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ISO 14001: A Promising New System for Environmental Management in a Malaysian Energy Company

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Abstract: The purpose of this study is to present the results of an empirical study carried out on a sample of certified industrial companies that operate in Malaysia, with the aim of identifying some of the critical factors for the successful implementation of the ISO 14001 registration process. The study reveals that it takes between 8 to 19 months to obtain the ISO 14001 certification. In addition, the ISO 14001 elements requiring the greatest effort are: identifying environmental aspects, Environmental Management System (EMS) documentation, training, EMS audits, operational control, environmental management program, objectives and targets and document control. The survey also reveals that high certification cost and lack of other available resources are the greatest obstacles for implementing the ISO 14001 standard.

Key words: ISO 14001, EMS audits, operational control, environmental management

INTRODUCTION

Environmental management began in earnest around 1970 as a direct result of environmental catastrophes and governmental reactions to those catastrophes (Schaarsmith, 2005). Solid waste management in developing countries has received less attention from policy makers and academics than that paid to other urban environmental problems, such as air pollution and wastewater treatment (Martin, 2002). The management of these wastes should be implemented in such a way that our present and future generations will not be affected (Salim, 2005). In 2004, China surpassed the United States as the world's largest waste generator and by 2030 China's annual solid waste quantities will increase by another 150% growing from about 190,000,000 tons in 2004 to over 480,000,000 tons in 2030 (The World Bank, 2005). Waste minimization, the utilization of incineration ashes, industrial waste management is regarded to be the major challenges in the future of Singapore (Bai and Sutanto, 2002). Over the past decade, Malaysia has enjoyed tremendous growth in its economy along with population growth.

This resulted in an increase in the amount of waste generated. In Selangor (a state in Malaysia), the highest percentage of Municipal Solid Wastes (MSW) consisted of massive wastes of approximately 46%, followed by plastic and paper at 15 and 14%, respectively (Fauziah *et al*., 2004). Certification of an ISO 14001 Environmental Management System (EMS) is currently an important requirement for those enterprises wishing to sell their products in the context of a global market. This study reviewed and discussed techniques to reduce the effect of solid waste on the environment by implementing ISO14001. The

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implementation of ISO 14001 will include the development of system procedures, standard operating procedures and work instructions. Implementation of ISO14001 for solid waste management and integration of our existing quality and environmental management systems for solid waste supports the goals of vision 2026. The study focused on a company, Recycle Energy Sdn. Bhd. located in Semenyih, Selangor. The proposed methodology for implementing ISO 14001 is part of a model for implementing EMS. The methodological approach used was a qualitative exploratory research method based upon sources of evidence such as document analysis, semi-structured interviews and participant observations. The study showed that there is a need to implement ISO 14001 for this company since, there are major shortcomings here which do not fulfill the ISO 14001 requirements. The output is to support effective integrated MSW management in the country.

Historically, solid waste disposal consisted of open dumping but now it is carried out in double-lined landfills with a collection of and controls for gases and/or leachate. Other disposal means include composting and various incineration processes, which also may be used for co-disposal of waste water treatment sludges. These disposals typically require controls for created pollutants, such as leachate and odour from compost operations and the chemicals and particulates emission from incinerator combustion. Recovery and re-use are practiced widely. Source or central facility separation is used for a variety of products including paper, glass, plastics, ferrous metals and non-ferrous metals. Also, refuse-derived fuels may be used for energy production and yard wastes may be composted to produce a humus soil conditioner (Robert, 1999).

The entire world hopes that the treatment of solid waste is in the correct direction to minimize the effectiveness of this treatment on the environment as shown in Fig. 1 below. Treatment and disposal of solid waste vary from one country to another and depends on the type of waste, composition, infrastructure, land availability, labour, economic aspects, recycling strategies, public awareness, calorific value of waste, energy availability and demand and environmental impacts.

