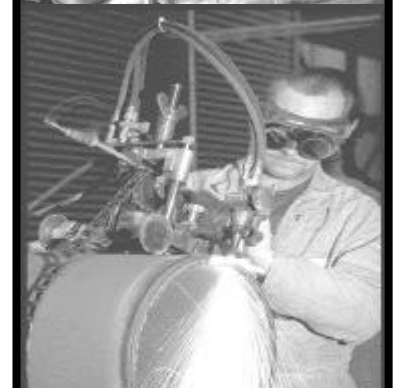


SUMMARY REPORT

PROFITING FROM WASTE MINIMISATION: OPPORTUNITIES FOR GEELONG MANUFACTURERS

Project Supported by:

- *EcoRecycle Victoria*
- *Geelong Manufacturing Council*
- *Barwon Regional Waste Management Group*
- *City of Greater Geelong*
- *Alcoa World Alumina Australia*
- *Geelong Cement*
- *EPA*



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Alcoa World Alumina Australia	Associated Kiln Dryers
Austanners Wet Blue	Austrimi Seafoods
Beaumonts Pies and Cakes	BHP Wire Products
Blue Circle Southern Cement	Brax Window Treatments
Brintons Carpet	Burrows Industries
Calco Timbers	Candy Australia
Challenge Meats	Clyde Wool Scouring
Colonial Pine Australia	E Brockman and Sons
Emu Ridge Australia	EP Robinson Pty Ltd
Excel Quarries Pty Ltd	Express Promotions Australia
Filigree Textiles	Ford Motor Company
Geelong Galvanising	Geelong Wool Combing
Godfrey Hirst	Hendersons Automotive
Jeff Skyes and Associates	KAAL Australia
Kwik Kopy Printing	MB Pre-Fab Pty Ltd
MC Herd	Melba Industries
Midway Pty Ltd	Pilkington (Australia)
Pivot Ltd	Plasmould Building Enterprises
Protectakote Pty Ltd	Quicksilver
Regal Cream Products	Rip Curl
Riverside Textiles	Rohm and Haas Australia Pty Ltd
Sandman Mattress Factory	Sands Print Group Ltd
Scott Filter Services	Shell Refining (Australia)
Splinters Furniture	Steggles Limited
Test Technology Pty Ltd	The Geelong Brush Co.
Vic Pits	Western District Meat Packaging Co.

The Project team wishes to thank these companies, and invites all manufacturers to become involved in future waste minimisation activities.

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1. INTRODUCTION

This report details the first stage of a project that aims to increase the productivity of Geelong manufacturers by minimising waste and increasing the utility obtained from resources.

The project is the initiative of a Manufacturing Waste Minimisation Working Group comprising of:

- EcoRecycle Victoria;
- Geelong Manufacturing Council;
- City of Greater Geelong;
- Barwon Regional Waste Management Group;
- Alcoa World Alumina Australia;
- EPA.

Research undertaken as part of this project included:

- Site visits and waste assessments at 50 manufacturing premises in the Barwon Region;
- A survey which was distributed to all those listed in a City of Greater Geelong's Manufacturing and Processing Register;
- A review of literature related to manufacturing waste generation and minimisation opportunities;
- Liaison with companies that may be able to receive wastes from other manufacturers;
- Consultation with companies and experts regarding possible waste minimisation opportunities.

The project has identified possible waste minimisation trials to be conducted within the Region with the support of the Waste Minimisation Working Group. A scoping exercise has been conducted for favoured options.

2. MANUFACTURING WASTE COSTS MILLION\$

Each year, Geelong manufacturers dispose of over 65,000 tonnes of general solid waste and over 15,000 tonnes of prescribed and special wastes to landfill. This means that Geelong manufacturers pay in the order of \$3.5 to \$4.6 million, or on average up to \$300 per manufacturing employee per year in disposal costs alone. This does not count the full, and sometimes hidden costs of waste such as the following:

- Loss of production materials that leave the factory as waste rather than product;
- Costs of energy, water, labour, equipment time and other process costs invested in materials that are wasted;
- Costs of transporting, handling and storing materials both before and after they become waste.

Often the cost of waste disposal is a small part of the full cost of waste to manufacturers. The study found examples where the cost of disposal was less than 1% of the full cost of waste. For example, several manufacturers are paying a few cents per kilo to dispose of waste, but the price for the raw material (eg. plastic) that they are throwing out is several dollars per kilo. A recent study by Monash University has found that waste disposal costs are typically less than a fifth, or 20%, of the full costs of waste. If this is the case in Geelong, then waste is costing the City's manufacturers around \$20 million, or up to \$1,500 per manufacturing employee, per year.

RECOMMENDATION 1: PROMOTE FULL COST ACCOUNTING FOR WASTE

It is recommended that members of the Manufacturing Waste Minimisation Working Group:

- educate manufacturers about the full costs of waste;
- encourage them to conduct full costing of their wastes; and
- seek funding to support demonstration trials of full costs accounting and waste minimisation plans for Geelong manufacturers.

3. WASTE GENERATION AND MANAGEMENT PRACTICES

Information from the site visits and survey responses were used to identify major waste types and examples of how wastes are currently being managed.

