ISO-14001 Certification of Rubber Industry-A Case Study

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Received: Aug. 30th, 2018
Accepted: Sep. 10th, 2018
Published: Sep. 25th, 2018

Keywords: *EMS, ISO, 14001, Rubber, standards, Environmental, ETP, PPCB.*

The impact of industrial organizations on the environment during recent decades is clearly evident. Due to it all over the world, many enterprises are putting all their efforts into seeking environment management such as using instruments that reduce negative impact on the environment along with improving economic efficiency. The ability to manage its environment performance is emerging as a strategic issue for many companies, globally. In order to address the impact of companies International Organization for Standardization (ISO), introduced the ISO-14000 series of environment management system (EMS). EMS in an industry can be achieved by reducing the pollutants at source level itself, good housekeeping, recycling, raw material change and product modification etc. The goal of this paper is to study the procedure adopted by an organization to get certified for ISO 14001 standards of EMS. The various environmental legislative, operational and management procedure considered for the study. It examines the perceived benefits of having ISO 14001 for certified firms. According to the results of analysis, the organization is effectively complying with ISO 14001 standards of EMS.

1. Introduction

Due to the rapid industrialization, there are lot of environmental, social and political changes are taking place which had leaded the organizations to think of different ways to be in the competition. The awareness for protection and conservation of environment has increased globally as global temperature is increasing, lot of harmful and toxic gases are being release in environment and due to the repletion of natural resources. The international business organizations are taking initiatives to adopt methods like sustainable business or green business to minimize the negative environmental impact as well as profitable. Every organization has its own set of goal (i) satisfy a customer's quality requirements, (ii) demonstrating safety in work place and (iii) complying with environmental regulations. To achieve the set goals an organization requires a management system which has framework of programs and procedures.

In an organization, to implement an environment policy Environmental Management System is used. It has a number of interrelated fundamentals that function together to help in managing, measuring, and improving the environmental aspects of company operations. It enables the organizations to achieve ongoing compliance with environmental regulations. It should also help to control the environmental impact of company activities, products and services to falling in line with their own environmental policy and objectives.

International Standard Organization (ISO) founded in 1947 and based in Geneva has rigorous process for standards development. It promotes the international management and development of communication, manufacturing and product standards. The ISO 14001 standards are also called the "green" standard because of it sets specific requirements for a comprehensive EMS. The ISO 14001 is a specific standard that is based on Total Quality management (TQM) business concepts of continuous improvement, or the plan do check cycle where a procedure is developed, implemented, and then improved upon if required (Goodshall, 2000). The reasons for this growth in interest range from identification of potential cost from waste or energy minimization programs, determination of potential liability both fiscal and under environmental legislation, to potential public relations benefits. The first two objectives can be satisfied by internal survey and auditing, to gain public acceptance as a company concerned about environmental performance, an element of external verification of the result is necessary. ISO 14000 standards is divided into two categories:

a) **Organizational evaluation:** Environmental Management Systems (EMS), Environmental Auditing (EA), Environmental Performance Evaluation (EPE).
b) **Product evaluation:** Life Cycle Assessment (LCA), Environmental Labeling (EL), Environmental Aspects in Product Standards (EAPS).

ISO 14001 standards state the basics for an Environmental Management Systems with information on how to initiate, implement, improve and sustain the EMS. The aim of this standard is to put together environmental management issues with the overall management of the company. The five major elements of ISO 14001 are Environmental Policy; Planning; Implementation & Operation, Checking & Action and Management Review. For implementation of ISO 14001, it require company to give its policy, identify environmental aspects and impacts, set objectives and targets and commit to comply with all appropriate legislation. It also asks the company to define procedures to achieve the targets and objectives, implementation plan, test and get corrective measures as per set procedures. In this standard an organization has to review its system for time to time. Environmental policy is the driving force of environment management system, and it also requires the commitment of the top management of company to comply with all pollution prevention, continual improvement and related laws. The environmental policy is to be communicated to all employees and public after developing carefully and according to the nature and scale of the operations.

ISO 14000 standard challenges each organization to set up its own objectives and targets, take notice of impacts of operations on the environment, committing itself to effective and reliable processes, prevention of pollution and continual improvement. In the long term, it promises to establish a solid base for reliable, consistent management of environmental obligations.