ISO 14001 is the Environmental Management System (EMS) specification developed by the International Organization for Standardization (ISO) of Geneva, Switzerland as a part of the ISO 14000 series of environmental management documents. Nowadays, with a continuous establishment of Environmental Management Systems and its related standards, more attention is being paid on ISO 14000 (Thomas, 2005). The effective implementation of ISO 14001-based EMS in manufacturing and service industries hinges on integrating it with

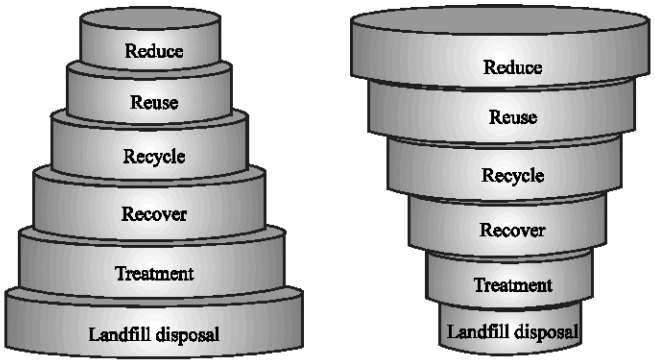

Fig. 1: Direction of the treatment of solid wastes

technical aspects Clements (1996) and Kuhre (1995) and the technical aspects include: assistance from environmental specialists, availability of monitoring and measuring equipment and the production process enhancement.

The sub-factors that come under Technology Assessment (TA) are as follows:

- Production Process Enhancement (PPE)
- Monitoring and Measuring Equipment (MME)
- Environmental Specialist Assistance (ESA)

Implementation of ISO 14001-based EMS requires reliable monitoring and measuring equipment to regularly monitor and measure all activities that can cause a significant impact on the environment.

The objectives of the study are as follows:

- To study and relate, the concept of ISO 14001 as a planning and management tool to improve the organization efficiency methods of implementing ISO 14001 as a tool to protect the environment
- To study the feasibility of ISO 14001 on solid waste management on a selected solid waste company to implement the principle of ISO 14001
- To recommend strategies to implement the ISO 14001 on solid waste management
- To do a gap analysis on the ISO 14001 implementation status on the selected solid waste company

MATERIALS AND METHODS

For the purpose of the study, ISO 14001 must be done to study the site that was chosen (Recycle Energy Sdn. Bhd.) during (2008-2009) and all the circumstances surrounding it that have been done through frequent visits and interviews with the people responsible for the operation in the Recycle Energy Sdn. Bhd . This is done in order to be able to assess the situation and determine the impact of all these aspects on the environment and to give recommendations to minimize the possible impact of these operations and processes on the environment. This was carried out through visits and roaming throughout the company, taking into consideration the company's waste collection and recycling that have a direct impact on the air, water and land through the gases resulting from the waste and stagnant water pools of waste collected, the sounds of the mechanisms and the machinery and the smell from the waste.

The ISO 14000 toolkit provides all of these, along with a training presentation, checklists and a comprehensive implementation guide. After receiving the waste, the company assigns its workers to separate the waste in a manual mode. Papers are collected and steamily pressed, plastic and steel cans are collected and steamily pressed on each end and plastic bags are collected and fragmented by special machines and after that steamily pressed. All this recycled materials will be compressed together with other remaining materials in the Recycle Energy Sdn. Bhd. Company. Then it is deposited in a land filling area far away from the company. Because of all these exercises, there will be pollution. Therefore, the ISO should be studied to prevent pollution and preserve the environment.

During the repeated visits to the company, the people involved have been interviewed. They have been asked to answer and discuss the questions about ISO 14001 which contains five principles and sixteen elements build up as a pyramid, the sixteen elements building one

upon the other. After the completion of the questions and discussions with the respondents, it was discovered that the Recycle Energy Sdn. Bhd. did not adopt the international standardization in most of their activities. Therefore, it was necessary to know and study the impacts and aspects to determine the degree of exercises' impact on the environment and what possible recommendations should be directed to reduce the impact, in line with the requirements of the Environmental Management System of ISO14001.

The techniques used will cover the current environmental management system such as the operations, impacts, as well as solid site environmental audits, which are as follows:

- EMS for Recycle Energy Sdn. Bhd.
- Management review applies
- Operation analysis
- Impact severity assessment
- Site environmental audit

RESULTS

Recycle Energy Sdn. Bhd. comprises a series of machines that constitute the entire plant, the activities and environmental aspects are shown in Fig. 2. The process begins with lorries carrying waste into a reception bay, whereby the waste is segregated into either the bulky and non-bulky type. The waste is further separated into recycled and non-recycled materials. Next, the magnetic separator will extract metallic components from the waste, pre-drying it. The recycled materials and torn waste is then separated manually to a finer size before the fuel fraction is extracted from the residue. The 10 to 15% of the incombustible materials including dirt, glass, metals, stones and very wet organics from the air separation unit, are sent to landfills nearby.

