high nitrogen content feedstock like grass clippings which have a ration of C:N ratio of17:1. This still raises the issue of what to use in winter when there is little green, high nitrogen material around. The other major consideration is oxygen. The process needs to be aerobic to be free of odour and work effectively and this means the product has to be turned.

There are no statutory British or European standards for mulch or compost, though the Waste and Resources Action Programme (WRAP) has created a voluntary, publicly available specification (PAS) for composted materials (PAS 100, 2005). PAS 100 specifies requirements for the process of composting including the selection of input materials, the minimum quality of composted materials and the storage, labelling and traceability of compost products. It also specifies requirements for a quality management system (QMS) for the production of compost to ensure they are consistently fit for their intended uses. The required specifications are generally identical for both compost and mulch with the only difference being the size of stones within the mix. For mulch stones greater than 4mm are allowed, whereas with compost they must

be lower than 4mm in size. The reason for this is that, often stones are used as a surface cover for surfaces or flowerbeds (as mulches are).

While it would be highly desirable to obtain accreditation to this standard it may be too unwieldy and time consuming for a small scale operation in an arboricultural yard. However the principles of the standard should be adhered to in order to produce a quality useable product.

Markets for compost are diverse. Compost is a broad term that describes a class of products rather than a specific product. The types and qualities of compost span a broad range and different types of compost suit different uses and markets. The WRAP Landmark Training Manual '*Developing organic waste management strategies'* defines the following as compost products:

- **Soil improvers –** Improving soil condition is the most common function and use of composts. As a soil improver composts are tilled into the soil to improve soil structure (by increasing the organic matter).
- **Ingredient in manufactured topsoil –** Composts can be mixed with other materials (for example, sand or construction waste fines) to produce topsoil for land restoration and landscape applications. As with growing media, the manufactured soil can be designed to fit specific applications.
- **Mulches –** Compost made from coarse or fibrous feedstock's perform very well as mulch. Mulches are spread on the surface to retain moisture, suppress weeds or for decorative purposes.
- **A constituent in growing media –** In combination with other components (for example, peat, sand, bark fines and vermiculite), composts can be used to supply growing media with desired characteristics such as a favourable bulk density, water holding and cat-ion exchange capacity, bulk and nutrients.
- **Top dressing –** Fine compost particles can be applied to the surface to improve structure and turf establishment. The particles penetrate through the grass into the turf.

With regards to arboricultural arisings, the most favourable option is to use the chipped waste material as mulch. Mulches and soil conditioners are derived mainly from composted bark and green waste as well as some recycled wood content.

Composting technologies are divided into two basic categories: those in which the composting process is carried out within some form of container known as 'in-vessel', and those that are not known as 'open'. Figure 1 shows the 2 processes and they are discussed further below.

Adequate space with hard standing is a basic pre requirement of either system. An open system is less expensive to implement.

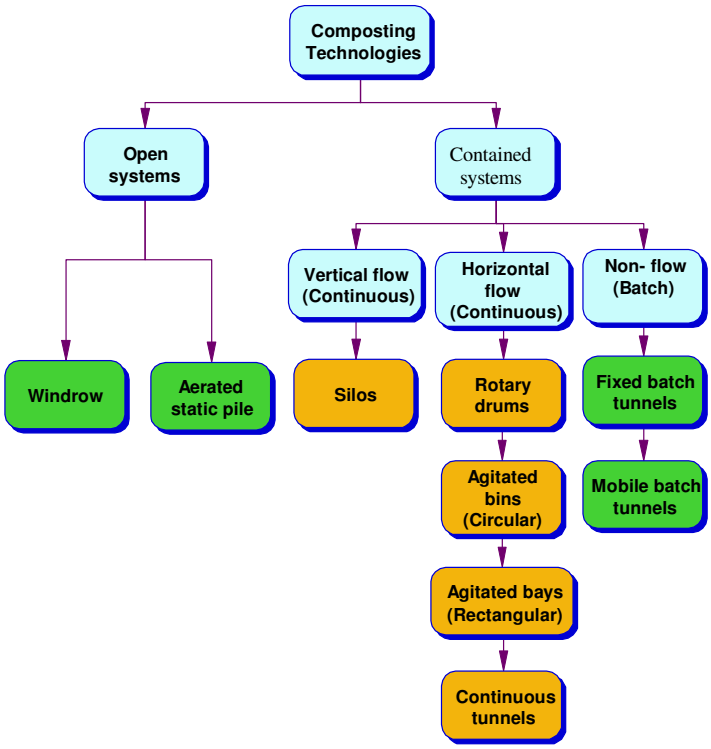


Figure 1: Composting Methods

Open Composting System

Costs of implementing this simple system could be relatively low but would depend greatly on what equipment the team already had and what would need to be purchased.

