ENVIRONMENTAL CHALLENGES FACING THE SUGAR MANUFACTURING INDUSTRY

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Abstract

The sugar manufacturing industry in South African is facing many challenges due to the rapid changes in environmental legislation over the past decade. The industry is also experiencing increasing pressure from community groups, as housing developments around some of the industries are on the increase. The requirement for responsible environment management is also becoming crucial when obtaining custom from industrial users of sugar. The environmental impacts of the sugar manufacturing processes and the cost implications of maintaining environmental compliance are listed. The experiences and environmental strategies implemented at Huletts Refinery, an industry situated in a pollution 'hot spot' and in close proximity to the community, are discussed.

Keywords: sugar manufacturing, environment, impacts, sustainability, natural resources

Introduction

Tongaat Hulett Sugar Refinery was established in 1910. The main purpose of the refinery is to refine raw brown sugar into white sugar. The refinery is located in Rossburgh, which forms an integral part of the Durban South Basin. This area consists of a mix of heavy industrial activity interspersed with dense community settlement. The last decade has seen rapid changes in legislation, together with increasing public awareness on environmental issues. These changes have seen the Refinery come under serious environmental pressure. The paper discusses the challenges faced by the refinery and the actions implemented to maintain environmental compliance.

Refining process

The Refinery is a 'stand alone' facility that receives brown sugar from the four milling operations of Tongaat Hulett Sugar and refines it into white sugar. The energy requirement for the refining process is derived from onsite use of coal. The key processes involved are shown in Figure 1.

Impacts

The environmental impacts arising from these processes are:

- Filter cake from the carbonatation process.
- Chemical effluent (brine solution) from the ion exchange process.

- Coal as the fuel source results in the release of sulphur dioxide (SO_2) and particulate matter (dark smoke).
- Boiler ash.
- Factory general effluent (boiler blow-downs, storm water runoff).
- Sugar dust.
- Noise.
- Odour.