Environmental Impact: Air Pollution

The emission or release of gases during the operation of the plant include five pollutants namely sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), lead (Pb) and particulate matter (PM_{10}).

Analysis of Results

Monthly air monitoring was carried out to determine levels of particulate matter (PM_{10}), sulphur dioxide (SO_2), carbon monoxide (CO), lead (Pb) and nitrogen dioxide (NO_2) within the boundary of the project site. The data was compared with the recommended DOE's Air Quality Standards. There two locations to monitor the air were as follows:

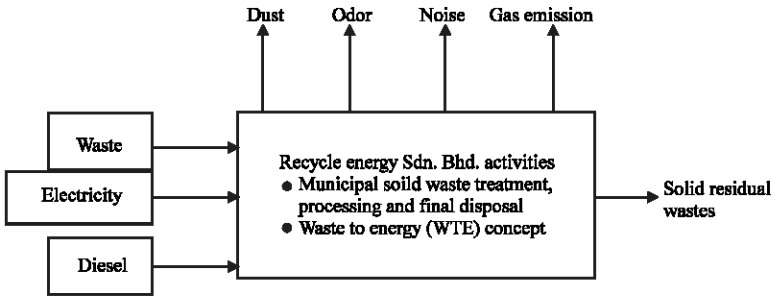

Fig. 2: Activities and environmental aspects of Recycle Energy Sdn. Bhd.

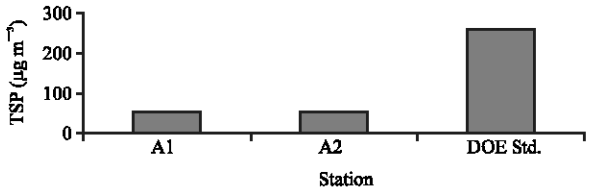

Fig. 3: Graph depicting the TSP

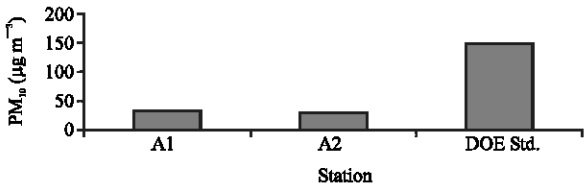

Fig. 4: Graph depicting the PM10

- A1-within the plant
- A2-within the nearby residential area; No.55, Kg. Pasir, Jalan Sungai Lalang, Semenyih

The measured Total Suspended Particulates (TSP) for Stations A1 and A2 were 52 and 48 μg m^{-3}, respectively during the average time of 24 h shown in Fig. 3. Both the results showed a reading of below 260 μg m^{-3} which is the limit of the Recommended Malaysia Ambient Air Quality Standards.

Particulate matter (PM_{10}) monitored from stations A1 and A2 during the 24 h period were ranged between 33 to 30 μg m^{-3} as shown in Fig. 4. A higher concentration of particulate matter was recorded within the site than within the nearby residential area. This is because of the operation in the plant but the result is still below the recommended limit which is 150 μg m^{-3}.

Sulphur dioxide monitored during the 1 h period was not detectable at both monitoring stations A1 and A2. The Recommended Malaysia Ambient Air Quality Standards for sulphur dioxide is 105 μg m^{-3}. Lead monitored during the 24 h period was also not in the detectable limit at both stations A1 and A2. Carbon monoxide levels in the air sample were found to be not detectable at both monitoring stations. The Malaysian Ambient Air Quality Guideline limit is 30 ppm. Nitrogen dioxide monitored during the 1 h period was also not detectable at both stations A1 and A2. The Recommended Malaysia Ambient Air Quality Standards for nitrogen dioxide is 320 μg m^{-3}. Overall, all of the parameters monitored during the current monitoring period are within the DOE limit. From the results obtained as shown in Table 1, it was found that the air quality within the site is still in a good condition. As all the air quality parameters are below the DOE criteria limit, the air quality level should be maintained.