At its simplest form a concrete surface would be required to use as a base for the compost (costing approximately £30 per m^2). The Compost Association (2001) state that as a simple rule; for every tonne of waste material to be composted, $1m^2$ of concreted area is required. This, however, considers that the required space contains other buildings such as offices or tunnels. A front-end loader (approximately £15,000 per year to hire) would be needed to turn the compost to ensure effective composting of the arboricultural arisings. Machinery hire costs could be minimised if machinery was shared between several sites.

The list below provides details of the machinery that would be required to set up a small-scale open-air composting system:

- Shredder or Chipper machine (required if arboricultural arisings are not chipped on-site, unless further green waste to be added)
- A front-end loader to turn the compost piles or windrows
- A screen if arboricultural waste has not been previously chipped or if other green waste is to be added.

In terms of day to day operations the arboricultural arisings would be piled or formed into a windrow (long pile) using a front-end loader. The initial composting time takes approximately 8 weeks. Within this time period the pile or windrow should be turned

using the front-end loader once per week. Turning involves the compost pile or windrow being moved to another location within the concreted area. Within this time period temperature and moisture should also be monitored in order to ensure that the waste material is composting effectively. Water can be added using a hose sprinkler. After the initial 8 weeks of composting a further 4 to 8 weeks should be allocated for the maturation stages of composting. Further turning and monitoring is also required during this period. This example is based on the waste material having an ideal C:N ratio of around 25/30:1 Given the very high carbon content of arboricultural arisings (C:N of around 300:1) a small quantity (around 10% of total waste material) of arboricultural arisings mixed with other nitrogen rich green waste (for example, grass clippings) would result in effective composting. Most of the commercial green waste recyclers use a large scale open system that may involve more specialist equipment including windrow turners.

Containerised "In Vessel" Composting System

The Vertical Composting Unit (VCU) is an in-vessel, aerobic composting system suited to processing biological waste in small to medium sized municipal and industrial applications. Composting takes place inside modular, insulated, stainless steel-lined composting chambers, measuring approximately 4.5m high and 2.5m square. With a maximum throughput of 3.6 tonnes per day per chamber, chambers are linked together to form systems of any capacity. The VCU system is typically favoured for facilities processing between 5,000t and 40,000t per annum.

Biological waste must have sufficient structural material (such as woodchip) to allow the passage of air through the waste when it is in the chamber. Bulking agents are typically shredded green waste or wood waste. The proportion of bulking agent required depends on the kind of waste being processed and varies between 30% and 50% by mass. These wastes are mixed in a large batch mixer before being fed into the chamber by a series of sealed conveyors.

The processing chambers operate continuously on a 'plug-flow' principle. As product is removed daily from the base, waste is fed into the top of the chamber. Typical retention times vary between 7 and 14 days, but can be as high as 4 weeks. Retention time used depends on the plant's requirements. The VCU's working principle is a re-engineering of the traditional composting process, with air drawn up through the decomposing waste as it moves down through the chamber. Heat is generated by the metabolic activity of microbes at the chamber's lower levels.

Rather than let this metabolic heat energy dissipate to atmosphere, it is harnessed to help create a natural chimney effect that draws in cool air at the open base of the chamber. Due to the rising heat, temperatures vary between 40°C at the base of the chamber and in excess of 70°C at the top. Effectively, daily waste input is heat treated before the degradation process begins. This system is very energy-efficient and does not require agitation, bio-filtration, external heating or air injection. With minimal moving components, maintenance and operating costs are very low.

