ISSN (Online): 2456-1290

International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)

Volume 2, Issue 4, April 2017

Environmental Management Planning for a Textile Dyeing Industry: A Case Study

[1]Kashmira B Patil, [2]Dr. V. D. Salkar

[1] P. G. Student in Environmental Engineering, [2]Associate Professor,

[1] [2]Department of Civil Engineering, Walchand College of Engineering, Vishrambag, Sangli, Maharashtra

[1]kashmirapatil1992@gmail.com, [2]vitthal.salkar@walchandsangli.ac.in

Abstract :- **In many nations, textile industries are major contributors in terms of industrial production, employment and economy. The subsequent pollution resulted is in the form of water, air and noise pollution which is very hazardous for health and environment. Increasing responsibilities of a management to comply with progressing environmental legislations has created a need of appropriate Environmental Management Plan (EMP). EMP is an integrated approach for comprehensive monitoring, reducing losses, waste generation and adverse environmental impacts. As textile industries vary substantially as regards raw materials, processes and products, the industry specific EMP is inevitable to conquer the environmental pollution. Attempts are made in the present study to demonstrate systematic formulation of EMP for a typical textile dyeing industry from Ichalkaranji (Maharashtra). The study involves careful consideration of water usage in textile processes, characteristics of waste and subsequently proposing suitable strategies for environmental protection. The significant observations and recommendations made are put forth in the present paper. The effluent is provided with primary treatment by the industry. The secondary treatment is carried out at common effluent treatment plant (CETP) installed by Ichalkaranji Textile Development cluster (ITDC). Primary treatment provided at industry is found to be rather inadequate to meet the expectations of CETP. So, there is a need to upgrade the primary treatment qualitatively. The stack height is also found inadequate, so needs revision as discussed in the paper. The proposed organizational structure of Environment Management Cell and Disaster Management Plan are also presented as part of the EMP. So, the present endeavor would help the industry for sustainable operation as well as future development.**

Keywords: **- Environmental Management Plan, Environmental Protection, Pollution, Textile Industry.**

I. INTRODUCTION

The textile industry is one of the most pollutants releasing industries at global level. Textile manufacturing produces large amount of waste in terms of water, energy and chemicals which will lead to increase pollution load [7]. The major problem with regard to water usage is it consumes considerably high amounts of water and produces highly polluted discharge water, in large quantities which may cause environmental damage [3]. Textile effluent is characterized by high BOD and COD loads, suspended solids, mineral oils and residual dye [1]. Further, due to stack emissions into atmosphere, air gets polluted. High noise level causes physiological effects and physical damage [2], [14]. So, appropriate Environmental Management Plan

(EMP) should be prepared to minimize different type of pollutions, negative impacts and is formed on the basis of prevailing environmental conditions and likely impacts of proposed activity on various environmental parameters [10]. Apart from different types of pollution, green belt development, health safety aspect of the workers, risk analysis and disaster management plan are also important considerations in the EMP.

A large scale textile dyeing industry in Ichalkaranji is selected to undertake a study on environmental aspects and carry out the work on EMP during the operational phase. The textile wet processing consumes large amount of water, energy and chemicals, and correspondingly generates liquid and solid wastes. The major operations performed in the textile processing industry are desizing, scouring, mercerizing, bleaching, dyeing and finishing. The selected industry utilizes different raw materials and chemicals, and has different wet process trains. The industry is doing its best for reducing the environmental adverse impacts. However, the further enhancement in environmental policies is the need of the day [5]. So, the present study is focused on improving the environmental management of the industry.

ISSN (Online): 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Volume 2, Issue 4, April 2017

Environmental Management Plan
(During operation phase)

Operation phase of any industry being longer in duration and because of its potential to create continuous impacts is important from the impact point of view, comprehensive and effective EMP has to be prepared and implemented during operation phase of unit to protect environment.

Water Environment

In textile wet processing, water is used as a solvent for processing chemicals and as a washing and rinsing medium. The quantity of water varies from industry to industry depending on fabric produce, process, equipment type and dyestuff. The water consumption in the selected industry is given in Table I whereas Table II represents average physicochemical characteristics of influent and effluent at different stages [12].