3.1 MAJOR WASTE TYPES

Table 1 details the manufacturing sectors and their major wastes. The largest 50 manufacturers in Geelong employ over 75% of areas the manufacturing workforce. The 50 premises visited during this study employ over 50% of the manufacturing workforce.

Research of quantities of waste generated by, and the number of employees within, each sector suggests that there is significant diversity within and between sectors, making it difficult to determine an average figure for waste generated per employee. Figures obtained varied between less than 1 tonne to over 700 tonnes per employee per year. Not all of this waste is landfilled, with those producing high quantities of waste either retaining it on site, or reusing or recycling. For example, the 700 tonne figure was from a sand quarry, and this material is mostly retained on site. Another company generating over 75 tonnes of waste per employee per year recycled most of the material on-site.

More typically, waste generation figures for material requiring off-site management were within the range of 2 to 10 tonnes per employee per year. Not all of this waste is landfilled, with large quantities of paper, cardboard, metals and glass being recycled.

Significant landfilled wastes identified include:

- Organic wastes from food processors and textile manufacturers;
 - Contaminated oily or chemical sludges from the petroleum and chemical, metallic minerals, and machinery sectors;
 - Textiles from textile manufacturers;
 - Timber from wood products and furniture manufacturers
 - Transport packaging from all sectors, including timber pallets, film plastics, cardboard (although much of the cardboard is being recycled), strapping, and metal and plastic containers;
 - Canteen and staff waste from all sectors;
 - Foundry sand from metal products and machinery and equipment manufacturers;
 - Cleaning rags and gloves from all sectors;
 - Filter cake, mineral dust from air filters, and spent catalysts from the petroleum and chemicals, metallic minerals and non-metallic minerals sectors;
 - Organic dust from air filters from textile, wood products, and furniture manufacturers;
 - Liquid and chemical wastes such as acids, alkalis, oils, and solvents from all sectors.
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3.2 CURRENT PRACTICES

Site visits and survey responses revealed the following:

- There is a high level of awareness of waste management issues by Geelong manufacturers;
 - The majority of respondents (56%) recycle at least one waste material typically paper/cardboard, metals and/or beverage containers from staff areas;
 - Over 40% of respondents reuse at least one type of waste material, typically metals, packaging and scrap paper;
 - Over 20% of survey respondents had conducted a waste audit to measure the types of waste they generated;
 - Commitment by management, involvement of staff, and the setting and monitoring of waste minimisation targets are important strategies employed by manufacturers that are most successful minimising waste;
 - Staff training and equipment re-calibration can reduce process waste. For example, a food manufacturer was able to reduce food processing waste by 30% (which also means a 30% reduction in production inputs) by training staff and measuring the performance of waste reduction strategies.
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TABLE 1 - MANUFACTURING SECTORS AND THEIR WASTE TYPES

SECTOR	NUMBER OF PREMISES	NUMBER OF EMPLOYEES	MAJOR WASTE TYPES
Food and beverage	64	1,485	<ul style="list-style-type: none"> ▪ Food processing wastes ▪ Grease trap wastes ▪ Cardboard/paper ▪ Plastic wrapping and containers ▪ Timber pallets
Textiles Clothing and Footwear	60	3,275	<ul style="list-style-type: none"> • Textile off cuts and dust • Empty and part-used spools • Wool Scour waste • Cardboard rolls and cartons • Plastic film wrap • Timber pallets
Wood and Paper Products (including prefab building and furniture manufacturers)	82	725	<ul style="list-style-type: none"> • Wood • Wood shavings/dust • Steel and plastic containers • Cardboard/paper • Transport pallets • Plastic film wrap • Textiles • Air filters
Printing and Publishing	29	340	<ul style="list-style-type: none"> • Paper • Timber pallets • Steel and plastic containers • Plastic film wrap • Cleaning cloths and gloves
Petroleum, Coal and Chemicals	23	1,065	<ul style="list-style-type: none"> • Sludges • Filter cake • Spent Catalysts • Filter Dust • Metals
Non-metallic Minerals	43	1,110	<ul style="list-style-type: none"> ▪ Glass ▪ Hardened cement ▪ Dust ▪ Timber pallets ▪ Cardboard ▪ Plastic wrapping
Metal products	75	2,870	<ul style="list-style-type: none"> ▪ Metal ▪ Foundry sand ▪ Spent pot lining ▪ Carbon dust ▪ Paint sludge ▪ Cardboard and paper ▪ Timber pallets ▪ Fly and bottom ash ▪ Dust ▪ Oil ▪ Acid
Machinery and Equipment	49	4,165	<ul style="list-style-type: none"> ▪ Metals ▪ Oil and Paint sludges ▪ Metal and plastic containers ▪ Textiles ▪ Fibreglass ▪ Cardboard ▪ Film plastic wrapping ▪ Timber pallets

4. GUIDING PRINCIPLES

The study used some guiding principals to identify and develop waste minimisation opportunities. These are described below.