Case Study – Fairfield Materials Management

One of the most successful in vessel composting enterprises is to be found locally. Fairfield Materials Management is located at New Smithfield wholesale market in Openshaw, East Manchester. Using the waste from vegetable traders it mixes this with

around 50% arboricultural waste as a bulking/aeration/carbon agent to produce a compost product which meets the PAS 100 standard. After 7 days in the VCU the product is matured for a further 6 weeks before being ready for sale. It is used by Manchester and Salford City Councils, local allotments and more recently by the Forestry Commission.

There are now 6 VCUs at the site with each one capable of handling 1300m³ year. Each VCU costs around £100k but there is subsidiary equipment which is needed such as a conveyor, mixer and screens which add around £150K to the operation.

Picture 13: Fairfield Materials Management's VCUs at New Smithfield market

Contacts: Fairfield Material Management 0161 231 2139

Fresh Chip for Landscaping and Equine Use

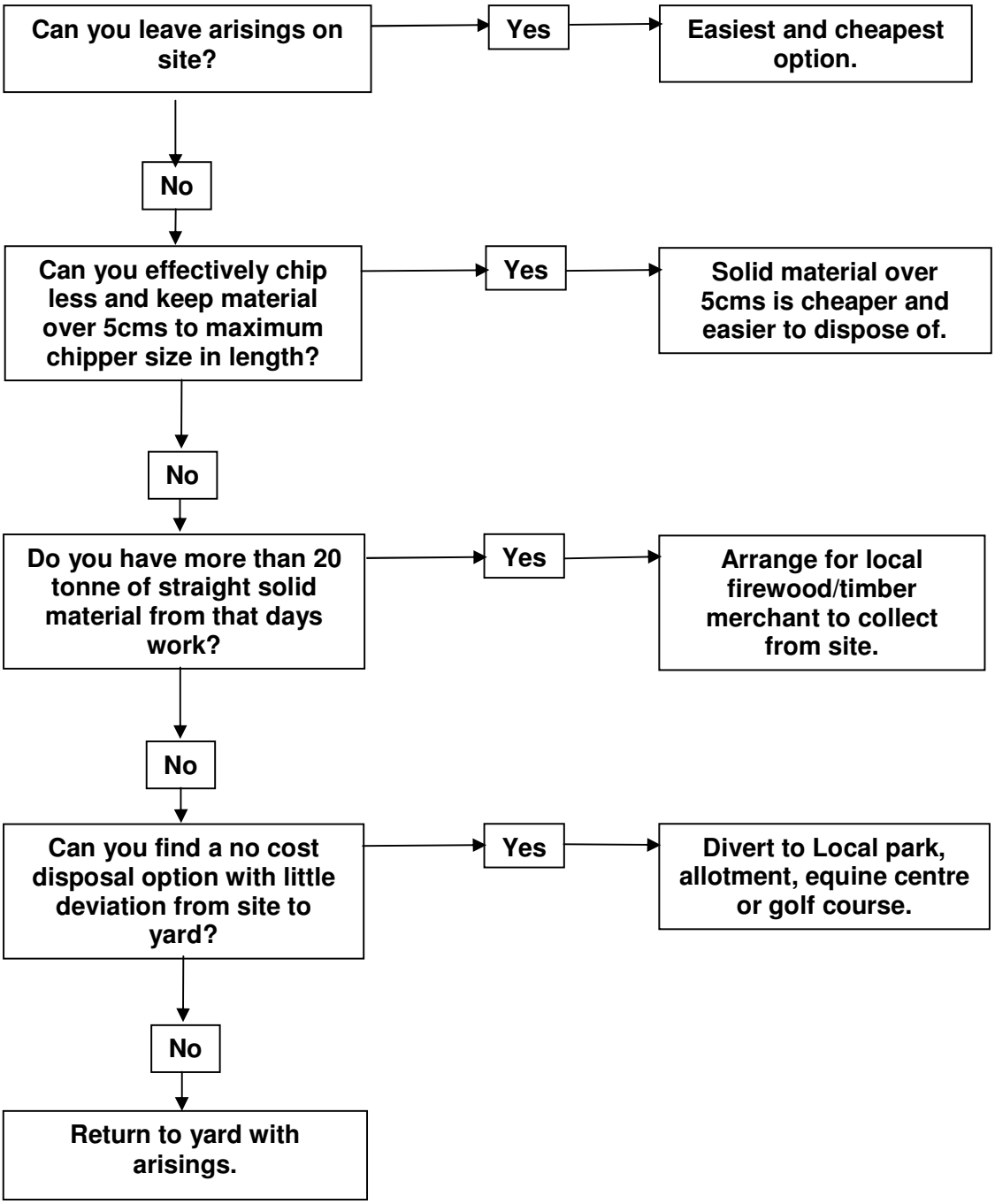
Fresh chip is often supplied to stables, golf courses and other similar locations. Contractors questioned indicated that this is typically done at zero cost or a nominal cost to cover transportation as it is a useful outlet for material that could otherwise be a cost item to dispose of.

