Cleaner Production

Cleaner Production in the Queensland Foundry Industry

Project Summary

Key Findings

- This project was initiated by the Queensland EPA, Sustainable Industries Division in conjunction with the Australian Industries Group. These two groups co-developed the draft Environmental Guideline, *Beneficial re-use of ferrous foundry by-products*.
- The project was facilitated by the UNEP Working Group for Cleaner Production based at the University of Queensland. It aimed to build on the beneficial reuse project to identify opportunities to reduce waste and increase efficiency at source.
- A detailed Manual and Self Assessment Guide has been developed to provide a detailed list of ideas that foundries may by able to apply to their own processes. It also provides step-by-step methodology to undertaking a Cleaner Production Assessment and developing a Cleaner Production Plan for foundry operations.
- While foundries already undertake Cleaner Production to some extent, most foundries have significant opportunities to achieve further improvements in these areas. By keeping an open mind, thinking laterally and focusing on continuous improvement, the ideas developed in this project can help improve the competitiveness of the Queensland foundry industry
- The project also included a series of site visits and demonstration projects as well as workshop based training for industry and government. Over twenty of the foundries in Queensland have been involved in these activities.

QUEENSLAND GOVERNMENT Environmental Protection Agency

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UNEP Working Group for Cleaner Production

AUSTRALIAN INDUSTRY GROUP

Background

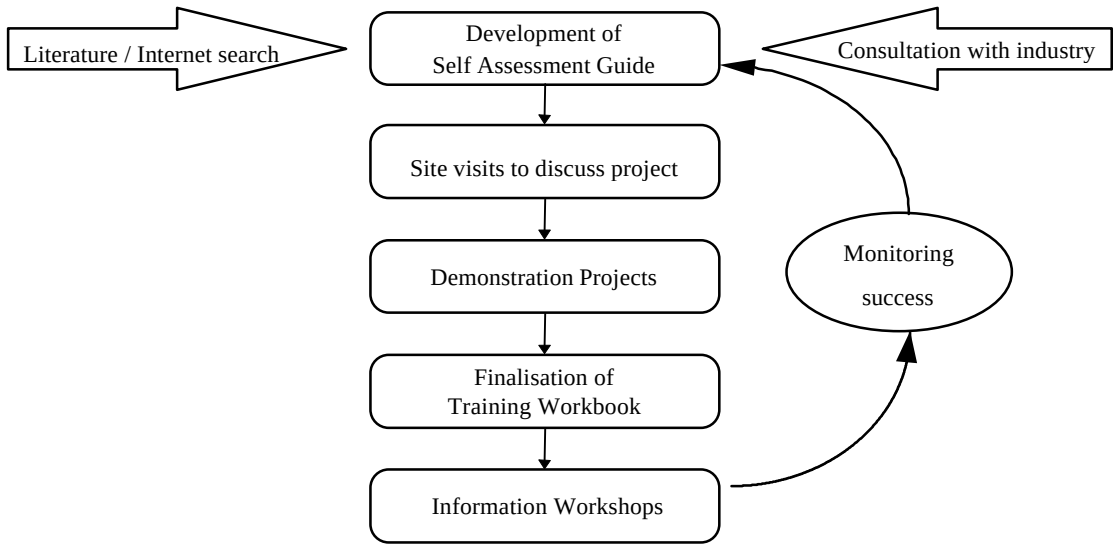
In March 1999, the EPA and the Foundry Industry Environmental Working Group released its draft Environmental Guideline, *Beneficial re-use of ferrous foundry by-products*. This project was designed to help facilitate the increased practice of beneficial reuse in the industry. This has already helped to reduce the quantity of foundry waste that is sent to landfill and is reducing the cost to industry for disposing of this material. It will also lead to flow on benefits by providing inexpensive inputs to other industries. The foundry sector generates over 50,000 tonnes of foundry by-products, predominantly sand, each year. Around 85% of this material is currently sent to landfill. Beneficial reuse could be increase to around 70% over the next five years. This would reduce the quantity of material going to landfill by 25,000 tpa with a potential saving of $500,000 pa.