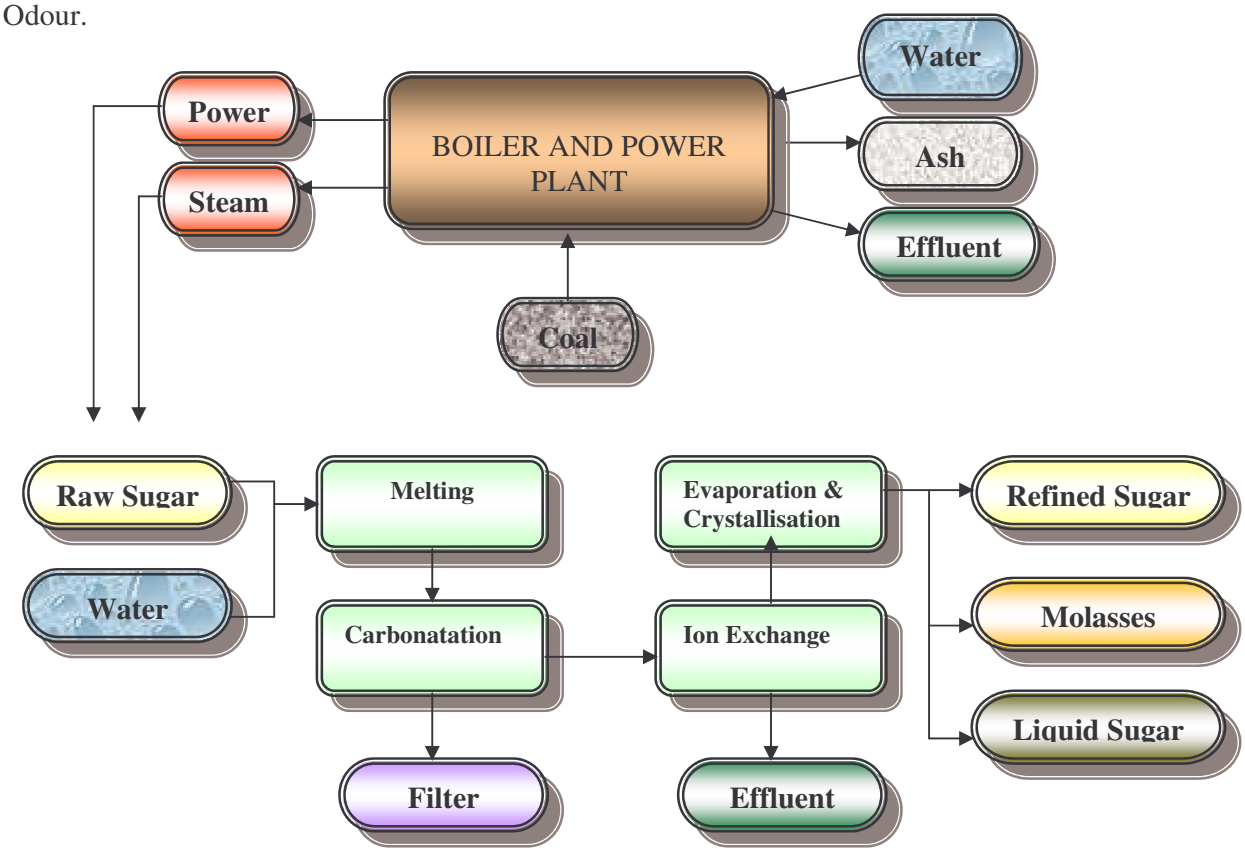

Figure 1. Refining process flow.

Legislation

The past decade has seen some rapid changes in South African environmental legislation. The key items impacting on the sugar industry are as follows:

Air

- Atmospheric Pollution Prevention Act – Act 45 of 1965
- National Environmental Management – Air Quality Act 39 of 2004
- eThekwini Municipality – Schedule of Trade and Occupational Bylaws (PN 134of 1979)
- National ambient air quality standards – GNR 236 of 19 March 2009
- National environmental Management Act 107 of 1998.

The above legislative changes have seen the energy generation process of the sugar manufacturing industry face many challenges. The emission standards driven by this legislation have been benchmarked against World Health Organisation standards and best available technology practices. The sugar industry will therefore be forced to re-evaluate technologies currently used in order to comply. The legislative changes also focus on ensuring that businesses operating in areas that present a high health risk to the community are managed differently and are given higher priority with respect to emission reduction and emission standards compliance.

Water
National water Act 36 of 1998
- Registration, licensing of water uses – Section 21(a)
- Call for registration of waste discharges, 2008/09 – Section 21 (f) and (d).

South Africa is a dry country, with low average rainfall. Many of our existing water resources have been over-used or significantly altered. The aim of the National water act is to provide a framework for protection of water resources.

Most sugar factories are situated alongside rivers, which have long been a source of water for manufacturing activities as well as an outlet for waste water. The river is a key water resource for a stand alone refinery, as the refinery does not have the advantage of a sugar mill where most of the water requirement comes in with the sugarcane.

The Act has called for registration and licencing of river water usage, which may have long-term implications of water restriction and higher cost.

Waste
- Environmental Conservation Act 73 of 1989
- National environmental management – Waste Act 59 of 2008.

The latter Act focuses on waste minimisation, integrated waste management, life cycle management and re-use, recycling and recovery. Having come into effect on the 1 July 2009, the industry is still assessing the implications of the Act.

Cost of compliance

Effluent permits
Sewer: Disposal of general effluent is done through the municipal sewer. This is a permitted process. The charge rate is performance based, which uses Chemical Oxygen Demand (COD) and settable solids as the performance criteria. The cost of disposal on an annual basis is approximately R3 million.

Chemical effluent: The ion exchange effluent is disposed of through the sea outfall. This is also a permitted process. The cost of disposal and transport on an annual basis is R2 million.

Waste disposal
- Filter cake is disposed of as landfill, at a cost of R3 million per year. Filter cake has high calcium content and options of using it as lime replacement in agricultural and animal feed industries are currently being evaluated.

- Boiler ash is supplied to the brick making industry.
- On-site waste management activities involve waste separation, recycling and re-use.
- Ground water monitoring is carried out every two years.

Emission management
SO_2 levies: As one of the major emitters of SO_2, the refinery was part of the South Durban sulphur dioxide committee. The refinery contributed annually towards this committee, which was involved in several projects related to emission management in the South Basin. The Multi-point Plan was then introduced in 2000, a project aimed at implementing a framework to monitor, measure and reduce pollution levels in the South Basin. Industries had to contribute towards a third of the cost of this project.

Emissions test: On an annual basis the refinery engages an external company to do emission verifications.

Capital investments
Between 2005-2008 the refinery spent R60 million on upgrading the steam generating equipment. This project has not only improved the performance of the plant but has contributed to a 30% reduction in emissions largely through a reduction in the use of coal.

EMS systems maintenance
There are costs involved in maintaining ISO 14001 certification as well as additional labour to maintain the system.

Future costs
The air quality licencing process coming out of the Air Quality Act will have the following implications:

- Licencing fee (this will be emission and risk based)
- Investments in emission monitoring equipment.
- Capital investments to reduce air emissions to meet the standards required.

