Management of Residuals from Coatings and Ink Related Manufacturers

Geocycle
Sustainable Waste Transformation

Introduction

Geocycle is a resource recovery company that specialises in transforming residual by-products and waste materials into quality assured alternative fuels and materials for cement kiln applications. Incorporated in 2000, Geocycle has operations in New South Wales, Victoria and their home state of Queensland.

As part of their commitment to new service development and delivery, Geocyle is interested in developing an understanding of current issues in managing residual materials arising from coatings and ink manufacturers. Of special interest is identifying opportunities where partnerships can be developed to deliver environmentally responsible and cost effective residual management services.

To further Geocycle's knowledge base, an investigative study was undertaken into the types of materials currently generated as by-products, the volumes generated and the methods used to treat and/or dispose of these materials. Forty-nine coatings manufacturers and eight ink manufacturers were selected for inclusion in the study. Throughout May and June of 2005, interviews were held with 26 coatings and four ink related manufacturers. During the course of the interviews, many participants expressed an interest in receiving some feedback on the information collected as part of the study. Accordingly, Geocycle has prepared this summary report, which serves as a useful snapshot of the waste management issues currently facing many manufacturers in the coatings and ink markets.

Overview of the Coatings and Ink Industry Segment

Paint production in Australia fluctuates between 185 and 225 million litres. Architectural and Decorative (A&D) paint production accounts for over 55 per cent while Industrial Paint and Coatings account for the rest. The Australian Paint Manufacturers Federation[1] notes that there is an ongoing trend of market rationalisation as manufacturers strive to gain economies of scale. The major factors impacting the industry include health, safety and environment legislation, demand for performance oriented quality products and cost reduction. One result of these drivers has been the increase in volume of water thinned A&D paint from 37 per cent to 48 per cent and the converse decrease in solvent thinned A&D paint from 12 per cent to 8 per cent.

Drivers for Improved Environmental Performance

The manufacture of coatings and inks comes under close environmental scrutiny. In addition to the 'normal' regulatory regime surrounding manufacturing operations, there are also requirements related to dangerous goods storage and handling (see Figure 1), and associated labelling and transportation standards for finished products.

Other issues relevant to coatings and ink related manufacturers include additional regulation in the management of prescribed and non-prescribed waste materials, with accompanying increases in fines for non-compliance. This is part of the overall trend toward 'Extended Producer Responsibility' (EPR), a policy approach in which the manufacturer has responsibility for the by-products they generate and also for the post-consumer stage of their product's life cycle.

Figure 1 – the powders, resins, solvents and additives used in coatings and ink manufacture must be handled in controlled conditions in order to protect workers and the environment

[1] See http://www.apmf.asn.au/downloads/studentguide0101.pdf for more information.

New South Wales, often seen as the national barometer for environmental policy, has introduced legislation to drive EPR in a number of key product sectors, including household hazardous and chemical wastes and agricultural/veterinary chemicals and their containers.

This action has alerted the chemicals industry to the need for more sustainable resource recovery options for the management of their by-products and end-of-life products. The management of by-products left as residuals from coatings and ink related manufacturers thus represents an opportunity for improved environmental performance in addition to achieving cost savings. Furthermore, by taking proactive voluntary action, it also represents the chance to avoid onerous regulation.

By-products arising from the coating and ink industry segments

Seven main by-product categories were identified, including washout liquids, separated solids and sludges, general solid waste, raw material packaging, off-specification and faulty batches, obsolete products, and other cleaning materials. The primary influence on material types within these categories was whether water based or oil based product was manufactured.

The study also observed the trend in the coatings sector towards water based acrylic paints. Many participants reported the generation of residual solids from treating washout water. Oleoresinous (oil based) paints are in decline and only contributed limited amounts of by-products. However, oleoresinous based systems still dominate in the ink manufacturing segment.

Other problematic by-products identified included metal containers, plastic containers, paper and plastic lined paper sacks, bulker bags and pallets. No recycling options are easily accessible for these materials.

By-product categories

The range of by-product materials identified during the study were grouped into seven major categories, including:

- wash outs – the washings arising from clearing out mixing vessels, paint lines and other containers. Usually differentiated by acrylic based or oleoresinous (oil) based and also separated into white and coloured wash outs
- separated solids and sludges – the residuals remaining after treating washout water or solvents which can remain as a sludge or dried to a putty like substance. Also includes fine dust arising from powder coating manufacture
- general solid waste – a range of generic materials such as cardboard, paper, plastic that is either recycled or disposed of to landfill, usually via a front lift bin
- raw material packaging – including metal drums, plastic containers, paper and plastic lined paper sacks, pallets, shrink wrap and the like which are often un-recyclable because of residual resin, pigment or extender
- off-specification and faulty batches – any product that did not meet manufacturer quality criteria
- obsolete products – end of line coatings or inks no longer sold
- other cleaning materials – for example, dirty rags, which may need special management.