2. Case Study

The case study have an attempt towards studying, the procedure for getting ISO-14001 certification by an organization. A Case study of rubber industry has been considered for the purpose. The Rubber industry was established in 1970 and is situated in Mohali (Punjab). The industry manufactures International Quality Reclaim Rubber from scrap tyres, butyl tubes, and natural rubber tubes, tread scrap for applications in both tyre and non tyre rubber products. Industry commenced its production with the latest equipment and technology which were designed and executed to comply with international standard of ISO 9000 and 14000. About 18000 MT per annum of Natural and Synthetic Reclaim Grades rubber is being produced. It supplies its product to largest tyre & tube manufacturer of India and across other countries Australia, Germany, Italy, Japan, Pakistan, Sri Lanka, Turkey, UK and USA. The reclaimed rubber is environment friendly and minimizes environmental hazard. The rubber produced is an alternative to natural and synthetic rubber and have a quality and versatility Super Fine Reclaim Rubber, Fine Medium Reclaim Rubber, High Tensile Reclaim Rubber, Butyl Reclaim Rubber

The reclaim rubber is solely manufactured from disposed bus and truck tyres having rubber content more than 50%. It is third source of rubber after natural and synthetic. It is manufactured by the process of De-polymerization. Waste rubber is ground material and is treated with chemicals, heat and then worked mechanically to free it from the contaminants such as steel, fibers and stones by process of separation and purification.

2.1 Operation and description

i. For manufacturing of Butyl Reclaim, the raw material mainly constitutes old butyl rubber auto tubes, rubber processing oil, reclaiming agent and packing material. Butyl rubber tubes are received in trucks, tempo & pickups from suppliers. Oil & chemicals are received in tankers & drums from suppliers. All the Raw Material is unloaded inside the company by stores and handled as per procedure. All the impurities like brass/ferrous material and natural rubber are collected at one place and sold to Scrap Dealer for recycling. Material storing bins are used to store ground rubber material.

ii. The production process is consisting of following operations:

a) **Unloading of raw material:** Butyl rubber auto tubes are received from the suppliers and unloaded lot wise in the company raw material storage area.

b) **Testing & Segregation:** Butyl rubber tubes stored in the RM storage area is physically / chemically tested and segregated. Only butyl rubber tubes are selected for further processing. Rest natural rubber is rejected and stored in Rejected area.

c) **RM cutting & Removal of Impurities:** Butyl rubber tubes are cut into small pieces and the metallic impurities like brass, ferrous, etc and punctures are removed from it. Impurities are shifted to the specified area for further disposition.

d) **Washing / Drying of Raw material:** Segregated Butyl tube cuttings are washed with water for removing soil / sand particles. Further the washed tubes are allowed for air drying.

e) **Final checking of Butyl tube cuttings:** Re - Inspection is performed on the dry butyl tube cuttings to identify any impurity left behind.

f) **Cracking:** Here the butyl tube cuttings are grinded on cracker machine and sieved through three mesh wire netting. The grinded material is sent to autoclave for devulcanisation process.

g) **Devulcanising:** Grinded butyl rubber material is shifted to autoclave through lift and loaded. Oils and chemicals are added to the autoclave as per formulation. The whole batch is cooked as per defined procedure.

h) **Inspection of cooked material:** After the cooking process, the steam is released from the autoclave through cooling line and sample is taken for physical inspection. If the material founds to be cooked appropriately, it is allowed to be unloaded.

i) **Unloading of autoclaved material:** After the physical checking, the material is unloaded in the trolleys and moved for pre-refining.

j) **Pre-refining of the batch:** Autoclave material is pre-refined on refiner machine and a thin sheet is taken from refiner machine and the same is further sent for straining.

k) **Straining of material:** The pre-refined material is passed through the strainer through 12 / 30 / 40 mesh wire netting to remove the metallic / non metallic impurities and uncooked rubber particles.

l) **Final refining:** All the strained material is refined on refiner machine and very thin & fine sheet of butyl reclaim rubber is prepared and wounded on winding drum to get ½ –¾ inch of rubber sheet. Sheet is cut with knife by the operator and rubbed with anti-bonding agent (whiting powder) and stacked on rehri for transfer to FGS.

m) **Final inspection:** Finish goods material is checked by packing inspector by taking transverse cut at both sides of the sheet with knife for checking the homogeneity and refining of the material.

n) **Packing & Dispatch:** After FQC, the products are packed in 25kg / 50 kg LDPE / HDPE bags as per customer's requirement. The material is transferred in the truck / container by forklift for dispatch.

iii. **Effluent treatment & Disposal:** The water consumption during various manufacturing process & cleanings is as under:

a) The water is used for drinking, bathing, cleaning, washing, toilets, etc.

b) Effluent water is generated during the autoclave process. The autoclave steam is discharged and condensed through the pipe line of the pollution control unit. The condensed water is the effluent of our industry which is treated chemically in the Effluent treatment tank and neutralized before its disposal.