4.1 WASTE MINIMISATION

The Waste Minimisation Hierarchy adopts the following principles:

Recycling is Good

Many manufacturers already recycle. Whilst this is preferable to landfill disposal, it is a poorer option than reuse or reduction, which typically result in greater cost savings to companies. Recycling services are subject to commodity prices for the recycled material, and at times of low prices, recycling services may be charged for. Manufacturers can help to maintain higher commodity prices by purchasing recycled or recycled-content materials.

Reuse is Better

Reuse of materials on site or by others is higher up the hierarchy than recycling. Reuse typically reduces resource input costs as well as disposal costs. For example, a plastics moulding operation may spend a few cents per kilo to dispose or recycle waste plastic that is valued at \$4-5 per kilo. A regrinding plant that allow plastic to be fed back into production will save much more than recycling.

Reduction is Best

Waste reduction should be the ultimate aim of waste minimisation. Waste reduction means that all costs associated with waste are eliminated. The full costs of waste include the costs of disposal, handling, storage, and production losses from materials losses and energy, waste and labour use. For example, the plastics moulding operation above saves money through regrinding for reuse, but still pays for the energy and labour of moulding and then again for the energy and labour of regrinding. These costs can be avoided by reducing plastic waste by more direct injection of plastic to moulds (waste is generated in the injection lines) and quality assurance measures (staff training, equipment maintenance) to reduce reject moulds.

4.2 CLEANER PRODUCTION

Cleaner Production means increasing productivity through waste minimisation. Often it involves redesign of production processes to increase material use efficiency, avoid problem wastes, reduce all waste, and/or generate by-products that can be reused or recycled.

4.3 ECO-EFFICIENCY

Eco-efficiency is a term used to describe the practice of designing and operating production systems to get the maximum use (and therefore product) out of resources. This involves adoption of waste minimisation and Cleaner Production approaches and actively seeking reuse applications for production by-products.

4.4 INDUSTRIAL ECOLOGY

Industrial Ecology is a term for one of the key objectives of this study; namely the cooperative exchange of waste by-products by manufacturers for reuse as substitutes for

first-use production inputs. Through such exchanges, manufacturing systems can emulate natural ecological systems where waste by-products from one organism are reused by others. This study has concentrated on solid and some liquid waste exchange opportunities, but other wastes such as gases and heat can be exchanged in Industrial Ecology systems. Industrial Ecology requires the establishment of 'clusters' or 'guilds' of manufacturers that can benefit through the exchange of waste by-products and the purchase of each others' products. Such systems operate successfully in Europe and North America, delivering cost savings to participants and reducing resource use and pollution. A number examples of waste exchange have been identified in the Geelong area. For example:

- Fertiliser companies use some waste acids and minerals from metal processing in the production of mineral fertilisers;
- Cement kilns use suitable wastes as a fuel to reduce gas consumption.

An aim of this project is to facilitate and support the establishment of 'guilds' of Geelong manufacturers that can benefit through waste exchange.

4.5 WASTE EXCHANGE

A key focus of this project was to identify opportunities for manufacturers to benefit from reuse of other manufacturers' wastes through an exchange system. There are different forms of Waste Exchange Systems. At the most basic level, they involve third party co-ordination of a waste register. This allows a manufacturer to find others that may generate or have a need for wastes they produce. More advanced Facilitated Waste Exchange systems can involve a third party acting as a broker, maintaining a database of available and required wastes and facilitating/brokering waste exchange. A similar service is provided by EcoRecycle Victoria through their home page (www.ecorecycle.vic.gov.au). Many similar systems operate around the world.

4.6 CONTINUAL IMPROVEMENT

As with any productivity improvement program, successful waste minimisation requires continual improvement processes to ensure that gains are on-going. Continual Improvement involve the following:

- Setting 'ideal' future targets (for example, several companies have set themselves 'zero waste' targets);
- Annual waste minimisation targets;
- Measuring progress towards these targets.

It also involves medium and longer term planning of what can be done to achieve waste minimisation objectives in the future. For example, an existing piece of plant may need replacement in five years time, at which time a less wasteful processing system may be able to be put in place. Continual Improvement also requires consideration of viability thresholds for waste minimisation initiatives. For example: how much would waste disposal costs need to increase in real terms before investment in new plant or a recycling system would be profitable? What increase in compaction density of film plastic (requiring investment in a baler) would make recycling viable?

4.7 MANAGEMENT COMMITMENT AND STAFF INVOLVEMENT

Successful waste needs commitment by management and involvement of staff in identifying, developing, implementing and reporting on waste minimisation initiatives. A number of Geelong manufacturers including Alcoa World Alumina Australia, Ford and Quicksilver have benefited through the establishment of environmental management teams that have helped to achieve waste minimisation and productivity improvements.