Air Quality Monitoring Results

The results summarized the differences between the air quality on the site and DOE and they show that they did not exceed the limits at the Recycle Energy Sdn. Bhd.

Environmental Impact On Water Pollution

The liquid that comes out or that is released from the waste, known as leachate causes water pollution. The Water Quality Index (WQI) was derived using Dissolved Oxygen (DO),

Table 1: Analysis of results for air pollution

Environmental aspect	Gas emission from the machinery
Environmental impact	Air pollution as indicated by the API level
Significance level	Significant
Target	• Reduce emission relative to production rate by 5-10% by October 2009 • Satisfy any outstanding legal regulations
Indicator	Record of maintenance
EMP	Review the operating procedures to comply with legal requirements Ensure proper maintenance of machinery Make sure all machinery is inspected once in 3 months Comply with DOE requirements

Table 2: Analysis of results for wastewater pollution

Environmental aspect	Wastewater
Environmental impact	Water pollution
Significance level	Significant
Target	Monitor the quality of the river water and its tributaries at the project site and for all Malaysia as global issues
Indicator	Record of maintenance to reduce the pollution to fulfill the DOE new requirements
EMP	• Sampling and analysis will be conducted every three months • Review the operating procedures to comply with legal requirements • Fulfill DOE requirement for wastewater pollution

Table 3: Analysis of results on noise

Environmental aspect	Noise and vibration level during operation and maintenance stage
Environmental impact	Noise pollution based on DOE requirement
Significance level	Significant
Target	• Reduce noise and vibration rate by 5-10% by October 2009 • Satisfy any outstanding legal regulations • Maintain legal compliance
Indicator	Record of complaints from the near residence
EMP	Review the operating procedures to comply with legal requirements Ensure proper maintenance of machinery Make sure all machinery is inspected once in 3 months

Biological Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Ammoniac Nitrogen (NH_3-N), Total Suspended Solids (TSS), pH and Dissolved Oxygen (DO), Table 2 shows the results for wastewater pollution in Recycle Energy Sdn. Bhd.

Calculation

Frequency	=	2
Seriousness	=	1
Frequency×seriousness	=	2×1 = 2
Legal requirements	=	2×2 = 4
Local impact	=	3×2 = 6
Regional/global impact	=	2×2 = 4
External community	=	2×2 = 4
Policies/directives	=	2×2 = 4
Management costs	=	3×2 = 6
Customer satisfaction/demand and competitive advantage	=	3×2 = 6
Total	=	4+6+4+4+4+6+6=34
Significance level	=	Significant

Noise Pollution

The noise generated throughout by the machines. The impact measured by the noise level at the boundary of the project site and at the village nearby, Analysis of results on noise pollution seen in Table 3.

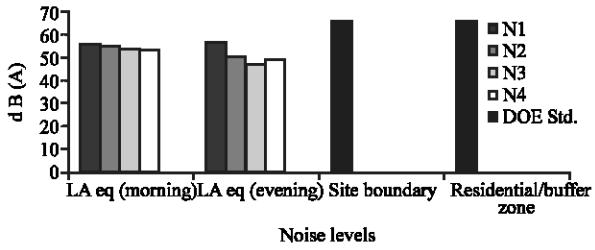

Fig. 5: Graphs depicting the boundary noise level at the project site

Calculation

Frequency	=	4
Seriousness	=	1
Frequency×seriousness	=	4×1 = 4
Legal requirement	=	2×4 = 8
Local impact	=	2×4 = 8
Regional/global impact	=	1×4 = 4
External community	=	2×4 = 8
Policies/directives	=	2×4 = 8
Management costs	=	1×4 = 4
Customer satisfaction/demand and competitive advantage	=	1×4 = 4
Total	=	8+8+4+8+8+4+4 = 44
Significance level	=	Significant

From the results obtained, it was found that the noise levels at all the four stations were all below the permissible level which does not exceed 65 dB (A) as shown in Fig. 5.

DISCUSSION

The process of developing the EMS for ISO 14001 certification highlighted not only procedures already in practice that addressed environmental impacts, but also generated procedural improvements. After examining them in more detail, the managers improved their existing practices for processes, equipment and areas of the plant that could increase emissions. The ISO 14001 programs required the environmental department to develop and maintain environmental management manuals for wastewater management, cooling water treatment, waste management, chemical management, air quality control, storm water pollution prevention, spill prevention, control and countermeasure plans and emergency prepareness and response.