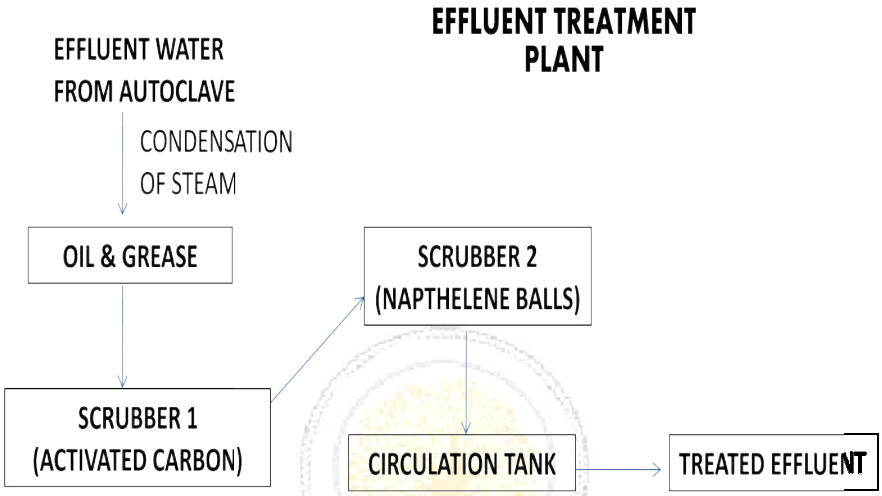

Figure 2.1 Existing Effluent Treatment Plant

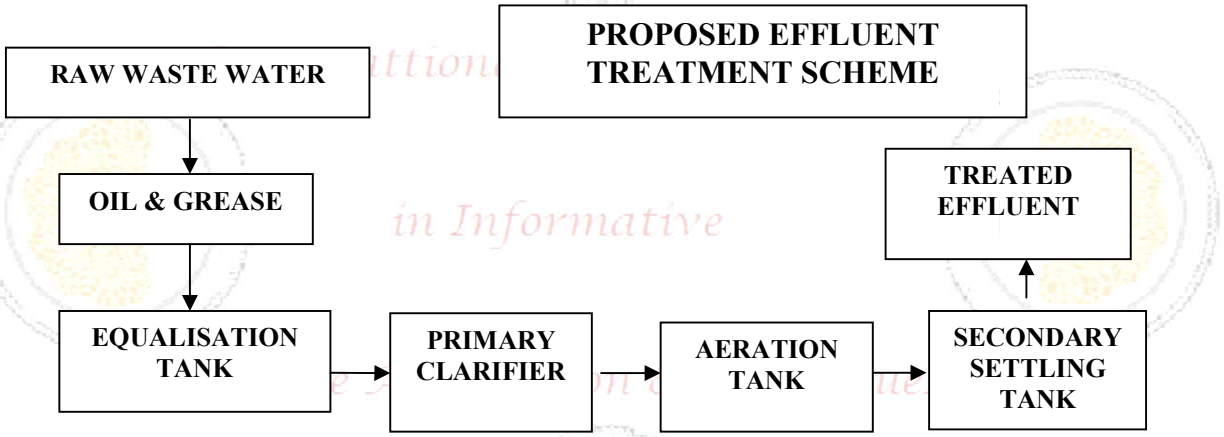

Figure 2.2 Proposed Effluent Treatment Plant

2.2 Design Features for Proposed ETP

Average flow of effluent = 1 KL/Day

A. Oil & grease chambers:

Compressed = 350m^3/ ML
Detention time = 3-5 mins
Area = 13.33m^2
Depth = 1.20 m
Free board = 0.30m

B. **Equalization tank:** (circular)

Detention time = 7.68 hrs (limit 6-10 hr)
Dimensions = 11.30m x 3.80m

C. **Primary clarifiers:** (circular clarifier)

Detention time = 7.52 hr
Overflow rate = 11m^3/m^2.d
Diameter = 11.30 m
Height = 3.75 m
Slope of bottom cone portion = 45^0

Overflow channel = 0.30 m X 0.30 m
Ladder, pipe railing & plate platform at the top of clarifier for inspection & maintenance are to be provided.

D. Aeration tank:

Effluent BOD after primary settling = 630 mg/L

Assuming,

MLSS	= 4000mg/L
MLVSS	= 2800 mg/L
Effluent BOD after secondary settling tank (SST)	= 30 mg/L
Microorganism decay coefficient	= 0.05 mg/L
Mean residence time, t	= 20 days
Growth yield coefficient	= 0.65
Tank volume	= 90m^3
Tank dimensions:	
Length	= 8.40 m
Width	= 5.00 m
Effective depth	= 2.50 m
Free board	= 0.50 m
Aerator capacity	= 7.50 bhp

E. Secondary settling tank:

Detention period	= 6 hrs
Capacity required	= 15 m3
Rectangular tank dimensions:	
Total depth	= 8.40 m
Length	= 4.20 m
Width	= 2.00 m
Free board	= 0.60 m

Baffle wall at the centre of tank for easy settlement of the sludge.

