INDUSTRIAL WASTE MANAGEMENT: FREE TRADE ZONES IN SRI LANKA

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Abstract

Industrial waste becomes a worldwide issue which was raise through the industrialization. Free trade zones are the one of major areas which is produced more industrial waste in Sri Lanka. Improper and isolation existing waste management practices in free trade zones create more environmental issues and spreading of deceases such as Dengue. Thus factories as well as zone management need proper system to handle the industrial waste. This study aims to explore the industrial waste management practices at Free Trade Zones in Sri Lanka in order to identify probable approaches to address the burning issues. Study was conducted through the case studies of three free trade zones which were generated highest industrial waste. Semi structured interviews were conducted with four participant of each case responsible for industrial waste management. In addition, two expert's interviews were conducted to verify the case study findings. Findings revealed that, majority of people were not satisfied with existing isolation practices of industrial waste management due to various issues visible in existing industrial waste management process.

Key words: Industrial Waste, Free Trade Zones, Industrial Waste Management, Sri Lanka

1 Introduction

In 19th century industrialization began around the central Europe which was gradually spread towards Asia. Result of industrialization and urbanization create industrial waste which becomes a key issue. All waste produced by industrial operations or created from manufacturing processes (Abduli, 1996) is defined as industrial waste and mainly comprised with industrial waste and hazard waste. The amount, composition and type of industrial wastes usually depend on the characteristics of each industrial activity (Abduli, 1996). Many countries have implemented regulations and policies to control industrial waste such as, National waste policy of Australia (2009), new law for recovery of waste in Sweden . According to the rules and regulation most of countries follow a concept, model or strategy for Industrial Waste Management (IWM) in industrial areas or industrial parks, such as popular pays principle, pay as throw, green purchasing 3R strategy, extend producer responsibility, cleaner production technology considered (Environment Protection Agency, 2003; Marta and Hanf, 2008; Jan, 2008; Mbuligwe and Kaseva, 2006; solid waste management in Asia, 1999). However, researchers (Marta and Hanf, 2008; Berkel, 2000; Munksgaard and Pedersen, 2001) identified that those concepts and strategies had weakness due to the poor coordination among other factors such as regulations, technology and institutions. Therefore, United Nations Environment Programme (2009), introduced two models for Integrated Industrial Waste Management (IIWM) in industrial areas as lifecycle assessment based IIWM and management based IIWM. As well as many researchers (McDougall *et al*. 2001; Yong 2007; Shekdar 2009) found that, integrated system is more suitable for IWM and specially at industrial park or free trade zone.

Equally in Sri Lanka, Industrial waste is hugely generated in free trade zones where number of industries operates at one reserved area. According to Board Of Investment (BOI) Sri Lanka, there is no proper industrial waste management system, except sewer treatment plant, maintain in free trade zones. Central Environment Authority mentioned that, CEA as a legal institution has not power to control of waste management in free trade zones because it was establish under separate parliament act and control through BOI. According to the National Environment Act No. 47 of 1980, there is environment protection license issue which was only cover waste water and sewage system. As a result, management of industrial waste is burning problem to free trade zones in Sri Lanka. In addition CEA public waste complaint recorded that, many public nuisances such as inland water pollution, soil pollution and unauthorized dumping arise due to improper waste management in free trade zones. These evident that free trade zones mange the waste in isolation without adhering to establish waste management procedure or with coordination established institutes such as CEA. Therefore, these establish the need of

integration not only within the free trade zones but also other institutions involve in waste management in Sri Lanka. Thus this study is aimed to investigate the Industrial Waste Management System (IWMS) in free trade zones in order to identify burning issues in Sri Lanka. This paper presents industrial waste management in general and Sri Lankan context, research methodology and the findings reveled through the case studies and expert's opinion survey. Next presents the findings of the secondary survey on industrial waste management.

2 Industrial waste management in free trade zones

The term industrial waste refers to all waste produced by industrial operations or created from manufacturing processes (Abduli, 1996). According to Casares *et al*., (2005) waste generation can be classified according to their composition as, paper and cardboard, glass, plastics, wood, metals, textiles and hazardous waste. However the last five years, the amount of industrial wastes has increased in industrial park or other industrial areas (Alhumoud and Al-Kandari, 2008; Pappua, 2005; Ahamad, 2009). Vishvanathan *et al*. (2006) excepting most European countries which maintain similar level of waste generation. However, in Asia waste generation rates can vary drastically and are reported to be between 73 to 900 kg per capita and year. World Bank (1999) predicts increments in industrial waste generation in Asia are expected in the future, where the figures set to triple by the year 2025. Report on solid waste management in Asia (1999) also stated that, recent years several countries have shown an interest in managing industrial waste.