Water Based Systems

The use of primarily water based paint systems directly influenced the composition of by-product materials. This has also led to increased efforts to introduce washout water recycling systems, either by reusing the washout water in subsequent product batches or by treating the water onsite to a standard where it can be discharged into the sewerage or storm water lines. Very few instances of washout removal for treatment by a waste management company were reported.

The solids from treating washout water included pigments, binders, fillers and extenders, and other additives. The most common pigment identified was titanium dioxide (white coloured paint). Fillers and extenders included calcium carbonate (chalk), silica, magnesium silicate (talc), aluminium silicates (clay) and zinc oxide.

Solids were removed by using flocculation, settling tank or sand pit systems. The resultant materials ranged from a semi-dry putty to a dry cake and were disposed of to landfill via a range of commercial contractors. There were usually no restrictions on landfill as the materials are principally inert.

During the course of the study some 364 cubic metres of dried solids generated on an annual basis were identified. This amount should not be taken as a quantitative result representing the whole sector as some of the larger manufacturers were not contactable or did not want to participate in the study.

The solids are not currently recycled and so represent a potential opportunity for resource recovery. However the relatively low price of landfill could lessen the attractiveness of this option.

Oleoresinous Systems

Only limited amounts of oleoresinous (oil-based) paints are manufactured in the coatings market. This is contrasted with the ink segment, where the proportion of ink manufacturers using oil based systems were in the majority (only one manufacturer of water based ink was identified).

Common solvents used are turpentine and white spirit. Typically washout solvents are allowed to settle in order to maximise reuse opportunities onsite for solvents. Other washout is combined into new product or taken offsite for recycling, either as solvent or as an ingredient into a gun wash product.

A number of commercial solvent recyclers and collectors were identified that collected these materials and transported them offsite for either recycling into new solvent, new products (for example, gun polish) or for use as an alternative fuel. Most study participants recognised the need for their waste collector to be properly licensed and were aware that these types of by-products were classified as prescribed waste materials.

During the course of the study some 2,250 drum equivalents of solvent by-products were identified. Again, this amount should not be taken as representative of the whole sector due to non participation by some large operations.

Overall solvent waste systems are put in place to minimise the generation of solvent waste, with unavoidable sludges stored in 205 litre drums for collection and processing (see Figure 2). One exception is the dust arising from powder coating manufacture, where large amounts of fine powder coating dust are generated as waste, comprising 40-50% epoxy resin with some polyester, 30-40 % fillers and extenders and 5-10% pigment, in addition to other additives.

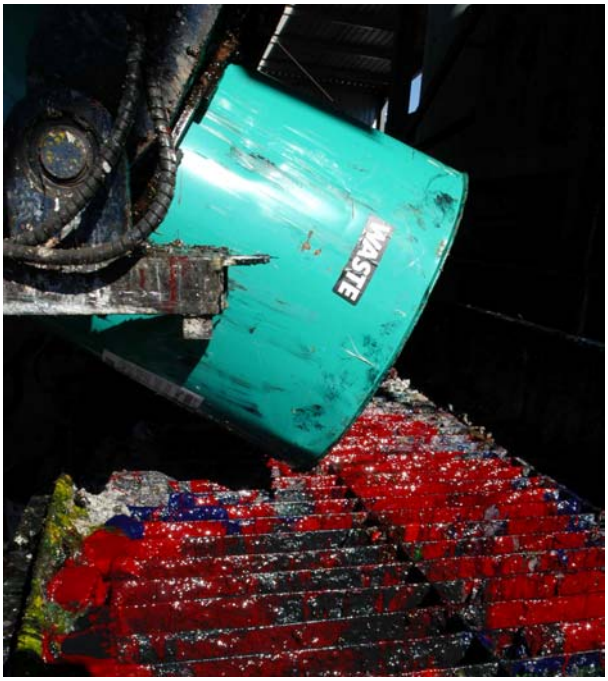

Figure 2 – metal drums are used to store separated solids and sludges. Drums must be drained prior to being recycled, and even then many metal recyclers may not accept them, creating additional challenges for resource recovery.

Other Problematic Materials

Throughout the course of the study, many respondents volunteered information on other problematic by-product types for which they are seeking solutions. Some common themes emerged, including the following materials:

- metal containers – many metal recyclers would not accept metal drums and buckets for recycling if there was any residual paint or ink, even if it had dried. This is because of the explosion hazard that paint presents when metal is processed
- plastic containers – (polypropylene and polyethylene) – there were no recycling opportunities for plastic containers with residual paint because of difficulties in separating the plastic polymer from the paint. It is cost prohibitive (time wise) to rinse out the containers, resulting in their disposal to landfill as waste

- paper and plastic lined paper sacks – these are used for pigments and extenders. Any residual left in the paper bag made it undesirable for recycling. For example, one Victorian generated in the order of 275 cubic metres of compressed bags per year, a significant amount of material to landfill
- bulker bags – bulker bags were also used to transport pigment and extenders. The majority of these bags end up in waste disposal
- pallets – pallets were used to transport raw materials contained in paper sacks, bulker bags and other containers. These are normally one-way pine pallets and are a waste management issue.