The industry has realised that, beyond the potential benefits of beneficial reuse, there is a significant opportunity to reduce waste and improve resource efficiency at source. These practices can reduce waste disposal costs but also offer benefits such as reduced purchasing costs, improved casting quality, increased productivity from improved work conditions.

The UNEP Working Group for Cleaner Production, based at the University of Queensland has expertise in helping companies and industry groups identify opportunities in these areas. The group has recently completed a successful project with the Queensland metal finishing industry, which used a similar methodology to the foundry project.

Project Summary

The major steps in the project can be seen in the following diagram:



Phase One: Self Assessment Guide

A literature review and industry consultation was undertaken to investigate the status of Cleaner Production techniques locally, nationally and internationally.

A Self Assessment Guide was developed to provide a step-by-step guide to Cleaner Production as well as checklists that provide Cleaner Production options for the foundry industry.

The Guide was launched as part of detailed Cleaner Production manual at a workshop based training program in October 1999. This program was attended by fifteen Queensland foundries as well as government representatives and consultants.

Phase Two: Site Visits and Industry Consultation

Fourteen casting operations were visited in June and July 1999. Collectively, these companies account for around 90% of the waste generated by the industry. Many companies were keen to receive assistance in developing Cleaner Production programs and were particularly interested in being made aware of the options that are available to them. The current Status of Cleaner Production in the Queensland foundry industry is discussed further below.

Phase Three: Demonstration Projects

Several companies expressed an interest in participating in the project further to look at some specific Cleaner Production issues. Three minor demonstration projects were carried out at these sites to help advance some specific opportunities that were identified.

Phase Four: Training Workbooks and Information Sessions

A comprehensive reference manual was developed to support the Self Assessment Guide. The sections in the manual include:

- Part 1: Background.
- Part 2: Cleaner Production Ideas.
- Part 3: Case Studies.
- Part 4: Self Assessment Guide.
- Part 5: Overview of Foundry Processes.
- Part 6: Cleaner Production Implementation Guide
- Part 7: Resources

The ideas section is organised into the following sections.

- Improving Housekeeping Practices.

  Housekeeping is an important part of the Cleaner Production process and can help raise staff awareness about environmental and efficiency issues as well as achieving significant savings at minimal cost. Ideas include maintaining a tidy site, segregation of by-products, inventory and maintenance practices.

- Selecting Alternative Inputs.

  The choice of inputs used in the foundry process can have a significant impact on costs and environmental performance of the operation. Changing inputs can help to improve the efficiency of the operation and can help ‘design out’ environmental and efficiency problems from the process.

- Improving Metal Yields.

  Improving metal yields can save the company money in a range of areas - reducing the energy needed to melt and remelt excess and reject metal. Topics include improving box yields and gross casting weight through better methoding, precision and direct pouring techniques, and the impact of casting simulation methods.

- Improving Energy Efficiency.

  Increasing energy efficiency presents a challenge for the industry. Case studies indicate that most foundries could achieve significant energy savings by optomising current practices. Other technologies may also help companies improve their efficiency. Topics include efficient melting practices and technologies, recapturing waste heat, improving the efficiency of ancillary services (e.g. compressed air, motors etc.), new demands for energy (e.g. more baghouses, sand reclamation etc.)

- Minimising Foundry By-products.

  Minimising by-product use and waste has the potential to reduce the cost of purchasing new inputs such as sand and binders, reducing unnecessary processing and reclamation of sand and reducing the cost of handling and disposing of by-products. Topics include how to improve the efficiency of sand and binder use in the foundry, reducing box weights, and reclamation options.

- Production Planning and Improvement.

  Automation, computerisation and process control will play an increasing role in improving process efficiency, minimising and managing resources and by-products and improving product quality and customer service. Topics in this area include emerging technologies such as rapid prototyping, CAD/CAM, casting simulation, integrated manufacturing systems, the use of the internet in commerce.