Table I. Water consumption during wet process

Process	Intake (L/day)	Losses (L/day)	Effluent (L/day)
Bleaching	210000	35000	175000
Mercerizing	80600	15500	65100
Dyeing	273500	52000	221500
Finishing	6000	1200	4800
Boiler	30000	3000	27000

Table II. Physicochemical characteristics

Parameters	pH	B.O.D	C.O.D	Chlorides	T.D.S	T.S.S
ETP inlet	11.8	990	1252	1820	2808	968
ETP outlet	7.33	680	955	1300	2932	545
CETP inlet	7.3	485	1208	1379	3200	595
CETP outlet	7.2	21	160	530	2410	89.4
Expected CETP inlet	5.5-9	<500	<1200	<1000	<2100	<500
Expected CETP outlet	5.5-9	<30	<250	<600	<2100	<100

**All parameters are in mg/L except pH*

The textile processing effluent is treated in the industry's own effluent treatment plant (IETP) where only primary treatment is given and then it is directly discharged to common effluent treatment plant (CETP) for secondary and tertiary treatments. The treated water is further used for agriculture purpose.

The physicochemical characteristics of CETP outlet water are within the standard limits as prescribed by CPCB but the primary treatment given at industry is found to be rather inadequate to meet expectations. So, there is a need to improve the primary treatment.
Further, it is recommended that
a) As, the industry uses daily 600000 liters of water, reuse and recycling of water shall be carried out [13].
b) Rainwater harvesting shall be carried out to recharge ground water and store for future use.
c) The IETP shall be upgraded to meet standards set for influent by CETP. The industry shall carry out regular operation and maintenance of IETP.

Air Environment

The industry uses 12 tonnes coal as a boiler fuel. Emission rate of sulphur dioxide is 40 Kg/hr. The industry has Multi cyclone dust collector with 50% efficiency to control stack emissions. But the present height of stack is 20 meters. The stack height shall be as per Central Pollution Control Board (CPCB) norms based on sulphur dioxide emission by using the equation

$$H = 14Q^{0.3}$$

Where,
Q – SO_2 emission rate in Kg/hr.
For particulate matter emission by using the equation,
Emission rate of particulate matter is 0.152 T/hr.

$$H = 74Q^{0.27}$$

Where,
H – Total stack height from ground level
Q – Particulate matter emission rate in T/hr.

The stack height required shall be 36.90 meter and 42.34 meter according to above two equations respectively. So, the stack height must be 42.34 meter.
Following measures are proposed to mitigate negative impact of operation phase of the project on the surrounding air environment:
a) Height of stack shall be as per statutory requirement. The minimum required stack height is 42.34 meters according to the CPCB norms.
b) Regular maintenance of machinery's in order to control emissions is essential.
c) Vehicles used for transportation will be periodically checked for pollutant emissions against stipulated norms.

Hazardous/Solid Waste Management

During operation phase, various categories of solid wastes are generated. i.e. Used Oil, Effluent Treatment Plant (ETP) Sludge, Discarded Barrels contaminated with hazardous wastes/chemicals, Non Toxic Process Waste, Coal Ash, Incinerable Waste and Spent Solvent. IETP sludge is transported by industry to Common Hazardous Waste Treatment Storage Disposal Facility (CHWTSDF Maharashtra Enviro Power Ltd.)Ranjangaon for its final disposal. Existing CHWTSDF has following components:

1. Waste Receipt, characterization and storage
2. Secured Land Fill along with stabilization treatment plant.

ISSN (Online): 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Volume 2, Issue 4, April 2017

3. Hazardous Waste Incineration
4. Common Multiple Effect Evaporation System
5.
6. Common Spray Drying System

Management of solid wastes shall be as followed:

a) Used oil shall be sold to Registered Reprocessors / reuse as lubricant.
b) Coal ash shall be sold to brick manufacturer.
c) Discarded barrels contaminated with hazardous wastes/chemicals shall be sold to authorized agencies.
d) Necessary Personal Protective Equipment shall be provided to workers while handling of hazardous waste.

Noise Environment

The existing textile industry generates various in noise levels around the industrial premises. The measurements for monitoring noise levels is carried out at all designated locations in accordance to the Ambient Noise Standards formulated by Central Pollution Control Board (CPCB) in 1989. The day and mid-day noise levels have been monitored instantaneously at various locations at inside and outside of industry using sound pressure level meter. Noise is recorded at "A" weighted frequency using a "slow time response mode" of the measuring instrument.