Geng (2007) pointed out that, IWM also involves the collection, transport, processing, recycling and disposal of waste materials. However, Casares *et al.* (2005) indicated that indiscriminate dumping of industrial waste in industrial estate contaminate surface, ground water supplies, blogs drains, create stagnant water for insect breeding and floods during rainy seasons. Thus, as aforementioned, many countries have implemented regulations and policies to control industrial waste. Most of the developed countries in Europe, Australia and USA have proper regulatory background for IWM as well as in some Asian countries like Malaysia and Japan (waste policy of Norway, 2009; Ireland waste management act no 566, 2009; Japan waste management and public cleaning law no.66, 2001). These are evident that most of the industrialized countries have established proper legal framework for IWM. In addition most of countries follow some concepts, strategies and models for industrial waste management in industrial parks. Among these polluter pays principle is enacted to make the party responsible for producing pollution and paying for the damage accrued to the natural environment. Most polluters are not paying unless forced by the government intervention (Economic Co-operation and Development, 2006). Pay As You Throw (PAYT) is another strategy which use-pricing concept for disposing of industrial waste where users in industrial parks are charged on a rate based on how much waste is presented for the collection of the municipality or local authority (Marta and Hanf, 2008). Further authors concluded that, PAYT must integrate with regulations of countries and financial mechanism of the companies to be effective. Similarly, the principle of reducing, reusing and recycling resources and products is often called the "3Rs" is the common platform for management of waste. National 3R strategy for waste management, Bangladesh, (2009) also emphasized that, implementation of the 3R strategy is also involve active participation of major

stakeholders in industrial areas or in industrial parks such as government, citizens and industrialists, private sector, informal sector, media and small and medium enterprises in their respective roles. Accordingly all these are evident that successfulness of the implemented strategies is depended on the active participation or the collaboration of all parties but not in isolation. In this context, Berkel (2000) stated that, Cleaner production as a new, integrative and preventive environmental management strategy for avoiding or at least minimizing the environmental impacts through industrial areas. Further author added that, only few companies have considered the implementation of cleaner production without regulatory incentives and technological training.

3 Industrial waste management process of free trade zones in Sri Lanka

According to waste generation index in CEA (2003), increment of solid waste generation is about 5% each year. Deputy Director of the solid waste management authority of the western provincial council in Colombo said "Inefficient collection and disposal of industrial waste is a major problem" (Lankasun, 2010). Environment Minister said, **"**Our main concern at the moment is how to dispose garbage piled up at three solid waste dumps located at Bloemendhal, Karadiyana and Kolonnawa" (Daily mirror, 2010 Sep, p.5). These are evident for the current status and its significance of the solid waste management in Sri Lanka. This is further aggravated through significant amount of industrial waste generates in free trade zones where numbers of industries are operating at one reserved area. Free trade zones in Sri Lanka are acting as key player of economic development and inflow of foreign direct investment into Sri Lanka. According to Board Of Investment (BOI), there are nine free trade zones in Sri Lanka, namely Mawathagama, Polgahawela, Mirigama, Katunayake, Biyagama, Horana, Malwaththa, Koggala and Wathupitiwela. However, continues complaints reported form public as well as ministries on improper waste management practices prevailing at the free trade zones. For an example, The Irrigation and Water Resource Management Ministry has requested to remove six factories dispose toxic waste to Dandugama Oya which is harmful to the bio diversity of the Oya (Lankasun, 2010). Further, a highest portion of the solid waste generated in the Koggala Export Processing Zone is fabric waste, comprising 56% of the total waste, followed by food waste (28 %), and paper and cartons (5 %) (Liyanage *et al*., 2012) . CEA indicated that waste generated in Katunayake industrial zone was dumped into a land previously within the zone without separation and sanitary land filling. CEA further added that free trade zones are established by a separate Act of Parliament and given power to BOI to control and supervision the industrial waste which are generate inside of zones. Therefore, CEA cannot take any legal action for environmental issue arises in free trade zones. In this context, As BOI indicated that only waste water treatment plants are established within most of the zones due to the lack of technology and coordination issues while one of waste recycling facilities has implemented in Katunayake free trade zone which is operated by private organization. Next explain the research methodology adopted for this study.