Fresh chip, particularly winter chip, may be useful as a surface and is often used as a footpath surface. It is also suitable for a low grade equine surface although many horse owners prefer relatively high quality material.

Woodchip may also be useful for informal play areas in places like Country Parks. There is a British Standard for impact absorbing surfaces (BS7188) although this is not statutory. It is possible to make woodchip to meet this standard.

The Way Forward – Some Solutions

Table 4: Decision diagram for arboricultural arisings from site to yard



From the decision diagram (table 4, above) it can be seen that there are many routes for removing timber and chip from the green waste stream, before they reach the yard. Once at the yard, the best option is to have a two bay/bin system for chipped and solid arisings. The easiest option but not necessarily the cheapest or best is to then ship the chip off to the cheapest green waste recycler and for the solid material, find a firewood merchant willing to collect or send it to a low cost wood recycler. For more complex but possibly cheaper solutions you will need more space with hardstanding and some capital investment for processing products. Essentially you need to set up a Tree Station.

Tree Stations

A tree station is a point (such as a yard) at which woody material can be accumulated, processed and marketed. There is considerable interest in the idea of such a facility from local authorities, it was a dominant suggestion from tree officers as regards ways of removing material from the green waste stream. In addition, The Mersey and Red Rose Forests Timber Stations Project 2004[10] showed that there are sites suitable for the development of timber processing infrastructure across the Mersey Belt.

However, to be viable a tree station or other reprocessing infrastructure must:

- Be cost effective (ie be able to pay for itself).
- As an alternative be worth funding because it provides a cheaper alternative to commercial green recycling.
- Provide activities such as training or job creation that are viable and worth funding by local authorities/government and or other institutions such as charities.

There is also little point in emulating what is already happening in the market place unless there is the opportunity to do it more cost effectively. Comparison between commercial and local authority green waste sites, for example, London Borough of Croydon and Onyx Integra Hampshire have shown that the private sites are more efficient and have lower staffing levels than the public alternatives. This was supported by an example in the study area, recently sub contracted to the private sector and now more financially viable.

Possible suggestions for tree stations/infrastructure in the study area include the following concepts.

Large fixed tree station

There has been interest in the installation of wood chip boilers from several authorities. Given sufficient demand a similar set up to that currently supplying Slough Heat and Power in the London Borough of Croydon could be established. Given the support of a gate fee such an operation could also supply Kronospan or other markets requiring chip.

The key issue is to make the operation cost effective so that the chip produced competes with that from commercial operations. This is possible if investment costs were partly covered by grant aid as was the case with the £200,000 investment at Croydon. Other factors would involve the free (in kind) use of a site, an input of arisings from outside the local authority of 1000 tonnes per annum at £20 per tonne gate fee (generating £20,000 per annum). Savings resulting from the use of chip in a boiler plus

[10] Op. cit.

sales to Kronospan (say, 500 tonnes per annum at £8 per tonne ex yard) would add to the viability. This would potentially represent an income of £40,000, which could cover one person's wages and contributions and much of the running expenses.

In addition good saw logs could be accumulated and milled on a contract basis by one of the several mobile saw mills in the area and a firewood business supplying bulk and local outlets could be set up. As there is already a known demand for chip from the council for mulching, material rejected from use for heat could be used for this purpose.

Perhaps the most important factor is who should run the tree station? It could be private or public or could combine elements of both with the firewood business for example being private and the saw-milling public. There are also good examples of such operations being run by charitable trusts.

Given the examples given for private/public green waste sites, some element of private sector involvement may be advisable. The chip producing operation for Slough Heat and Power is run by Croydon's arboricultural contractor and the firewood business by their forestry contractor. A further issue for any initiative is that many successful projects have depended upon key individuals and on their departure have diminished.