Current Status of CP

The general awareness of Cleaner Production among the industry representatives was high. This was particularly the case among the members of the Environmental Steering Committee that was responsible for developing the EPA's *Beneficial re-use of ferrous foundry by-products* manual. All companies were able provide specific examples of Cleaner Production activities that have been undertaken and many had developed plans for future improvements. The smaller and non-ferrous foundries tended to have a lower interest in exploring improvement opportunities for their operations as they perceived there were fewer options, the quantities produces were too small to justify many options, non-ferrous sands had restricted opportunities for reuse, and in some cases the value of production was relatively high making the relative importance of waste reduction lower. Most of the interest in Cleaner Production came from the larger foundries where the costs savings were seen to be significant.

With the exception of noise and odour, the most significant aspect of foundry processes has been the generation of large quantities of foundry byproducts and wastes. The companies surveyed generated approximately 50,850 tonnes of foundry byproduct per annum.

Around 85% of this material is being sent to landfill. The remainder is being put to beneficial reuse as night cover at landfills or as composting material. The total cost to industry to dispose of this material is around $830,000.

If the companies achieve their stated goals, the quantity of material diverted from landfill could be realistically increased from the current level of 15% to around 70% over the next five years. This would reduce the quantities of material going to landfill by 25,000 tpa. The potential savings for disposal of this material could be in the order of $500,000. This does not include any costs incurred for handling the material.

Sand reclamation has even greater potential for the industry. This is due to the dual benefits of reducing disposal costs and the reduced cost of purchasing new sand. Internal recycling currently averages around 39%. This already saves the industry a significant amount of money and helps minimise material entering landfill. Current plans, being considered by the industry, may increase the average level of internal recycling of sand to over 50%. This would save the industry a further $172,000 in disposal costs and over $1 million in sand purchase costs.

Energy efficiency is an area where most foundries recognize there is opportunity for improvement. All but one of the foundries visited use electric furnaces, either electric arc or electric induction. Many of these systems have been installed in the past five years in an effort to improve energy efficiency, environmental performance and increased throughput. Energy, however, remains one of the most important issues facing the industry.

The major Cleaner Production plans that are being considered by the industry include:

- Beneficial reuse of industry byproducts, particularly sand, baghouse dust and shotblast.

- On-site and off-site sand reclamation and reuse.
- Simple energy efficiency programs (eg. covering ladles, energy management and production scheduling, ensuring equipment is turned off when not in use, etc.).
- More complex energy efficiency programs (e.g. capturing waste heat from the furnaces and heat treatment processes for generation of electricity, acrylic paint drying, wet sand reclamation systems, etc.).
- Increase on-site recovery and reuse of metals including shotblast, machining fines and baghouse dust metals.
- Better segregation of shotblast from sand to increase reclamation.
- Conversion of baghouse dust to slag to reduce disposal costs or increase beneficial reuse options.
- Regenerating machine cutting oils.
- Investigation of new resin systems.
- Changing energy sources (e.g. grid power to bagasse, propane to natural gas, diesel to electricity).
- Improving layout and housekeeping practices.

This is not an exhaustive list of options for the companies surveyed but represents the options that are currently being explored and have the potential to be implemented in the short to medium term.

The Next Steps

An industry workshop was held on Monday, 11th October at the Queensland Manufacturers Institute to discuss Cleaner Production opportunities in the foundry industry. The session was hosted by the Queensland Environmental Protection Agency (EPA) and the Australian Industry Group (AIG), chaired by Mr. Phillip Glew and presented by staff of the UNEP Working Group for Cleaner Production. In attendance were 17 representatives from 15 foundries in South East Queensland, 3 AIG representatives, 1 representative from the EPA and 3 representatives from the UNEP Working Group.