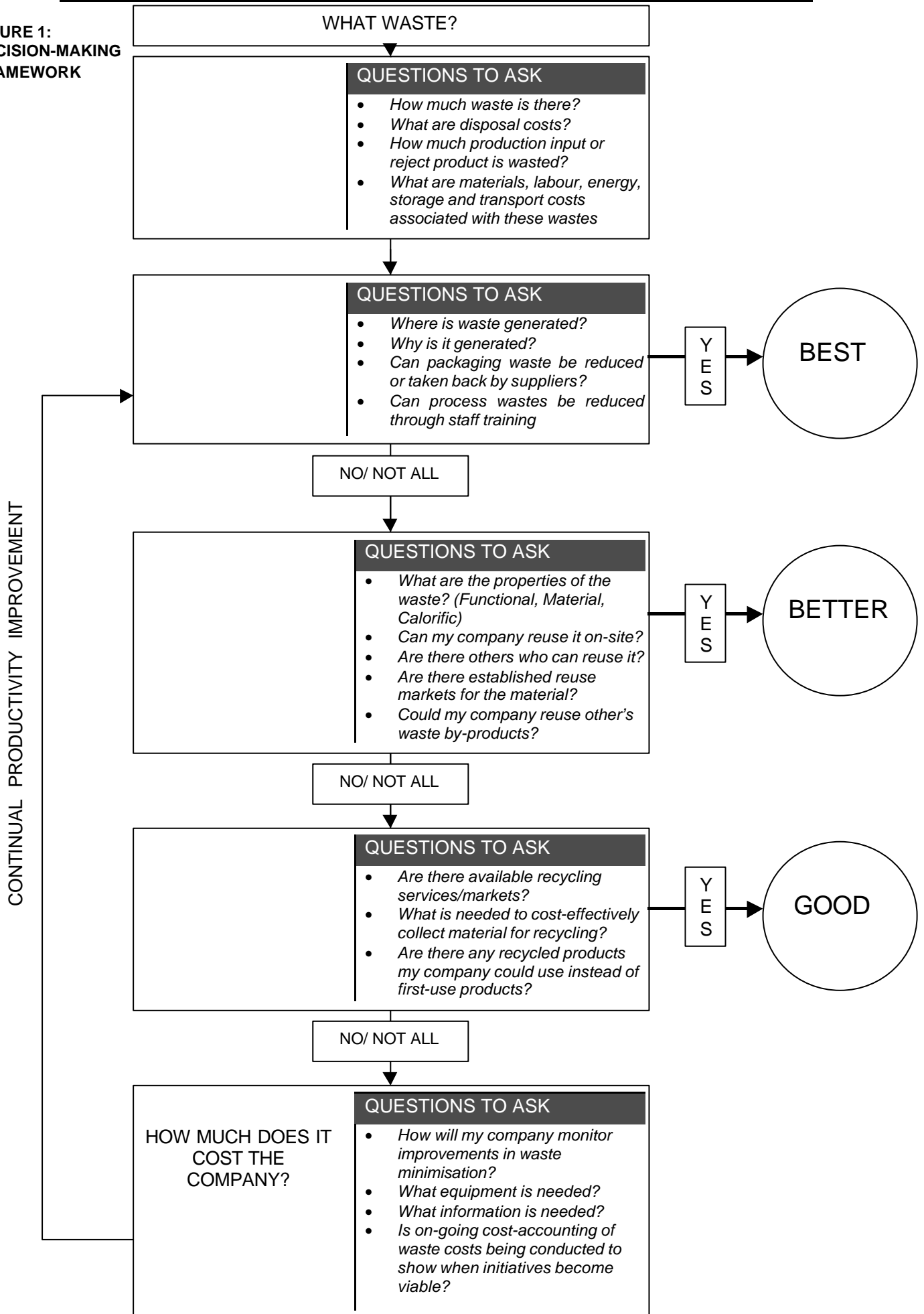
Figure 1 shows a decision-making framework that can be used to identify waste minimisation opportunities.

Further details are available in EcoRecycle Victoria's publications *Manufacturers Waste Reduction Manual* and *Waste Not – Want Not: an Essential Kit for Manufacturers*

RECOMMENDATION 2: PROMOTE AWARENESS OF WASTE MINIMISATION PRINCIPLES

It is recommended that the Manufacturing Waste Minimisation Working Group promote awareness of the principles of waste minimisation and publicise new developments and successes.

FIGURE 1:
DECISION-MAKING
FRAMEWORK



5. OPPORTUNITIES FOR WASTE MINIMISATION

Opportunities for waste reduction, reuse and recycling for different sectors and wastes were identified. The most significant opportunities are discussed in the following sections.

5.1 COMPOSTING

The study identified an opportunity for manufacturers generating significant quantities of organic waste to composting facilities. Manufacturers that could benefit from composting include:

- Textile manufacturers such as wool scourers and tanneries that generate organic sludges and high BOD wastewaters;
- Food manufacturers including abattoirs, seafood processors, poultry raising and processing manufacturers, and any manufacturers generating grease trap or other organic waste;
- Timber manufacturers generating large quantities of sawdust and waste timber.

Geelong and the Barwon Region has a number of experienced composting operators active in the area, including:

- Geelong Wool Combing, which operates a facility on-site to compost its own wool scour waste as well as waste from Austanners and Tasco;
- Organic Recyclers, which operates a composting operation at Colac that composts abattoir and dairy processing wastes, a composting facility at Brooklyn that receives some manufacturing waste from the Region, and bioremediation facilities at Alcoa World Alumina Australia's Point Henry and Portland sites.

A waste management company, Transwest, is establishing a composting facility near Colac to process domestic organic waste and some manufacturing waste.