The EMS required more and better record keeping and documentation and forced managers and workers to find better ways to do these things. Managers in several departments improved controls. Planning and scheduling of environmental tests and instrument equipment calibrations became more structured and precise.

ISO 14001 certification also required the plant's managers to set specific and measurable goals for improving performance in environmental aspects of the facility's operations. In solid waste, for example, the plant developed specific targets for reducing landfill waste, assigned responsibility for solid waste costs to each department and performed waste

hopper autopsies to identify the types of materials that were being disposed. As a result of ISO 14001 requirements, supervisors felt stronger pressure to ensure environmental compliance because it was seen as a plant-wide and company-wide priority.

Recycle Energy Sdn.Bhd. has a management structure, but it does not specify in detail the responsibilities of each person which is related to the environmental management system. The organization structure does not declare publicly to be easy for every one to follow it easily.

From the results obtained, air quality within the site is still in a good condition. As all the air quality parameters are below the DOE criteria limit, the air quality level should be maintained.

It is first complete research study done in Malaysia for energy sector, the results here showed added value to the research at the energy sector in Malaysia and for others who wants implement ISO14001.

CONCLUSIONS

This research at the Recycle Energy Sdn. Bhd. company showed that more elements than the environmental impact of the air which was represented by gases being emitted when receiving waste and during the separation of solid waste and chemical treatment remedies, in addition to the odour from solid waste and the sound output of the machines and mechanisms are the main contributors to this environmental impact. Methods to reduce these environmental impacts and to control the effect on the environment were studied for the ISO14001 to the mechanism of the serious impact on the environment. The ISO 14001 is a

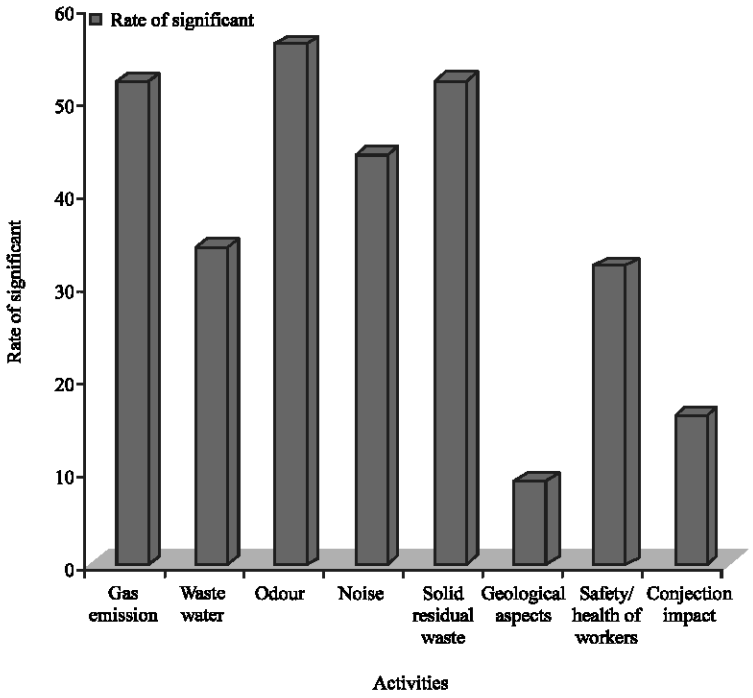

Fig. 6: Summary of the results

standard concerned with environmental management and the way an organization goes about minimizing its harmful effects on the environment. Using ISO 14001 as a management tool allows an organization of any size and type to control the impacts of its activities, products or services about the environment. The main challenge Recycle Energy Sdn. Bhd. Company faces would be the lack of awareness and knowledge about managing solid waste (SWM) through the environmental management system ISO 14001 among all levels of their employees. This awareness will require a long time and a staff of high-efficient experience to do with the awareness and taking into account the overall levels of absorption, notices and short comings because all levels are found in one company. Based on the results obtained from this research and as shown in Fig. 6, a summary of the aspects and impact assessment, objectives and targets, indicators and Environmental Management Plan (EMP) set for Recycle Energy Sdn. Bhd indicated that all of them followed the DOE requirements.

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