Table: 3 Measurements of Noise Levels

Area	Avg. Noise level (decibel)
A. Inside industry sectors	
1. Bleaching Machines	90-95
2. Boiler Room	90-95
3. Generator Room	100-105
4. Dyeing Department	95
B. Outside Industry near commercial area	67.9

The high noise level observed inside the industrial departments is found exceeding the desired limit of 75 decibel (specified by CPCB) at all locations. Outside the industry the average noise level is found exceeding the limit of 65 decibel.

Following precautionary measures shall be adopted to control the noise level

a) Regular noise monitoring will be required.
b) Audiometric tests shall be conducted for the employees working close to the high noise sources.
c) Regular oiling, lubrication and proper maintenance of the equipment shall be carried out to minimize noise generation.
d) Workers in vicinity of strong noise shall wear earplugs and their working time shall be limited as a safety measure.

Biological Environment (Green Belt Development)

Tree plantation is one of the effective remedial measures to control the air pollution and noise pollution. A green belt is effective as it sinks the pollution. It also causes aesthetic and climatological improvement of area. According to CPCB guidelines, 33% of available land area should be covered with green belt. The total 80,000 sq. ft. land area is available at site; out of this area about 12000-15000 sq. ft. (15%-18.75%) area is covered as greenbelt and other forms of greenery. So the industry has lack of plantation. Only 15-18.75% of total land area is covered with Ashoka, Neem, Mango and Banian trees. So, more plantations are necessary.

Selection of Plants for Greenbelts

To control emissions and noise during operations, industry requires more vegetation. It is necessary to plant of different species like Borsali, Sharu, Nilgiri, Kadam, Gulmohar, Limda which are fast growing, evergreen, having minimum of leaf fall and sensitive to air pollution.

Risk Management Plan

There is a need of attention on the following risks in the industry

a) Drawing the hands in between two rollers, roller and casing and roller and fabric when fabric is passed into the machine manually. (Approximately 12% of accidental cases are caused by rollers). Risk Management- Distance between two rollers should be greater than 120 mm to avoid the risk of drawing.
b) Safety against stumble, slip and fall. Risk Management- Keep building and floors in good condition. Use suitable and intact ladders and wear suitable working shoes
c) Hearing loss because of noise. Risk Management- Use ear protection and do frequent medical check up
d) Handling various chemicals causes skin irritation. Risk Management- Use personal protective equipment like hand gloves and aprons.

ISSN (Online): 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Volume 2, Issue 4, April 2017

Disaster Management Plan

Disaster can occur due following reasons:

1. Fire hazards can be caused due to improper storage facility of toxic chemicals

Disaster Management-

a) Fire extinguishers have been placed in the selected industry but it is required to increase the quantity and to place them at proper fire sensitive locations.

b) First aid training to ward staff and safety personnel.

2. Burst of boilers due to sudden increase in pressure

Disaster Management-

Periodic checks and regular maintenance are required for Safety valve and Pressure gauge.

3. The industry uses coal based boiler. There is risk in removing the choke in the ash hopper.

Disaster Management-

a) Industry requires a provision to hold the slag from splashing when the choke is removed.

Environmental Management Cell

Environmental Management Cell is one of the important considerations of EMP for comprehensive monitoring. Preparing an EMP, it is necessary to have Environment Policy as per rules as well as regulations and permanent organizational structure to ensure its effective implementation. The industry should create a team consisting of heads from various departments to co-ordinate the activities concerned with management and implementation of the environmental control measures. Environmental Management Cell shall undertake the work of collecting data about discharge effluents, stack emissions, noise level, green Belt Development and also health and safety of workers etc. Fig. I shows organizational structure of Environmental Management Cell.