4 Research Methodology

Comprehensive literature review was carried out to identify the strategies for industrial waste management in general and specific to Sri Lanka. Empirical data gathering on industrial waste management practices and issues prevailing in free trade zones was carried out through case study approach. Case study approach facilitates the in depth analysis of particular contemporary event where investigator has no control over that. Thus, considering above case study approach was selected as the most suitable research method for the study. In this study, a free trade zone was selected as a case and IWM process was selected as unit of data analysis. Three case studies were selected based on the highest waste generation of all free trade zones, hereafter referred as zone A, B and C.

Semi structured interviews were selected as data collection method of this study. The interviews were conducted with key professionals such as zones environmental managers, factory managers or responsible person for waste management activities in selected free trade zones in Sri Lanka. The interviewees were selected on the basis of their experience, the degree of relevance and involvement in IWM in selected free trade zones. Twelve interviews were conducted representing four from each free trade zone. To further verification of case study data, two expert interviews were conducted having experience in legal requirements and waste processing. Information gathered through interviews covers the type of waste generated, existing IWM approach and handling practices, response and awareness on waste management policy and regulations and factors affecting in IWM in the free trade zones.

Research was used content based analysis for analysis of data. NVivo were used as software for data analysis and code based structures and cognitive mapping were used to presents the findings due to its suitability in displaying the relationship of views identified from the interview transcripts. Finally, proposed conceptual framework for integrated industrial waste management for free trade zones was presented.

5 Research Findings

Findings of the research is presented in three broader headings as, existing strategies, issues prevailing and proposed conceptual framework for integrated approach.

5.1 Existing strategies of industrial waste management practice

Findings revealed that most of the factories as well as zones were not keeping records of waste generation properly due to inadequate allocation and insufficient dedication. However, findings revealed that few factories inside the zones calculate and maintain their solid waste generation.

With regards to waste collection, representative of zone B stated that, *"BOI environment unit is not responsible for separation of waste in the collection. Separation is done by factory wise".* However, in factory wise there are some collection strategies for few waste items such as, bins, huts and containers but majority of waste are collect as mix waste. Further, most factories used

open space for collection of all solid waste items and use storage tanks for waste water collection. As an example, zone C interviewee stated that, "*For solid waste we use open space to collect all type of waste items without separation because, we do not have enough space separate to all types of solid waste items".* However, findings revealed that separation of waste in factory wise were useless since disposal is directed towards BOI open yard.

Waste transportation is done by the factories, disposal companies or waste buyers. Most of the factories enter into contract with transporters for waste transportation up to disposal point. With respect to waste water transportation used underground pipeline system. Findings revealed some difficulties in transporting the waste water sludge due to the hazard contents as well as usage of poly bags for transportation. As pointed out use of poly bags can be badly affect to the soil conditions. This is further aggravated due to use of unprotected opened vehicles. Thus, factories have agreement with Holcim Geocycle Company which is the only company having hazardous waste transportation license in Sri Lanka with adequate resources.

When considering waste processing, chemical treatment strategies were used for waste water and incineration for others with support of external party. , Many researchers (Geng, 2007; Tsai, 2010) reveled that, in industrial estate or in industrial park have several waste treatment facilities such as hazardous waste treatment center, energy-recovery incinerator etc. Therefore, when compare with other countries Sri Lanka free trade zone waste treatment is not in satisfactory level.

With respect to waste recovery, without involvement of zone management some people tend to collect the waste from open dump yard for reuse and recycle. In same some factories are provided waste to external parties who are approved by BOI. When consider the other countries most of industrial parks give their waste items to professional government-owned company or approved recyclers with monitoring procedure (Geng, 2007; Ahamad, 2009). Zone management open dump yard is used as the common method for waste disposal. Accordingly, in the waste disposal stage zones are not using proper strategy. Many researchers (Mengiseny S.E., 2006; Geng, 2007) pointed out that, most of industrial parks and industrial areas use sanitary land filling as internal disposal facility. Having provided with a brief overview of industrial waste management practices at free trade zones in Sri Lanka, next explains the issues prevailing due to improper practices of industrial waste management.

5.2 Industrial waste management issues

- **Inadequate knowledge on industrial solid waste recovery, processing and disposal**

Inadequate knowledge on waste recovery, disposal and processing is a common problem. Inadequate knowledge on maintaining a sanitary land filling, processing of hazard industrial waste such as "sayanite" and utilization of waste waster sludge as an alternative energy were few issues highlighted by the interviewees.

- **Lack of coordination among internal bodies**

Lack of coordination and physical resources were identified as the barriers to provide common industrial waste generation database. As noted though maintain and calculation of waste generation of zone is very essential thing due to poor coordination of factories between zone environment unit create major barrier for it. Further, this was aggravated due to inadequate resources to maintain network system regarding waste management. This was further justified by the factories who indicated that lack of labor and equipment to do the necessary calculation and maintain the same.