Composting manufacturing wastes will require large volumes of woody waste to provide bulking materials that allow composts to aerate and provide carbon for compost micro-organisms. Green organic and timber waste from domestic sources is available to act as a bulking agent.

The Barwon Regional Waste Management Group and member councils are currently investigating opportunities for promoting greater diversion of organic wastes from landfill.

Key limitations to the expansion of composting operations are:

- Seasonal fluctuations in market demand for products resulting in periods of oversupply;
- Odour control requirements of either large buffer distances or capital-intensive engineering works to prevent inconvenience to neighbouring properties;
- Consumer resistance to waste-derived composts due to misconceptions about the quality and properties of these products.

RECOMMENDATION 3: PROMOTE COMPOSTING

It is recommended that the Manufacturing Waste Minimisation Working Group, through the Barwon Regional Waste Management Group, work with Geelong Wool Combing, Organic Recyclers, Transwest and other credible composting operators to:

- **Promote the establishment and operation of suitably located facilities for processing organic waste from manufacturers;**
- **Promote the use of compost products;**
- **Promote best practice by composting operators to ensure good quality products and operations.**

RECOMMENDATION 4: SUPPORT COMPOSTING TRIAL

It is recommended that the Manufacturing Waste Minimisation Working Group assist Geelong Wool Combing to conduct a trial of expanded composting to process wool scour waste from other sources.

5.2 BIOREMEDIATION

An opportunity has been identified for Geelong manufacturers generating contaminated sludges to treat these through bioremediation. Bioremediation involves the use of microbiological activity to break-down contaminants. It is particularly useful for decontaminating soils and sludges contaminated with petroleum hydrocarbons such as oils, fuels and solvents. Bioremediation can significantly reduce waste management costs by converting prescribed wastes into clean soil for landscaping.

Composting processes can be used to accelerate bioremediation. Alcoa World Alumina Australia are currently operating bioremediation at their Point Henry and Portland sites, and uses the compost produced to rehabilitate and landscape their sites.

Shell Refining has expressed interest in investigating bioremediation to treat oily sludges at its Corio site, and using the resulting compost for on-site landscaping and re-vegetation.

As a composting process, bioremediation will require significant quantities of wood waste as a bulking agent.

RECOMMENDATION 5: SUPPORT BIOREMEDIATION

It is recommended that the Manufacturing Waste Minimisation Working Group:

Promote bioremediation as a waste management alternative to contaminated sludge generation and disposal.

- **Promote the success of bioremediation at Alcoa Australia, using the site as a demonstration to manufacturers in Geelong and other regions;**
- **Support and assist the trial of bioremediation at Shell Refining;**
- **Assist, through the Barwon Regional Waste Management Group, manufacturers wishing to establish bioremediation operations to secure sufficient wood waste for composting;**
- **Support the marketing of Geelong manufacturers' expertise in this area.**

5.3 TRANSPORT PACKAGING

A significant waste minimisation opportunity for most manufacturers is the minimisation of transport packaging. Transport packaging consists of cardboard cartons and inserts, timber pallets, plastic film wraps and foams, strapping and metal and plastic containers.

5.3.1 Reduction Opportunities

Manufacturers can reduce their transport packaging waste by specifying that suppliers:

- Use less transport packaging;
 - Use and take back reusable transport packaging;
 - Take back all transport packaging (giving the supplier incentive to reduce this waste)
-

Manufacturers can also reduce this waste by purchasing their own reusable transport packaging.

5.3.2 Reuse Opportunities

Manufacturers have an opportunity to reuse non-returnable packaging. One company, Quicksilver, achieved cost savings of between \$17,000 and \$20,000 in carton purchases simply by reusing imported cartons. Another company, Rohm and Haas, has reduced the generation (and costs) of metal and plastic chemical drums by having chemicals supplied in returnable and reusable, pallet-sized tanks.

Non-returnable transport pallets are a common waste across all sectors. Many are potentially reusable, and many manufacturers already reuse them when they can. However, the number of incoming pallets is often greater than demand. This study has identified a potential business opportunity for sturdy non-returnable pallets to be reclaimed as a free resource, screened, repaired and labeled, and then sold or hired to transport and other companies. Reusable pallets retail for \$8 to \$15 each. Pallets could be used to export materials or used for domestic transport. Those used domestically could be labeled for on-going reuse, with the pallet recovery business taking responsibility for the take back of these pallets.

RECOMMENDATION 6: PROMOTE MINIMISATION OF TRANSPORT PACKAGING

It is recommended that the Manufacturing Waste Minimisation Working Group:

- **Promote, through the Barwon Regional Waste Management Group's "Waste Wise" education activities, waste reduction and reuse strategies for transport packaging to manufacturers;**
- **Liaise with leading transport and packaging companies and encourage them to use reusable transport packaging;**
- **Assist businesses wishing to purchase reusable transport packaging through support for applications to funding bodies. These businesses could serve as demonstrations.**

RECOMMENDATION 7: SUPPORT PALLET RECOVERY

It is recommended that the Working Group support the trial or establishment of a pallet recovery, repair and reuse operation by:

