Waste Derived Fuels Blending Platform – Case Study

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ABSTRACT

Historically, in South Africa, waste treatment technologies have focused principally on reducing the risks associated with the disposal of both general and hazardous waste at landfill sites and as a result of this there are very few viable alternative waste management options available for the bulk of waste streams produced locally.

With the promulgation of the new waste classification and management regulations on 23 August 2013, certain waste disposal restrictions and prohibitions came into effect relating to the disposal of waste to landfill. Examples are the landfill of hazardous wastes containing low levels of an array of organic compounds or of waste with a calorific value of greater than 25MJ/kg that will be banned from landfill by 23 August 2017. In effect, this prohibits the disposal of many hydrocarbon-based materials to local landfill sites and creates a niche for the development of alternative solutions for the management of these waste streams.

Cement kilns in Europe are moving towards the replacement of fossil fuels with hydrocarbon-based waste derived fuels (WDF's). The technology to substitute coal with a WDF in cement kiln operation is well developed internationally but requires a consistent and controlled WDF supply in order to implement effectively. This implies the need for co-operation between major industrial, waste management and cement industry stakeholders.

With the objective of meeting WDF chemistry control and supply consistency requirement, a so-called "blending platform facility" was constructed as a privately owned joint venture project between waste management and cement industry stakeholders and was commissioned in April 2014. It is the first of its kind in Africa. Acting primarily as a co-processing facility, the plant receives, stores and blends hazardous waste sludges (liquids and solids), with inherent calorific value to be used in the pre-calcination process at a cement kiln(s). Consolidation of suitable waste streams into a controlled WDF product (rather than a direct introduction of individual waste streams into a kiln) provides a platform for the integration of waste from a wide range of industry sectors and improves the consistency of WDF supply, quality monitoring (of both

incoming wastes and outgoing WDF product) and transportation (achieved by specifically customized vehicles) to levels appropriate to supplement cement production.

In addition, relatively small volumes of drummed, highly controlled wastes are screened for compliance with process and permit requirements and introduced through a chemical chute at a cement kiln for safe destruction.

Cement kiln co-processing of hydrocarbon wastes rather than disposal of these streams to landfill represents a paradigm shift in South African waste management practice and with the ongoing support of local legislative an economic drivers, will contribute to bringing this area of South African waste management in line with international best practice.

1. INTRODUCTION AND BACKGROUND

1.1 Co-processing

Cement is an essential product giving society reliable modern infrastructure. Co-processing in the cement industry is the optimum way of recovering energy and material from waste and is recognized and used by countries for many years. It offers a safe and sound solution for society, the environment and the cement industry, by substituting non-renewable resources with societal waste under strictly controlled conditions (Cembureau 2009). In addition, the co-processing of waste as a conventional fuel replacement is conducted mainly because of the cost benefit associated with the reduced fuel consumption.

The co-processing of alternative fuels provides a solution in terms of reducing fossil fuel dependency as well as contributing to the lowering of emissions. Co-processing in the cement industry is carried out safely, thus not affecting the health and safety of its workers or surrounding environment.

The cement kiln is a good opportunity for waste treatment as there is efficient and complete incineration where thermal oxidation destroys the organic molecules and converts them to carbon dioxide and water. All waste-contained resources are utilized and there is no ash remaining. The cement kiln also offers strict destruction conditions for the wastes (Lafarge Industrial Ecology 2013).

1.2 Legal overview

Legislation in South Africa progressively restricts the landfilling of hazardous waste with a significant calorific value over the next fifteen years (GN R 634 of 23 August 2013). The first conditional ban will be triggered in three years. The result is a ban on the landfill of any waste with a total organic carbon content of six percent. In addition the legislation introduces stringent concentration thresholds for the disposal of waste containing any of a wide range of organic chemicals to landfill (Basel 2011).

This section provides a broad overview of the legal framework within which the subject waste management activity(ies) is undertaken. The section, furthermore, outlines the legal and fiscal instruments that are either in place, or proposed, to assist the Department of Environmental Affairs (DEA) in driving the implementation of the waste hierarchy and avoidance of waste to landfill in the context of the South African waste management sector.

Waste management activities in South Africa are undertaken within a well developed and robust legal framework. In the context of this paper, this framework is inclusive of, inter alia,

i) the National Environmental Management Act 1998 (Act 107 of 1998, as amended) (NEMA),
ii) the National Environmental Management: Waste Act 2008 (Act No. 59 of 2008, as amended) (NEM:WA),

iii) the NEM:WA Waste Classification and Management Regulations and associated Norms and Standards for the Assessment and Disposal of Waste to Landfill (GN R 634, 635 and 636 of 23 August 2013), as well as

iv) the Department of Environmental Affairs' (DEA) 2011 National Waste Management Strategy (NWMS) and 2014 Draft National Pricing Strategy for Waste Management Charges (NPS-WMC).

Notwithstanding the goals of the DEA's 2011 NWMS to "promote waste minimisation, re-use, recycling and recovery of waste, as well as to grow the contribution of the waste sector to the green economy", Section 16 (1) (b) of the NEM:WA places a legal obligation ('duty of care') on waste generators to take all 'reasonable measures' to reduce, re-use and recycle waste. Although the nature and extent of such 'reasonable measures' are not defined, the Regulator's intent to move waste up the waste hierarchy is evidenced through the inclusion of such general duties in law. Further, specific, legal mechanisms were promulgated in Norms and Standards under the August 2013 Waste Classification and Management Regulations. These Standards prohibited the disposal of certain waste streams to landfill; and hence promote waste management sector investment in, and development of, alternatives to landfill. These are discussed in the following section.