The small fixed tree station

Smaller sites tend to be more difficult propositions due to low margins on many wood products and the fact that large volumes of throughput are required to benefit from economies of scale. This makes greater added value products such as milled timber and social benefits such as training more attractive in this context.

Design is also important with the ability to move materials in and out as well as processing them quickly and easily being vital. The potential example of Salford offers some scope especially as it is sited next to a nursery which sells products to the general public. This site could provide milled material, firewood and charcoal. There would also be the potential for selling other added value products such as turned items.

Mobile tree station

Another option is a mobile operation mainly comprising of a mobile sawmill and firewood processing. It could visit existing yards and process material on site. This is an attractive low cost option. Also there are already many pieces of underutilised processing equipment in the public sector that could be mobilised jointly for this kind of operation. Again viable markets need to be in place before this type of operation becomes a realistic proposition. These markets may be external but could also be internal within the local authority.

Conclusions

In the Merseyside and Greater Manchester areas there appears to be no arboricultural arisings going directly to landfill. The majority is being used as mulch or being composted through a network of recycling companies.

Some authorities have no or very small disposal costs, whereas for others the costs are considerable. For those authorities who have negligible disposal costs there are some implications as regards the spread of disease and nutrient leaching which are associated with the practice of leaving chip on site, otherwise, where viable, this practice should be encouraged.

There are also good examples of successful enterprises using arisings which could be applied on a wider scale; these could be facilitated by the use of concepts, such as tree stations, better training of operatives and the development and securing of real markets. In the case of the latter there seems genuine potential in the markets for wood chip for energy.

However, there are also possibilities for the reduction in volumes produced from careful species selection for replacement trees and pro-active management. These two points are fundamental for minimising arisings and pro-active management is also important as regards the increasingly litigious area of duty of care.

Lack of awareness as regards any idea of quantity and costs of arisings from the tree officers producing them was often the result of a lack of control. Greater control and the unlocking of contracts, which may not be the most cost effective, can also reduce costs and lead to more pro-active use of arisings.

There are consequently genuine possibilities for the reduction in both amount of and costs of disposal for arboricultural arisings. There are also a variety of means to achieve these goals, whether it is by reducing volumes, creating better products or managing costs more effectively.

While there are no quick fixes, those authorities which currently pay for disposal can do two simple things which can substantially reduce costs. Firstly if at all possible leave chip on site. Secondly keep chip and solid in separate bays or bins and shop around for the best price particularly a cheaper price for the disposal of solid material.

Appendix 1 Questionnaire

Name of authority

Contact name and position

1	What percentage of your tree work is carried out directly by the authority and how much is contracted out?	
2	Who are your main contractors and can we contact them if necessary?	
3	For your direct works what is the weight/volume of the material you produce per annum?	
4	Composition of material (%)? chip/solid/brash	
5	How is the above disposed of? chip/solid/brash	
6	What are the average disposal costs per tonne? chip/solid/brash	
7	What are your annual disposal costs and what percentage is this of your overall operating budget?	
8	Over the past 5 years has this been an increasing percentage of your overall operating budget?	
9	Do you dispose of arisings on a daily basis or do you temporarily tip and store material in a yard?	
10	How are volumes of arisings recorded	
11	How much material can you store at the yard? weight/volume.	
12	Is the yard mostly full?	
13	Do you have any zero cost or income markets for your arisings? Are you aware of any ?	
14	Do you undertake any post cutting processing?	
15	Are you currently looking for other ways to dispose of material.	
16	How interested would you be in exploring lower cost disposal options with surrounding authorities? Very/Mildly/Not	
17	Would a common depot between several authorities be viable?	
18	Do you have any feeling about how the treatment of arisings could be improved ?	
19	Proactive or Reactive	
20	Do you have any other comments to make?	