Water use: River water will no longer be a 'free' resource.

The community

A number of difficulties have emerged in the South Durban Basin as local communities have raised concerns over the health and quality of life related impacts. The refinery is one of the major industry emitters of sulphur dioxide (SO_2) in the South Basin. As such, it has been under huge pressure from community and government to reduce pollution levels in the South Basin. Apart from the legal requirements, the other risk to the business is the negative impact on the brand. The South Durban Basin has a very active community as well as many activists.

Forming relationships with its neighbours, local authorities and the public became essential for the refinery. A community forum was established in 2006. The forum is independently facilitated. The initial meetings were very difficult, and the refinery came under severe pressure from community members and activists. The key success factors for such a forum is to establish relationships that are based on openness, commitment and transparency. Quarterly meetings of the forum are held. Over the years the forum has achieved the following:

- Improved understanding by the members of the refinery operations through business information sharing.
- Undertaking many projects to deal with complaints (noise, odour, dust).
- Sharing environmental progress reports with members.
- Significant reduction in complaints.

The customers

The pressure for environmental compliance from the marketplace is also on the increase. As an industry that is part of a global market, the need to demonstrate sound environmental business practices is an important criterion that is being considered by the market. The majority of key industrial customers of the sugar industry measure their potential suppliers on environmental practices.

Environmental management system

The implementation of an environmental management system (EMS) is fast becoming a necessity for industry. A company with an operational EMS will be able to demonstrate to authorities, customers, local communities and employees its commitment to environmental management.

The key elements of EMS (Anderson *et al.*, 1996) are:

- Legislative and regulatory compliance.
- Identifying environmental aspects and impacts.
- Developing environmental management plans for theses aspects.
- Evaluating environmental performance.
- Developing a documented system for environmental practices, polices, procedures and corrective action.
- Emergency planning.
- Pollution abatement.
- Resource conservation.

In 2003, the refinery started the implementation of an EMS, using the ISO 14001 standard, as its reference. In 2004, certification against this standard was achieved and has been maintained annually. The EMS has proved to be an important tool in managing environmental risks, reduction in waste and legislative compliance.

The focus areas for the refinery will be the reduction of effluent volume and compliance against the latest emission standards.

The following set of graphs illustrates the performance of the EMS over the past few years in terms of overall progress (Figure 2), SO_2 emissions (Figure 3), external complaints (Figure 4), volume of effluent produced (Figure 5) and Chemical Oxygen Demand (COD) of the effluent (Figure 6).

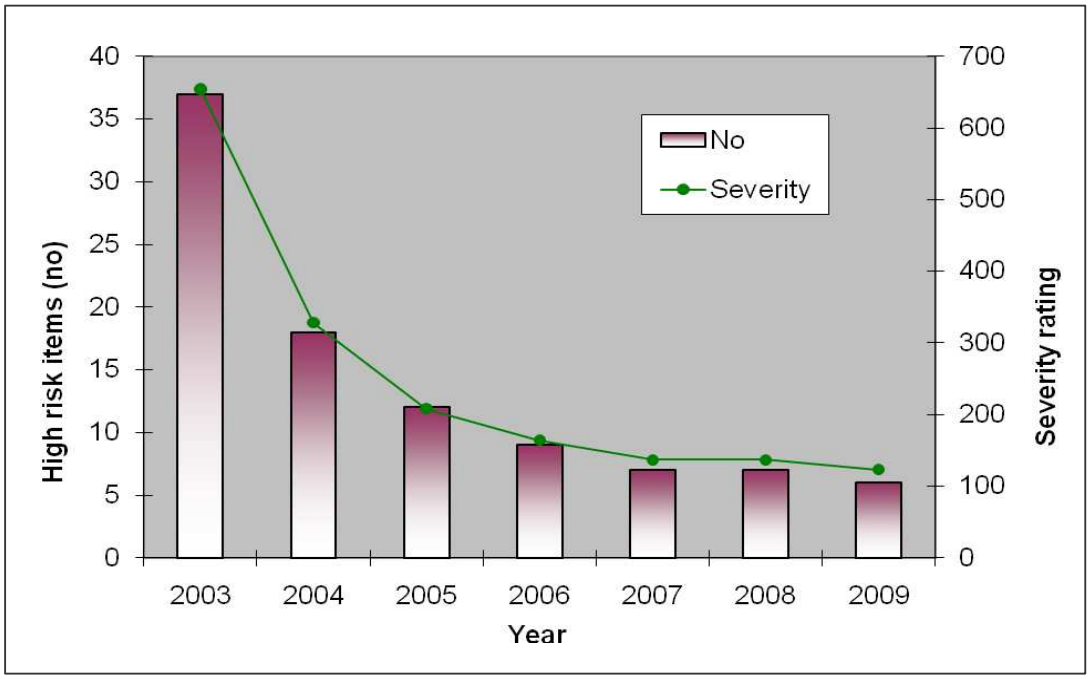

Figure 2. Environmental Management System progress (2003-2009).