Section 5 (1) of the National Norms and Standards specific to the Disposal of Waste to Landfill included a list of waste streams prohibited for disposal to landfill, together with timeframes associated with the effective date of implementation of these prohibitions. Notable in the context of this paper are the prohibitions related to i) flammable wastes with closed-cup flashpoint lower than 61° Celsius (effective immediately), ii) liquid waste (effective August 2019), and iii) hazardous waste with calorific value >25MJ/kg (effective August 2017). The National Norms and Standards applied in the Assessment of Waste for Disposal to Landfill can also ultimately result in the prohibition of certain waste streams to landfill, as outlined below.

In terms of provisions in the Regulations (G N R 636 of 23 August 2013) related to landfill disposal of waste, waste generators are required to assess their waste in accordance with the Standard for Assessment of Waste for Landfill Disposal prior to landfill disposal, which in turn must be conducted in accordance with the provisions of the Standard for Disposal of Waste to Landfill. For the new assessment requirements for waste disposal, both the leachable- (LC, mg/l) and total concentration (TC, mg/kg) of specific elements, anions and chemical substances in waste must be compared with specified threshold values to determine the particular type of waste (Type 0, 1, 2, 3 and 4) for disposal. These particular types of waste must be disposed of at one of four new classes of landfill (Class A, B, C or D), each with a particular containment barrier design; where Type 0 waste is in fact prohibited for disposal to landfill.

The upper TC threshold limit for contaminants is referred to as the TCT2 concentration threshold. The upper LC threshold limit is referred to as the LCT3 concentration threshold. The determination for a Type 0 waste requires that either the measured TC or LC in the waste be greater than the corresponding TCT2 or LCT3 concentration limits for a contaminant respectively. By way of example, the TCT2 threshold limit for petroleum hydrocarbons $_{(C6\text{-}C10)}$ is 2 600mg/kg. A waste with a measured petroleum hydrocarbon $_{(C6\text{-}C10)}$ concentration > 2 600 mg/kg would thus be a Type 0 waste, and prohibited for disposal to landfill.

The legal mechanisms promoting investment in waste derived fuel (WDF) preparation facilities are clear. Further thereto, the Regulator also recently published a draft National Pricing Strategy for Waste Management Charges (NPS-WMC, August 2014). Included amongst the stated objectives of the NPS-WMC, is the aim of "implementing economic instruments as part of a basket of policy instruments which will i) Increase the diversion of waste away from landfill towards reuse, recycling and recovery and ii) Support the growth of a southern African (regional) secondary resources economy from waste" (DEA Draft NPS-WMC,

2014). Examples of such fiscal instruments included in the draft NPS-WMC for discussion, and of potential relevance to the subject paper, are disposal taxes, raw material taxes and resource extraction taxes. All of which, if implemented alongside complementary legal mechanisms, would further justify and promote investment in the WDF sector in South Africa.

2. THE WASTE DERIVED FUELS BLENDING PLATFORM

With the objective of meeting WDF chemistry control and supply consistency requirement, a so-called "blending platform facility" was constructed as a privately owned joint venture project between waste management and cement industry stakeholders and was commissioned in April 2014. It is the first of its kind in Africa. Acting primarily as a co-processing facility, the plant receives, stores and blends hazardous waste sludges (liquids and solids), with inherent calorific value to be used in the pre-calcination process at a cement kiln(s).

Consolidation of suitable waste streams into a controlled WDF product (rather than a direct introduction of individual waste streams into a kiln) provides a platform for the integration of waste from a wide range of industry sectors and improves the consistency of WDF supply, quality monitoring (of both incoming wastes and outgoing WDF product) and transportation (achieved by specifically customized vehicles) to levels appropriate to supplement cement production.

In addition, relatively small volumes of drummed, highly controlled wastes are screened for compliance with process and permit requirements and introduced through a chemical chute at a cement kiln for safe destruction.

A qualification of waste streams is undertaken prior to incorporation into the WDF.

The product specifications include parameters such as calorific value, moisture content, and heavy metal content.

Wastes not accepted are : nuclear waste, infectious medical waste, chemical or biological weapons destined for destruction, waste containing PCB's and waste water sewage sludge.

An on-site state-of-the-art laboratory provides rapid analysis, qualification and a results turnaround time of under 30 minutes to ensure that the blended product meets the strict waste permit requirements of the cement kiln.

The waste is then blended to form the correct recipe and is again sampled and analysed for compliance to permit and the cement kiln's quality and waste permit requirements.
The final product is then transferred into custom-built flatbed trailers with sludge containers to be transported by road to the cement kiln to be used as a WDF.

3. CONCLUSION

Historically, in South Africa, waste treatment technologies have focused principally on reducing the risks associated with the disposal of both general and hazardous waste at landfill sites and as a result of this there are very few viable alternative waste management options available for the bulk of waste streams produced locally.

The co-processing of alternative fuels provides a solution in terms of reducing fossil fuel dependency as well as contributing to the lowering of emissions. Co-processing in the cement industry is carried out safely and in a controlled environment. Legislation in South Africa progressively restricts the landfilling of hazardous waste with a significant calorific value over the next fifteen years. The objective is to produce sludge alternative

fuels for co-processing in South Africa, providing clients with an alternative to landfill disposal of their waste. The blending platform produces a blended alternative fuel product and ensures that it meets the strict waste permit requirements of the cement industry.

Cement kiln co-processing of hydrocarbon wastes rather than disposal of these streams to landfill represents a paradigm shift in South African waste management practice and with the ongoing support of local legislative an economic drivers, will contribute to bringing this area of South African waste management in line with international best practice.

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