During the workshop, participants were asked to identify what they believe are the key Cleaner Production opportunities for the foundry industry and the role of individual foundries, industry groups and government agencies in implementing these opportunities. The specific areas covered were sand by-products, other by-products, metal yields and energy yields. The recommendations generated by the Queensland industry are summarised below:

- Metal yield and energy represented the most significant untapped opportunity for most foundries.
- Most foundries have already made significant gains in the area of waste minimisation and by-product reuse but there is still scope for further improvement in many foundries. Most of the large foundries are actively pursuing beneficial reuse strategies.
- At the foundry level, progress in Cleaner Production required commitment in the following areas.
    - ♦ Ensure the top management team is driving the project;
    - ♦ Appoint a champion who can overcome the inevitable obstacles;
    - ♦ Develop effective monitoring, and performance indicators for key resorces, by-products and environmental outcomes;
    - ♦ Develop effective incentive programs to encourage staff participation and to share the rewards gained from the improvement process;
    - ♦ Undertake awareness and skills training;

- Be open to cross-fertilisation of ideas within the industry;
- Encourage suppliers of binders and other inputs to develop less toxic and more reactive products;
- Encourage greater communication between designers, engineers and foundrymen at the design stage to reduce over-engineering and improve operational efficiency; and
- Participate in educational activities that increase the community's awareness of the foundry's technical capabilities (eg. foundry tours for school groups).

- At the industry level, the following roles were identified for the industry group:
  - Facilitate increased interaction between foundries to advance mutual Cleaner Production goals;
  - Coordinate the development of a chain management approach to work with key suppliers and customers. For example, investigate the viability of a centralised sand reclamation facility or develop a project with major customers to improve awareness of the role of good design in efficient manufacturing;
  - Actively market beneficial reuse options;
  - Actively promote the industry as an innovative, environmentally conscious and sophisticated sector to overcome its dirty and low-tech image; and
  - Increase the industry group's role as a clearinghouse for Cleaner Production, environmental and technical information.
- At the government level, the following roles were identified:
  - Work with industry to build on the emerging non-regulatory, partnerships models for environmental protection and improvement;
  - Continue to break down barriers for beneficial reuse including the development of markets, the amendment of government specifications to allow reuse, and increasing the confidence of and benefits to the private sector to undertake reuse;
  - Provide financial assistance for industry wide research activities particularly in the areas of sand reclamation for small foundries, shared reclamation facilities, energy efficiency and metal yield; and
  - Build on the Cleaner Production project to develop site specific skills based training of staff.

Conclusion

In general, the outlook for Cleaner Production in the industry is very promising. Both beneficial reuse and internal reclamation are likely to significantly improve environmental performance and reduce costs to the industry over the next five years. However, there is still work to be done to remove some barriers. These include :

1) removing legislative and bureaucratic costs of beneficial reuse and environmental compliance;
2) increasing opportunities for the foundries to work together to develop solutions for mutual problems where individual companies are too small to work alone;
3) adopting a supply chain management approach particularly in terms of working with major suppliers to develop better inputs and developing centralised recycling facilities;
4) working to enhance the image of the foundry industry as an innovative, environmentally conscious and high-tech industry.

Report Prepared By:

This report was prepared for the Queensland Environmental Protection Agency by the UNEP Centre for Cleaner Production and the CRC for Waste Minimisation and Pollution Control which are based at the University of Queensland. The research team included Stuart Pullar, Bob Pagan, Marguerite Lake and Bill Clark.

The foundries involved in the projects were:

ANI Bradkin - Ipswich Foundry
ANI Bradkin - Runcorn Foundry
Associated Engineering
Austcast Foundry
Bundaberg Foundry
Bundaberg Metal Industries
Crevet Ltd
Crown Castings
Downs Aluminium Castings
Farnell & Thomas
Investment Casting QLD
Larges Foundry
Mallets Foundry
Nu-Spray Foundry
Qalcast Foundry, Gold Coast
Reliance Manufacturing Company
Toowoomba Foundry
TYCO - Gold Coast Foundry
Walkers Foundry, Maryborough
WareTech Foundry

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