The high-risk items (Figure 2) were related to air emissions, water use and effluent management. The reduction in the risk rating was achieved through the development of action plans for each of these risk areas. The plans involved implementation of improved operational practices and capital investments.

Environmental performance graphs

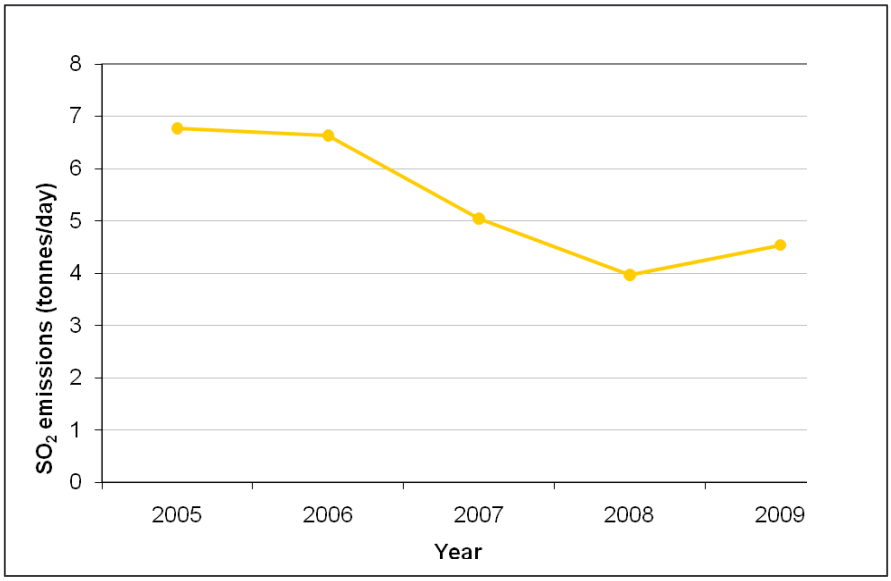

Figure 3. Sulphur dioxide emissions.

The reduction in sulphur dioxide shown in Figure 3 was predominantly achieved through the reduction in the coal usage. The capital investment in the boiler plant improved boiler efficiencies resulting in the optimisation of coal usage.

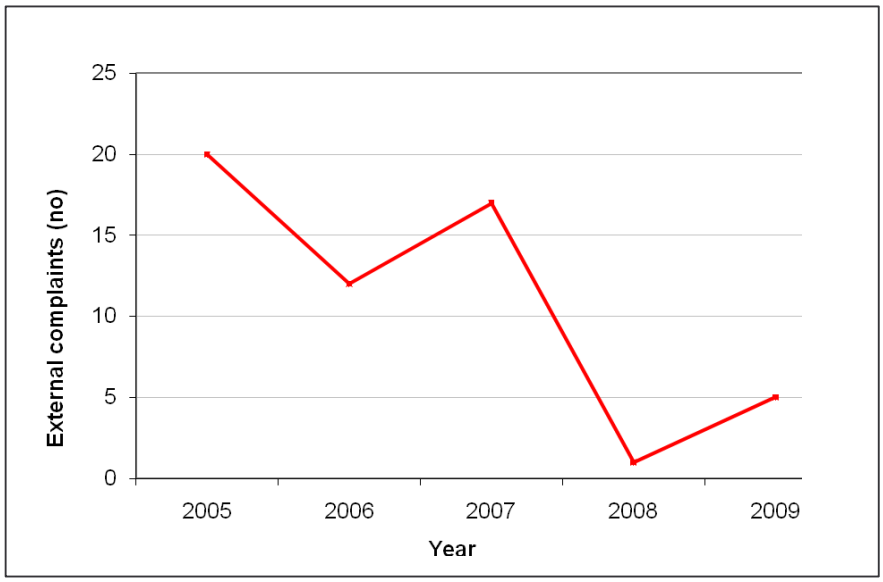

Figure 4. External complaints.

The reduction in complaints shown in Figure 4 was achieved through a combination of activities, namely, the development of the community forum, capital investments and operational improvements. The forum provided the opportunity to deal with the complainants directly and also for them to get a better understanding of the plant processes.