In addition to the materials identified above, participants expressed interest in having better management systems for liquid wastes, principally around the management of acrylic paint washout water.

Needs Identified

The study identified specific requirements for improved management of residual materials generated by coatings and ink related manufacturers, including:

- whole of site service management as a specialist product offering for coatings and ink related manufacturers - this would manage liquid and solid by-products, simplifying compliance and management for manufacturers
- developing recycling opportunities for plastic lined paper bags and plastic buckets with small amounts of resin as fuel feedstock - these materials were identified as problematic and are currently sent to landfill as waste
- recycling services for low volume generators including storage and collection solutions - a specialised storage solution for generators of low volumes of materials would allow the safe onsite storage of these materials until sufficient volumes warranted pick-up from recyclers
- public returned paints as part of clean-up and other take back initiatives - an ongoing solution for these returned materials has not been identified. As increased pressure is placed on industry to prevent old paints from entering the waste stream, viable and reliable alternatives will be required.

The wider use of suitable residual materials as alternative fuels would contribute to meeting some of these identified needs. Many of the by-products identified in this study have good solvating properties and a high calorific value, often with limited opportunities for direct reuse or other recycling opportunities. This suggests that some of the by-products from the coatings and ink market would make a good source of alternative fuel, provided an appropriate conversion technology is used. One such conversion technology is the manufacture of a fuel for cement kiln use.

Use of Alternative Fuels in Cement Kilns

Cement and cement products are essential materials in the Australian construction and building industry of today. The cement industry in Australia comprises Adelaide Brighton Ltd, Blue Circle Southern Cement Ltd and Cement Australia Pty Ltd. These three companies operate ten cement works, which together account for 100% of integrated clinker and cement supplies in Australia.

Environmental issues have taken on an increasing importance in the Australian Cement Industry, as evidenced by plant upgrades to improve energy efficiency and to reduce emissions, the release of a second Cement Industry Environment Report and a growing uptake of alternative raw materials and alternative fuels. Alternative materials and fuels offer a range of environmental benefits such as reduced depletion of non-renewable resources, recovery of resource value from previously wasted and in some cases hazardous materials and conservation of landfill space (see Figure 3 for a schematic of the cement manufacture process). There may also be additional benefits such as reduced greenhouse gas emissions from the replacement of fossil fuels and a reduction in emissions such as nitrogen oxides (NO_x) from cement kilns.

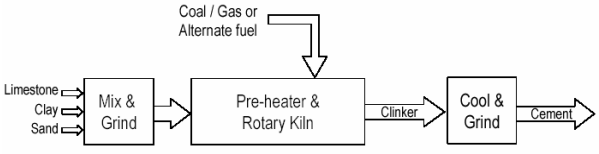

Figure 3 – Schematic of the cement manufacture process. Cement powder is added with rock aggregate and water to make concrete.

Alternative fuels are used to replace fossil fuels such as gas, coal or oil, which would otherwise provide energy for the cement kiln. The extremely high temperatures (over 1,500°C) and long residence time of combustion in cement kilns ensure that any complex organic compounds are destroyed, in addition to neutralising any potentially harmful mineral elements. Furthermore concrete made from cement manufactured using alternative fuels has the same safe construction and environmental properties as if it had been made using traditional fossil fuels.

The current range of fuels used by cement kilns include tyres, carbon anode dust & spent pot linings from the aluminium industry, a blend of recovered oils, dewatered sludges and grease trap emulsions and solvent based fuel. The Gladstone plant operated by Cement Australia (see Figure 4) is one cement kiln currently using alternative fuels supplied by Geocycle. There are many opportunities to use the residual materials from coatings and ink related manufacturers as a fuel for cement kilns. This would change existing patterns of polluting land with waste (landfill) and deliver resource recovery outcomes performed by a licensed operator in controlled conditions.

Figure 4 – Gladstone clinker production facility operated by Cement Australia in Queensland is one of the ten cement works operated in Australia

Further Information

Geocycle is in the business of preparing quality assured fit-for-purpose alternative fuels and materials for cement manufacture. Geocycle is interested in talking further with manufacturers in the coatings and ink related markets in order to explore opportunities for developing some of the service delivery improvements identified in this report. For more information please contact:

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Figure 5 – Alternative fuel materials ready for testing at Geocycle laboratories. All additional materials are tested as part of the quality assurance programme before being used in fuel products.

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