Appendix 2 Kronospan Specifications

Hackerchip (unpeeled woodchip) Specification

MATERIAL	Standard softwood species from the conversion of British softwoods but excluding:- Western Red Cedar, Yew, Redwoods and Cypress. Limited quantities of white hardwood chips will be accepted subject to agreement. Dark coloured material is not acceptable. Mixed loads of softwood and hardwood chips will be accepted by prior arrangement.
DIMENSIONS	Minimum / Maximum Length 12mm 50mm Width 12mm 35mm Thickness 12mm 35mm (Note:- Sawdust must be excluded)
QUALITY	Maximum bark content:- 15% Chips must be clean cut and free from foreign bodies such as metal, stones, sand, paper and plastic. The timber must be free from rot and decay.
MILL STORAGE	To avoid contamination, hackerchips must be stored at source in silos or on concrete.
DELIVERY	Material must be delivered in tipping wagons, walking floors or curtain-sided chipliners. Wagons that cannot be tipped or pushed out with a front loader will be the responsibility of the supplier to unload. Each load must be accompanied by an advice note specifying softwood, hardwood or mixed hackerchips, mill of origin and the supplier's name.
CHAIN OF CUSTODY	All suppliers must be able to demonstrate Chain of Custody, or a commitment to achieving certificated supply. A copy of the suppliers Chain of Custody certificate must be made available for retention at Kronospan, Chirk. All delivery notes must record the Chain of Custody number.
DOWNGRADING	The buyer reserves the right to reject any load that does not comply with the specification. Loads will be downgraded from hackerchips to wood fibre if either:- 1) Bark content exceeds 15%. 2) Chip size is out of specification. 3) Contamination of fines and dust.
MOISTURE CONTENT	Maximum: 120% - Minimum: 50 %(Of dry material weight.) Loads with moisture content greater than 120% will be subject to downgrading.

Kronospan Ltd reserves the right to reject any load that does not meet the above specification.
Kronospan Ltd reserves the right to amend the above specification.

Appendix 2 Continued

Chipwood Specification

	Standard Quality	2nd Quality (Price reduced by 20%)	Reject (Part or total)
Quality	Timber must be clean, well trimmed and free from:- decay stones metal mud or grit fire damage	Timber containing:- blue stain slight decay or fungal attack mud and / or grit * *(collected at source or in transit)	Timber containing:- forked material excessive decay or fungal attack excessive mud and / or grit contamination with metal and stone oversized branch stubs
Straightness	Bow must not exceed:- 15cm / m in one direction or 10cm /m in two directions Material must be reasonably straight to allow processing or stacking without further cross-cutting.	Any material where bow exceeds that of Standard Quality.	Material that will require further cross-cutting to allow processing or stacking.
Length	Minimum / Maximum Short 2.0m / 2.4m Long 2.5m / 2.8m	Minimum / Maximum Random 1.0m / 6.0m Loads greater than 4.0m in length must be delivered on crane lorries for self unloading.	Any material less than 1.0m in length will be downgraded to off-cut price. Any material greater than 4.0m in length without the means to self unload.
Diameter (over bark)	Minimum / Maximum 6cm / 60cm	Material less than 6cm.	Material greater than 60cm.
Species	Loads consisting solely of one UK conifer species. (With the exception of Larch, Red Cedar and Cypress species). Mixed conifer loads containing in total up to 5% Larch.	Mixed conifer loads containing more than 5% Larch. Loads containing Red Cedar and Cypress species.	
Chain of Custody	All suppliers must be able to demonstrate Chain of Custody, or a commitment to achieving certificated supply.		

	A copy of the suppliers Chain of Custody certificate must be made available for retention at Kronospan, Chirk. All delivery notes must record the Chain of Custody number.
Moisture Content	Maximum: 120% of dry material weight.
	Loads with moisture content greater than 120% will be subject to downgrading.
Deliveries	Timber lorries delivering to site must be compliant with the Road Haulage of Round Timber Code of Practice.
	Suppliers delivering with gross vehicle weights in excess of the maximum legal limit, 44 tonnes, will have the load weights capped at the maximum legal limit.

Kronospan Ltd reserves the right to reject any load that does not meet the above specification.
Kronospan Ltd reserves the right to amend the above specification.

Appendix 3 British Biogen Woodchip Specification

Wood Chip:
Wood chip size grades are important. Wood chip burning plant will generally operate best on material between 2 and 25mm maximum dimension. However, it is accepted the fuel production methods do produce a wider range of particle sizes than this. Very fine dusty material can upset combustion in a boiler, and large chunks and long stringy material can block feed systems, so any grading system will put limits on these constituents.