- **Liaising with transport companies and pallet manufacturers to find an organisation willing to participate in the scheme;**
- **Assisting the establishment of a drop-off facility and/or collection service to recover suitable timber pallets;**
- **Liaising with companies that could supply waste paint to label pallets;**
- **Promoting the availability of pallet drop-off and/or collection services;**
- **Promoting the availability of the recovered pallets.**

The Working Group could support the establishment of a timber pallet recovery operation by supporting participants to apply for funding to:

- **Develop a business plan;**
- **Establish drop off and collection systems;**
- **Promote their services and products.**

5.4 FOUNDRY SAND REUSE

The Geelong area has a number of manufacturers that cast metal products. Foundry sand from these manufacturers can potentially be reused for casting following grinding. However, reused foundry sand needs to be refreshed through the addition of fresh sand, with a portion of the used sand being drawn off. This material can potentially be reused as a sand in civil engineering applications such as roadways, drains and paving. It can also be used as trench and base fill material. To be suitable for such reuse applications, foundry sands must have sufficiently low levels of chemical contamination from binders used in casting moulds and cores.

Ford Australia has successfully modified its production processes to ensure that spent casting sand is effectively uncontaminated and has gained EPA approval for reuse applications for the material. Markets for this and other suitable foundry sand need to be secured. Potential markets are ready-mix concrete suppliers and other concrete product manufacturers.

RECOMMENDATION 8: SUPPORT FOUNDRY SAND REUSE AND MARKET DEVELOPMENT

The Waste Minimisation Working Group should consider helping Ford Australia and other sources of foundry sand to link with potential markets. The Working Group should support potential suppliers and users of foundry sand to obtain resources for relevant research and demonstration trials. The City of Greater Geelong could arrange for demonstration uses of foundry sand in public works projects.

5.5 TEXTILE REUSE AND RECYCLING

The study found large quantities of natural and synthetic fibre wastes are generated by textile manufacturers.

Off cuts of fabrics and carpets have a reuse potential in the manufacturer of smaller items. For example, mats can be made from carpet off-cuts. Fabric off-cuts can be reused as cleaning cloths.

Larger pieces of textile waste such as ends of rolls and obsolete stock could be reused as weed suppressant matting in re-vegetation plantings.

Textiles can also be recycled, typically involving shredding for fibre reuse in non-woven fabrics such as cleaning cloths, carpet underlays, heat and sound insulation and moulded automotive components. There are textile recycling collection services available in Melbourne and a number of these are willing to collect from the Geelong area. However, there is often a fee for collection services, particularly for smaller loads from individual manufacturers. Geelong textile manufacturers that have previously used recycling collection services have sometimes experienced inconsistent and irregular collection. Formal collection agreements are needed. To secure these, it may be necessary to consolidate large loads of textiles for collection or delivery to markets. There may be potential for the establishment of a centralised facility for the collection and sorting of textiles for reuse and recycling.

RECOMMENDATION 9: PROMOTE TEXTILE REUSE AND RECYCLING

It is recommended that the Manufacturing Waste Minimisation Working Group promote reuse and recycling of textile waste by:

- Promoting case study examples of companies that are benefiting by reusing off-cuts to produce sideline products;
- Supporting a feasibility study and business plan development for a centralised textile waste collection facility;
- Facilitating links between textile manufacturers and companies or community groups requiring ground-cover matting for tree planting. This activity could also be linked with the use of composts and timber waste mulches.

Another form of textile waste is partly-used spools from knitting and weaving machines. Part-used spools can be re-spooled for reuse. Alternatively, some threads can be recycled by shredding and respinning. One leading Geelong textile manufacturer is establishing a nylon thread recycling operation and may be willing to investigate suitable material from other manufacturers.

Empty spools of polypropylene or cardboard could be reused if they are returned to suppliers or others spooling threads and yarns. Alternatively spools can be recycled.

RECOMMENDATION 10: SUPPORT REUSE AND RECYCLING OF YARN AND THREAD WASTE

It is recommended that the Manufacturing Waste Minimisation Working Group support re-spooling and recycling of thread and yarn from knitting and weaving operations by:

- Encouraging investment by manufacturers in re-spooling or recycling equipment and assisting them to seek Business Victoria or other funding for the installation of such equipment;
- Assisting companies investing in re-spooling and recycling equipment to source suitable materials from other textile manufacturers to ensure that the equipment is used to their full capacities;
- Assisting companies producing empty spools to identify companies that can reuse or recycle the spools.

5.6 MINERALS TO FERTILISERS

The study identified opportunities for mineral wastes from spent catalysts, galvanising and other metal processing, filter cake and filter dusts to be used in the manufacture of fertilisers. Such a use of wastes will require:

- Strict quality assurance systems to ensure that wastes are suitable for fertiliser production;
 - Sufficient, consistent supplies of suitable wastes.
-

RECOMMENDATION 11: SUPPORT TRIAL OF WASTE TO FERTILISER

It is recommended that the Working Group further investigate this option through a trial by:

- Liaising with fertiliser companies and potential suppliers of mineral wastes to seek their agreement to participate in a trial;
- Assisting the participants in designing the trial and applying for trial funding;
- Providing support for coordinating the trial and monitoring outcomes;
- Conducting an assessment of the cost-benefit of the trial and the future viability of waste to fertiliser;
- If the trial proves that use of wastes for fertilisers is viable, working with participants to develop systems to ensure that sufficient quantities of suitable materials are supplied to fertiliser companies.