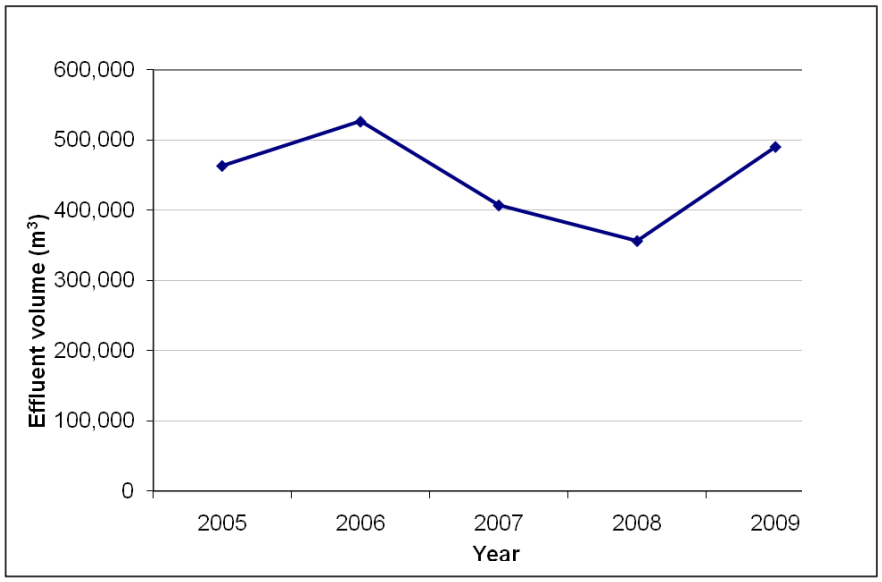

Figure 5. Effluent volume.

Effluent volume reduction is an area that has shown minimal progress (Figure 5). The refinery's water system is very complex and there are no systems in place to accurately measure water usage across the plant. This makes it difficult to monitor and control. This will be the area of focus for the plant in 2010. The measurement systems were installed during the maintenance shut-down.

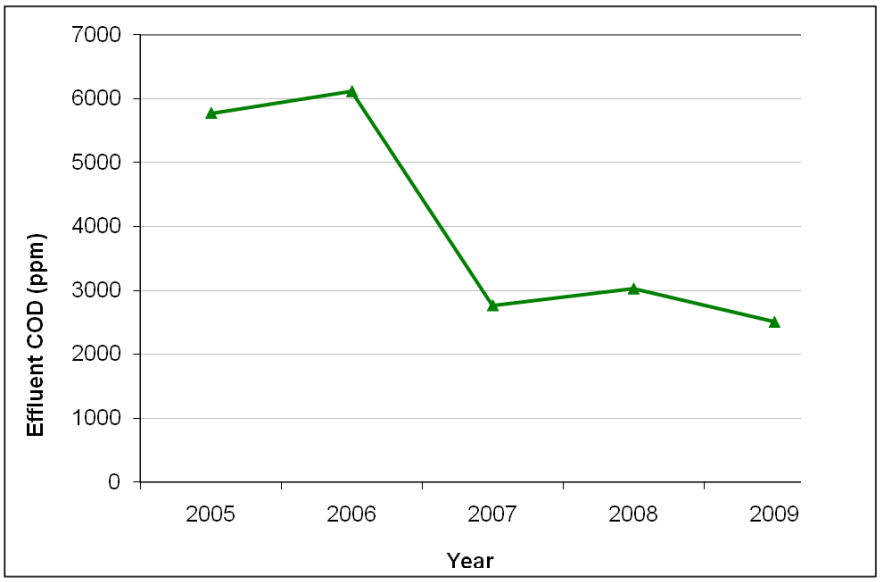

Figure 6. Chemical oxygen demand (COD) of the effluent.

The initial high COD levels (Figure 6) were attributable to sugar losses in effluent. The investment in the boiler plant brought major stability to the process operations. Stability in the operations minimises overflows and spillages that contribute to sugar losses in effluent. This has resulted in benefits in both effluent price reduction and overall sugar yield for the plant.

Conclusions

Sugar manufacturing is a well-established industry with traditional technologies. The growing global focus together with legislative pressure on environmental issues has forced the industry to review its practices and ensure that the environmental impacts of the sugar manufacturing processes are being dealt with in a responsible manner. Proactive environmental management is proving to have the benefits of enhanced public standing, reduced environmental risk, improved communication, reduced legal liabilities and better strategic position in the marketplace.

REFERENCES

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