3. Results for Effluent Treatment Efficiency & Analysis

The results for analysis of effluent samples taken from each unit of the ETP are given in the tables below. All the testing was done on weekly basis. The analysis was done on effluents of the plant.

3.1 Results of Wastewater Analysis

The permissible limits of the treated effluents for discharge as laid down by PPCB are given in Table 3.1

Table 3.1: Standards (maximum) for effluent discharge wastewater for the rubber industry

PARAMETERS	CONCENTRATION
pH	5.5-9.0
Biological oxygen demand	100 mg/L
Chemical oxygen demand	400 mg/L
Total solids	1000 mg/L
Suspended solids	150 mg/L
Ammonical nitrogen	300 mg/L
Total nitrogen	300 mg/L
Oil & grease	10 mg/L

Source: Environmental Protection Act 1996.

The ranges of the raw influent to the treatment plant are shown in Table 3.2 and characteristics of raw & treated effluent during the test period are shown in Table 3.3.

Table 3.2: Range of the characteristics of raw influent to the treatment plant

S.NO.	PARAMETERS	CONCENTRATION
1	pH	5-6
2	BOD	850-950mg/L
3	COD	1600-1800mg/L
4	Oil & Grease	250-350mg/L
5	TDS	2100-2400mg/L
6	Suspended Solids	800-1200mg/L

Table 3.3: Results of Wastewater Analysis

S.NO.	PARAMETERS	Raw Influent	Treated Effluent
1	pH	6.9	6.2
2	BOD	615 mg/L	120 mg/L
3	COD	1270 mg/L	405 mg/L
4	Oil & Grease	225 mg/L	7.3 mg/L
5	TDS	2310 mg/L	986 mg/L
6	Suspended Solids	1215 mg/L	117 mg/L

As analyzed, it is observed that all the parameters of the treated effluents are within standard limits prescribed by the PPCB. It is also observed that all the units and equipments are applied in an excellent manner for getting the best efficiency possible for the treatment of effluents. The quality monitoring of the plant was done and results are shown in table 3.4.

Table 3.4: Air Quality Parameters

Parameters	Concentration	Standard Limit
PM	123mg/Nm^3	150mg/Nm^3
NO_x	-	-
SO_x	35.0 µg/m^3	120 µg/m^3
SPM with 12% CO_2	138.0 – 160.0 mg/Nm^3	250 mg/Nm^3
CO_2	6.8%(122122.5 mg/m^3)	

4. Discussions

After analyzing the results of the wastewater parameter analysis and stack monitoring; it is observed that the all wastewater quality parameters are within the prescribed limits of the standards given by pollution control board. The pollution control facilities in the industry are up to mark. The performance of the pollution control devices are also analyzed by applying design check on then and it is found that the design of ETP is extra safe. ETP is designed in such a way that it can bear extra load and the expansion of the industry can be planned without any change in the ETP design. Each unit of ETP is applied in such a way to give the best level of treatment and to provide maximum efficiency to the ETP. There is further provision of improving the technology used in ETP, as the industry just installed the sand beds for sludge drying.

There is not any provision of stack monitoring and ambient air monitoring in the industry, but the stack monitoring is done by PPCB annually and the presented results are also taken from the annual report of the industry. It is observed in the results that the stack emissions are also within the limits of standards prescribed by PPCB. Ambient air quality is not tested at all. The air pollution control devices installed are bag filters and cyclones, which gives sufficient efficiency for air pollution control.

5. Conclusion

Based on the study carried out the following conclusions are drawn:

The Industry is on the progressive way to prevention of pollution and continual environmental improvement by developing environmentally safe products and processes. Although Industry has least environmental impact of its products, processes and services, but there is no official or documented commitment for continual improvement in environmental conditions. There is no well defined Environmental Policy neither it's documented. The plant is having laboratories for quality testing and effluent analysis, having the desired testing equipments and well trained staff. Fire Hydrants and DG sets are maintained in good working conditions and are serviced regularly. The employee working in any accident or disaster prone area are trained well and made aware of the working instructions as fixed by Quality Control standards. Various safety measures are provided to the workers in the operational area. The industry follows a well managed emergency preparedness procedure. Employees are trained for this purpose from time to time. Being a small scale industry, the access to management is quite easier which results in a better communication between workers and management and hence efficient working of the whole organization team is maintained. The treatment plant is quite efficient in reducing the wastewater parameters such as BOD, COD, Suspended Solids and Total Dissolved Solids. The performance of the treatment with respect to BOD and COD is reasonably good. After the treatment of the wastewater the water quality parameters are under the prescribed limits of PCB. Hence the treated effluents can be well disposed off on to the land as well as in the water bodies (sewage system).The stack emissions are also within the prescribed limits. Overflows, spills & leakages are kept to be minimized. Plant layout is properly designed. This minimizes transfer distance of materials between storage & unit operation.

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