- **Profit oriented private sector**

Findings revealed that most private sectors involved in industrials waste processing or treatments are profit oriented. Thus, there arose many issues such as providing unsatisfactory service in industrial waste management activities, not providing total solutions for management of industrial waste and autonomy of sole proprietors. For an example, they are providing solutions for the waste items which can be an earned highly as well as sole proprietors charged higher processing value which is not bearable. Thus, many noted that BOI must monitor their activities and discuss with them and come up with total solution for waste problem.

- **Loopholes in legal provision**

Findings revealed that loopholes in legal provisions made for industrial waste management at the implementation. As noted few factories are disposing industrial waste management in accordance to prevailing legal provisions. Further findings revealed that there were no any legal actions against the factories having poor waste management practices. As reasoned legal system which is affecting to BOI zones is not giving a proper provision for waste processing and recovering. Therefore without treatment waste put to disposal. As pointed out, "*legally there is no explanation to waste recovery and waste processing in Sri Lanka regulation as well as in BOI guidelines. Therefore most of factories are not following suitable methods for waste processing*".

- **Unawareness of new industrial waste management strategies**

Unawareness of new waste management strategies such as co-processing is another issue highlighted in waste management activities. As noted, "*Though other countries have more waste processing and waste recovery methods and awareness among the public about those*

methods in Sri Lanka there are no any awareness programs about waste management activities in the industry". Further interviewees were opinioned that, BOI or Central Environment Authority (CEA) as institutions need to aware the public about the industrial waste management strategies.

- **Insufficient government investment**

Findings revealed that, government investment is not up to the satisfactory level to manage the industrial waste. Zone management representatives pointed out that, though BOI is a government organization, annual budget allocation for waste management in free trade zones are inadequate. Thus, waste water treatment cost is covered through the service charges. Though there are proposal for the install a incineration for each zone due to the cost allocation problem of BOI, these proposals are not approved. Further there is no any indication on industrial sold waste management fund allocation as it disposal to open yards without any treatments. As pointed out by Zone management representative, "*we use common pit for waste disposal which is away with the zone. That common pit is also not maintaining with environmental protection. As my knowledge poor budget allocation from government is created to this improper waste disposal method*".

- **Poor monitoring**

Findings revealed many issues prevailing in industrial waste processing and disposal due to poor monitoring mechanisms. As noted, the waste processing handled by external recyclers approved by BOI not managing the waste in environmentally friendly manner. According to the interviewee of Zone C though most of waste items of the zone C manage in common pit which is situated near to Aththanagalla river, in the rainy season most of waste items directed to Aththanagalla river. Further findings revealed that BOI has poor monitoring procedure regarding to the waste water treatment plants of factories resulted in disposal of waste water without any treatments.

- **Unsatisfactory service *of facilitator***

Interviewees revealed that unsatisfactory service provided by the BOI as the key facilitator. As noted by interviewee of Zone A "*BOI as our facilitated institution is not giving proper service about waste management. They only supply the dump yard which is also not maintain correctly. Waste management is a facility for investor. Therefore, BOI bind to do it in a proper way*".

- **Insufficient technology**

Insufficient technology mostly related with issues arises due to waste transportation and recovery. Protected vehicles for sludge transportation, use of sludge as an alternative power for boiler operations and maintain open dumping yards are noted as the prevailing issues due to insufficient technologies.

- **Negative attitudes**

As mentioned previously, attitudes of investors towards waste management also adversely impacts for use of proper waste management strategies. Negative attitudes of zone management and investors towards waste management are highlighted. Examples, good practices as waste separation and waste processing are unnecessary things which are costly for zone management and none concerned on environment friendly waste processing and disposal mechanisms are noted. These attitudes are further supported with the poor legal system prevailing in the country.

Apart from these Zone C revealed that special issues related with such as high cost involved for transportation due to long distance to waste disposal and political influence for waste recovery and waste disposal. As noted, "*we give project proposal to install a incineration for our zone. But because of political influence our management is not getting the approval*".

Accordingly, findings established various issues pertaining to industrial waste management mainly due to ineffective and inefficient management of BOI as the facilitator for free trade zones. These issues further aggravated by the lack of coordination among the other key responsible authorities such CEA as well as the internal relationships among the zones and within factories.