5.7 WASTES TO FUEL

Many of the manufacturers surveyed and visited generate quantities of oil, solvent and chemical sludges. Under EPA's draft Industrial Waste Management Policy, energy recovery from wastes such as oils, solvents and chemical sludges will be preferable to stabilisation and disposal. Where reuse and recycling is not possible, EPA will have the authority to require energy recovery.

Blue Circle Cement currently uses wastes for 40% of the energy requirements of their kilns, and have capacity for additional waste rubber and oils. Oil and other wastes used as fuel are supplied by waste management facilities having strict quality controls. These are currently sourced from facilities outside the Barwon region, though some of the material is originally from Geelong. This means that materials are transported out of the area for sorting and load consolidation, and then transported back for use as a fuel. There is potential for the establishment of a prescribed waste treatment operation within the Region to supply Blue Circle and other potential users of waste-derived industrial fuels.

RECOMMENDATION 12: INVESTIGATE ESTABLISHMENT OF A GEELONG-BASED WASTE FOR FUEL RECOVERY FACILITY

It is recommended that the Manufacturing Waste Minimisation Working Group investigate the feasibility of a Regional facility for processing of wastes to supply Blue Circle and other potential users of waste-derived industrial fuels.

RECOMMENDATION 13: PROMOTE USE OF OIL AND SOLVENT RECOVERY SERVICES

It is recommended that the Manufacturing Waste Minimisation Working Group promote the use by Geelong manufacturers of prescribed waste collection services that recycle, reuse or supply energy recovery markets.

5.8 NON-METALLIC MINERAL WASTES TO CONSTRUCTION PRODUCTS

Some wastes such as fly and bottom ash, dried cement and concrete, and slimes from sand cleaning can be used in civil works such as road and drainage construction. Wastes can also be used in concrete products. Trials may be required to test the structural properties and performance of materials.

RECOMMENDATION 14: SUPPORT TRIALS TO REUSE APPROPRIATE WASTES AS CONSTRUCTION PRODUCTS

It is recommended that the Working Group support manufacturers interested in trialing the use of waste non-metallic materials in construction applications.

5.9 WASTE EXCHANGE

The study has identified a role for the Manufacturing Waste Minimisation Working Group members in promoting the exchange of waste by manufacturers, namely:

- Developing and distributing a directory of manufacturers that either generate specified wastes, are interested in receiving specified wastes, and/or manufacture waste-derived products. This is the least cost option, and would require an annual survey of manufacturers and preparation and distribution of the directory;
- Establishing and maintaining a facilitated waste exchange service to allow manufacturers to register the availability or demand for a waste. Such a system would require the Working Group to act as a 'broker' matching supply with demand. This option is more labour intensive and would require on-going staffing and database maintenance. EcoRecycle Victoria currently provide such a service through their homepage and information line.

RECOMMENDATION 15: PROVIDE A WASTE EXCHANGE DIRECTORY AND INFORMATION SERVICE

It is recommended that the Manufacturing Waste Minimisation Working Group:

- **Seek funding to develop and distribute a waste exchange directory for the Geelong area. Production of the directory could be supported through advertising by participating businesses;**
- **Promote the use of EcoRecycle Victoria waste exchange service, and survey Geelong manufacturers regarding the usefulness of the service to their needs;**
- **Seek funding to provide a telephone information service, in addition to the provision of the directory, to facilitate waste exchange. Barwon Regional Waste Management Group could provide this service.**