Consultation with fuel suppliers and boiler manufacturers has been used to produce a retail grading system which reflects the variation in fuel tolerance of different combustion systems. British Biogen expects to review the grading system periodically to ensure that it continues to meet supplier and user needs, and to make sure it is compatible with the harmonised EU grades currently under development. Wholesale suppliers and purchasers may wish to agree different specifications to suit their particular needs.

Retail wood chip is described by three grades; Super, Fine and Coarse.

Size	<2mm	2 – 25 mm	25 – 50mm	50 - 100mm	100 – 200 mm
Description	Dust	Small	Medium	Oversize	Slivers
Super	<15%	Any	0%	0%	0%
Fine	<15%	Any	10%	2%	0%
Coarse	<15%	Any	Any	<30%	<2%

Max of 5% tramp material. No stones >25mm. Chipped Oversize and Sliver material is assumed to be "long and thin" – material greater than 50 mm square is unacceptable.

Standard definition: A standard wood chip sample may be tested by measuring the percentage of material (by dry weight) passing through a series of sieves having round holes of 200, 100, 50, 25, and 2 mm in diameter. Slivers passing end-on through the 100mm grid should be picked out and added to the slivers fraction. Tramp material and hard stone material should be separated from the smaller fractions by hand.

Appendix 4 Slough Heat and Power Specification

WOOD CHIP SUPPLY SPECIFICATION

Material

- All hardwoods and softwoods
- All colours of wood (unpainted) are acceptable
- Free of green leaves and needles

Dimensions

- Not to exceed 50mm in any dimension
- Undersize <5mm in all dimensions – not to exceed:
  - 20% for recycled wood (WWDF)
  - 5% of total for virgin wood (Biomass)

Moisture and Fines Content

- At the time of delivery, not more than:
  - 20% moisture for recycled wood (WWDF)
  - 50% moisture for virgin wood (Biomass)
- Suppliers will take all reasonable measures to ensure that wood is not exposed to unnecessary moisture

Quality

- All material must be clean and free from contamination such as plastic, melamine, metal, stones, dirt, toxic chemicals, and other foreign bodies.
- All material must be free of rot, decay, infestation, and fire damage.

FOR FURTHER INFORMATION AND DETAILS OF COLLECTION AND DELIVERY CONTACT:

Charlotte Bruton at TV Bioenergy:
Telephone: 01635 817420
Fax: 01635 552779
E-mail: charlotte.bruton@tvenergy.org

Delivery

Material can be collected from site by prior arrangement or may be delivered direct to Slough Heat and Power WITH AGREEMENT AND SCHEDULING FROM TV BIOENERGY. Please note that:

- Collection from site will generally be in 25 tonne loads
- Sites must have good access and be approved by TV Bioenergy in advance
- The site will need to have reasonable equipment capable of loading the chips onto a delivery vehicle arranged by TV Bioenergy
- Suppliers will be responsible for ensuring that adequate insurance is in place to cover liabilities to their own and to contractors' personnel whilst engaged in loading on the supplier's premises

- Delivery will preferably be made using bulk tippers, although walking floor and ejector trailers can also be accepted.
- Vehicles are subject to a maximum height restriction of 15 feet (4.5 metres)
- Wood chips should be protected by a waterproof cover at all times between loading and delivery
- Delivery hours are 0730 to 1900 Monday to Friday, with Saturday deliveries subject to confirmation
- No more than two of a Supplier's vehicles shall be present in the immediate vicinity of the Power Station at any given time.
- Suppliers shall ensure that all drivers, whilst within the Slough Trading Estate, comply with all reasonable and lawful instructions issued to them by SHP's authorised personnel and strictly adhere to the Rules of Conduct from time to time published by or on behalf of SHP.

Rejection

- If a load of delivered material is outside this specification, such load may be rejected and returned to the Supplier, and subsequent deliveries cancelled until the reason for failure has been identified and corrected. All costs will be for the Supplier's account.

Quality Assurance

- Suppliers must provide a statement of the procedures employed to ensure that the quality of the material delivered will always meet the above specification.
- TV Bioenergy or its representatives may visit the Supplier's production sites at any reasonable time