5.3 Strategies to enhance industrial waste management

Findings revealed that most issues are arising due to the isolation of waste management activities and relevant parties. Thus, many interviewees were pointed out the importance of intergradations of industrial waste management activities. Example,

"In BOI zones only applicable to BOI rules and regulations which limits are far below to CEA limits. Further through BOI is not considering inside waste management activities, CEA also have no enough power to investigate waste management of inside the zones. Thus, proper legal framework is needed to evaluate waste management according to Sri Lankan regulations. CEA as a legal institution need to do awareness programs about regulation to industrial people.".

Accordingly, the importance of CEA as legal institution to provide proper monitoring, awareness and control of waste management activities with collaboration of BOI are highlighted. In addition, need for collaborations with private institutions, other government organizations and global corporations for sharing new technologies and knowledge are emphasized. However, most interviews revealed the importance of active involvement of BOI as facilitator for each above mentioned collaborations. As noted, *"private sector is profit oriented. If total process is give to handle private sector Company, they can give higher prices for processing the waste items as they wish. Therefore it can badly affect to the investors. As our facilitate company BOI can involve in handling private sector participation".* Further, importance of information system and proper operation management system to integrate all waste management activities in free trade zones are identified. Above mentioned proposals were further verified two expert interviews conducted with a legal expertise attached to CEA and a

waste processing expertise attached to Holcim Geocycle who only has hazardous waste transportation and waste processing license by CEA.

When considering the legal system experts also verified that CEA need to have proper procedure to control and monitor environmental protection license of BOI factories and full legal power need to be vested on CEA to get action of environmental matters in BOI zones. Thus, expertise opinions were realized that, need to improve the legal provision with clear dedication power, proper monitoring and controlling procedure.

With reference to proposer operation management system expertise pointed out that, waste separation followed by waste management hierarchy is essential for proper waste management system. Thus, practices such as reduce, reuse, and recycle have to be implemented and for residual waste a proper disposal method has to be introduced. Further separation must start at the initial stages of waste management and need to integrate BOI waste management system along with factory waste management systems.

Need for information system for management of information about waste management activities are verified by the expertise. Expertise of waste processing revealed the need of measuring waste generation at each zones to *identify which waste is high and what is the reason and give quick solution for that issue. It is more beneficial if it maintains as networking system which can use relevant parties to get information about waste management".* The CEA representative point of view, *"waste generation detail is needed for factories, zones as well as to the country. CEA cannot get correct waste generation figures through the free trade zone.*

Expert also agreed that institutions must provide proper awareness about waste management activities. Expertise for waste processing revealed that, *"we get waste processing knowledge from our group which is spread through 70 countries. When considering Sri Lanka any institution is not providing sufficient awareness to industry about waste management technologies".* In contrast, expertise of CEA stated that i*nstitutional support is essential to success waste management activities and they are bind to provide support based on the request made. .*

Accordingly findings of case studies and verified expert's interviews established the need for integrated industrial waste management for free trade zones in Sri Lanka. Summary of above findings can be illustrated at table 01.

Table 1: summary of Findings

Issues of existing system	Suggestions for improve the existing system
▪ Lesser knowledge about waste management activities ▪ High cost for waste transportation ▪ Insufficient technology ▪ Long distance to transport for waste disposal ▪ Unawareness of new strategies	▪ Follow the waste management hierarchy ▪ Separate the each waste item in first stage of waste management ▪ Use protected places and vehicles for transport of hazardous waste.

▪ Poor legal provision for waste processing and waste recovery ▪ Insufficient government investment ▪ Poor monitoring of waste management activities ▪ Insufficient budget allocation from factory management ▪ Profit oriented private sector ▪ Negative attitude of investors ▪ Unsatisfactory service level from BOI ▪ Insufficient labour power ▪ Lack of coordination of relevant parties	▪ Use combine operation management system ▪ Maintain proper waste measurement and information sharing system ▪ Maintain proper guidelines and monitoring procedure. ▪ Improve the BOI environmental license procedure

6 Conclusions

Industrial waste has a negative impact on environment and it causes number of problems throughout the world due to inappropriate handling of industrial waste. Free trade zones are one of major areas which produce highest industrial waste which creates various issues for human being and environment. Many complaints and improper waste management strategies are also visible in Sri Lankan context as well. Therefore prime aim of this study is to investigate the Industrial Waste Management System (IWMS) in free trade zones in Sri Lanka in order to identify burning issues. Findings revealed that, majority of the representatives of free trade zones are not satisfied with the existing waste management practices due to issues visible in legal framework, operation management, lack of knowledge and awareness, inadequate technology, lack of coordination etc. Further many pointed out that these are become more critical due to isolation of activities. Accordingly, integrated approach to IWMS for free trade zones in Sri Lanka is proposed.

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