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 KEY FINDINGS

- Waste disposal costs are typically not the major component of the full costs of waste. Loss of production materials, and related energy, water, labour, equipment time, transport, storage and handling costs contribute the most to waste costs.
 - Waste is costing Geelong manufacturers in the order of \$4 million to \$5 million for disposal costs alone.
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- Waste disposal costs are only part of the cost of waste, and the full costs of waste to Geelong manufacturers may be approximately \$20 million per year.
 - Many Geelong manufacturers are aware of waste management issues and costs and many are making progress in waste minimisation.
 - Geelong has a diversity of manufacturers, with all sectors well represented. This makes Geelong a favourable location to trial and demonstrate waste minimisation initiatives, including co-operative waste exchange by manufacturers.
 - Geelong has a number of best practice examples and national leaders in industrial waste minimisation including Alcoa World Alumina Australia, Geelong Wool Combing, Ford Australia and Pilkington Australia.
 - Significant wastes generated by all manufacturing sectors include:
 - Transport packaging consisting of:
 - Cardboard cartons;
 - Timber pallets and crates;
 - Plastic stretch and non-stretch film wraps;
 - Foam plastics;
 - Packaging tapes;
 - Cleaning gloves and rags;
 - Steel and plastic containers (tubs, buckets, tins) from oils, solvents, glues, paints, coatings, dyes and food additives.
 - Significant wastes on a sector by sector basis include:
 - Food and beverage sector wastes such as:
 - Food waste;
 - Grease trap sludge;
 - Food contaminated cardboard and paper;
 - Reject product;
 - Periodic spoilage of perishable inputs and products.
 - Textiles, clothing and footwear sector wastes such as:
 - Textile off cuts and dust;
 - Empty and part-used spools of thread and yarn;
 - Wool scour and other cleaning sludges;
 - Cardboard rolls and cartons.
 - Wood and paper products sector wastes (including prefabricated building and furniture manufacturers) such as:
 - Wood;
 - Wood shavings/dust;
 - Textiles;
 - Air filters.
 - Printing and publishing sector wastes such as:
 - Paper;
 - Dirty inks and solvents;
 - Petroleum, coal and chemicals sector wastes such as:
 - Oily sludges;
 - Chemical sludges;
 - Filter cake;
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- Spent catalysts;
 - Dust;
 - Air filters;
 - Metals.
- Non-metallic minerals sector wastes such as:
 - Glass;
 - Hardened cement;
 - Dust;
 - Filters;
- Metal products sector waste such as:
 - Metal;
 - Foundry sand;
 - Spent pot lining;
 - Carbon dust;
 - Oily sludge;
 - Paint sludge;
 - Fly and bottom ash;
 - Dust;
 - Filter cake;
 - Air filters.
- The most promising opportunities for waste reduction include:
 - Where possible, replacing non-reusable transport packaging with reusable items.
 - Staff training to reduce waste;
 - Machine calibration and maintenance to reduce waste;
 - Staff training to keep reusable and recyclable materials separate and clean for collection;
 - Process modification to reduce or eliminate wastes, particularly those that cannot be reused or recycled.
- The most promising opportunities for reuse and recycling include:
 - Composting;
 - Bioremediation;
 - Transport packaging reuse;
 - Foundry sand reuse;
 - Textile reuse and recycling;
 - Minerals to fertilisers;
 - Wastes to fuels;
 - Wastes to building products.

6.2 FORMATION AND ROLE OF MANUFACTURING WASTE MINIMISATION WORKING GROUP

There is a role for a coordinating organisation to promote waste minimisation, facilitate waste exchange and to help provide the resources and communications required for Geelong manufacturers to reduce, reuse and recycle wastes.

It is recommended that a Manufacturing Waste Minimisation Working Group is formally established with a membership consisting of:

- Geelong Manufacturing Council;
- Barwon Regional Waste Management Group
- City of Greater Geelong;
- Representatives from each manufacturing sector.

The functions of this group would include:

- Facilitating links between waste generators and potential or actual markets/users;
- Facilitating the formation of industry sub-groups to develop waste reduction and exchange opportunities;
- Assisting manufacturers willing to adopt or trial waste reduction and exchange initiatives to apply for funding;
- Assisting and promoting the outcomes of waste minimisation initiatives adopted or trialed by Geelong manufacturers;
- Facilitating communications and coordination between different sectors to:
 - Avoid unnecessary duplication of work ;
 - Co-ordinate involvement of different businesses that could benefit from proposed waste exchange initiatives;
 - Ensure that all manufacturers are informed of developments and progress;
- Maintaining a register of companies involved or wishing to be involved in waste reuse and recycling initiatives, for use in facilitating links between waste generators and markets/users;
- Promoting and marketing Geelong manufacturers as national leaders in waste minimisation;
- Encouraging local and other businesses and organisations to adopt purchasing policies that give preference to products and services produced by Geelong's Waste Wise businesses;
- Maintaining an information library of relevant articles, Internet website links, and useful contacts/sources of information for use by companies wishing to develop waste minimisation programs;
- Promoting the waste minimisation support of EcoRecycle Victoria, Business Victoria, EPA and other organisations;
- Monitoring and reporting the effectiveness of the working group's initiatives through periodic surveys of Geelong manufacturers about their awareness and participation in waste minimisation initiatives, and quantifying the amounts of waste being reduced, reused and recycled each year.

It is recommended that the Manufacturing Waste Minimisation Working Group:

- Facilitate the formation of sub-groups of manufacturers to further develop waste minimisation opportunities within and between sectors. It is proposed that sub-groups should be formed both around individual manufacturing sectors and around identified waste exchange opportunities. A suggested structure for sub-group formation is shown in Figure 2;
- Seek resources to trial the most promising waste reduction and exchange opportunities;
- Publicise the outcomes of trials of waste reduction and exchange opportunities;
- Continue to promote opportunities for productivity gains through waste minimisation to Geelong manufacturers.

The Barwon Regional Waste Management Group has a legislated responsibility for waste minimisation and management planning within the Region. It also has a major role in educating the community and businesses about waste minimisation and facilitating the development of waste management and processing systems.

The Geelong Manufacturing Council plays a key role in promoting the interests of Geelong manufacturers, and in promoting and facilitating improvements in markets and productivity.

It is recommended that the Barwon Regional Waste Management Group and Geelong Manufacturing Council take lead coordinating roles within the working group.

6.3 PARTICIPATION AND ROLE OF MANUFACTURERS

It is recommended that, through the Manufacturing Waste Minimisation Working Group, manufacturers establish waste reduction and exchange sub-groups. Waste reduction sub-groups could involve representatives from the same sector, whilst the waste exchange sub-groups would form around particular types of waste.

FIGURE 2 - PROPOSED GROUP FORMATION