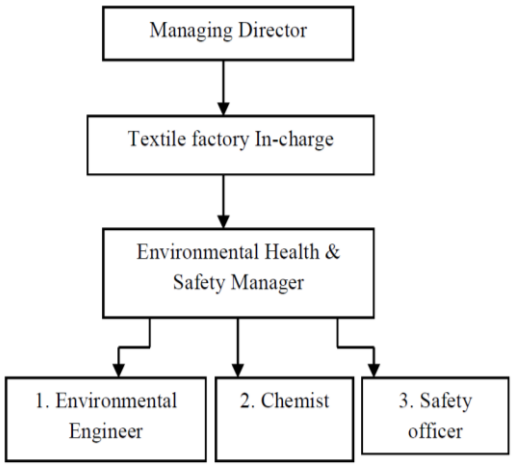

Fig. I Organizational structure of Environment Management Cell

CONCLUSION

The textile industries are one of the huge waste generating industries [6]. The study on its pollution control measures is very helpful for determining the appropriate environmental protection and impact minimization techniques [10]. Proper environmental management plan would help the industry to operate and develop sustainably. The present paper underlines significant requirements in this view.

ACKNOWLEDGEMENT

We thank the Managing Directors of Textile Dyeing Industry and Common Effluent Treatment Plant at Ichalkaranji for permitting us to carry out the study. Also we are grateful for the co-operation of technical staffs and workers.

REFERENCES

[1] Ashfaq A. and Khatoon A. "Waste Management of Textiles: A Solution to the Environmental Pollution", *International Journal of current Microbiology and Applied sciences*, vol. 3(7), pp. 780-787, 2014.

[2] Atmaca E, Peker I and Altin A. "Industrial Noise and Its Effects on Humans" *Polish Journal of Environmental Studies*, vol.14 (6), pp.721-726, 2005.

[3] Babu B, Parande A, Raghu S. and Kumar P. "Cotton Textile Processing: Waste Generation and Effluent Treatment."*The Journal of Cotton Science*, (11), pp141–153, 2007.

[4] Efendi N. "The Institutional of Environment Management on Textile Industry: A Case study on the textile industry in Bandung regency, West Java-Indonesia" *International Journal of Humanities and Social Science Invention*, vol. 3(8) pp.49-57, 2014.

[5] Islam M, Mahmud K, Faruk O. and Billah M. "Textile Dyeing Industries in Bangladesh for Sustainable Development" *International Journal of Environmental Science and Development*, vol. 2(6), pp. 170-181, Dec. 2011.

[6] Jaganathan V. Cherurveettil P. Chellasamy A. and Premapriya M. "Environmental pollution risk analysis and management in Textile Industry: A Preventive." *European Scientific Journal*, pp. 480-486, Aug. 2014.

[7] Joshi M. "Environmental Management System for the textile industry: A case study"

ISSN (Online): 2456-1290
International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE)
Volume 2, Issue 4, April 2017

Indian Journal of Fiber & Textile Research, (26), pp 33-38, 2001.

[8] Khan M, Islam M. and Khalil E. "Investigation on Effluent Characteristics of Organic Cotton Fabric Dyeing With Eco-Friendly Remazol Reactive Dyes."*American Journal of Engineering Research*, vol. 3(12), pp. 62-68, 2014.

[9] Kumar A. "Environmental Management Plan for Chemical industries especially resin manufacturing unit." *Octa Journal of Environmental Research*, vol. 2(3), pp. 262-273, Sept. 2014

[10] Parvathi C, Maruthavanan T. and Prakash C. "Environmental Impacts of Textile Industries." *The Indian Textile Journal*, 2009.

[11] Roy R, Fakhruddin A, Khatun R, Islam M, Ahsan M. and Negerd A. "Characteristics of Textile industrial effluents and its effects on Aquatic Macrophytes and Algae." *Bangladesh Journal of Scientific and Industrial Research*, vol. 45(1), pp.79-84, 2010.

[12] Seema S. and Goyal V. "Physico-Chemical analysis of textile effluents of dye and printing clusters of Bagru Region, Jaypur, India." *Journal of Environmental Research And Development*, vol. 8(1), pp.189-194, 2013.

[13] Shaid A, Osman S, Hannan A. andBhuiyan R. "Direct Reusing of Textile Wastewater in Scouring-Bleaching of Cotton Goods Devoid of Any Treatment." *International Journal of Engineering Research and Development*, vol. 5(8), pp. 45-54, Jan. 2013.

[14] Talukdar M. "Noise pollution and its control in textile industry" *IndianJournal of Fiber and Textile Research*, vol. 26, pp 44-49, 2001.

● ● ●