



Report on
“Indian Cement Industry and Sustainability”

K. Kumarasivam Young Environmentalist Internship Award 2017

Industrial Training Internship at JK Lakshmi Cement Ltd, India

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2017 KKEF Young Environmentalist Internship Award



Certificate of completion by Mr. Naveen Kumar Sharma, Sr. Vice President, JKLCL, Unit head (UCWL)

1.0 INTRODUCTION

1.1 REPUBLIC OF INDIA*

India, officially known as the Republic of India is a country in South Asia. It is the seventh-largest country by area, the second-most populous country, and the most populous democracy in the world. In the medieval era, Judaism, Zoroastrianism, Christianity, and Islam arrived, and Sikhism emerged, all adding to the region's diverse culture, making the country rich with cultural values.

In 2017, the Indian economy was the world's sixth largest by nominal GDP and third largest by purchasing power parity. India is a federal republic governed under a parliamentary system and consists of 29 states and 7 union territories. India is widely recognized for its wide cinema, rich cuisine and lush wildlife and vegetation. It is a pluralistic, multilingual and multi-ethnic society and is also home to a diversity of wildlife in a variety of protected habitats.

Gujarat is a state in Western India, has an area of 196,024 km² with a coastline of 1,600 km, most of which lies on the Kathiawar peninsula, and a population more than 60 million. Its capital city is Gandhinagar, while its largest city is Ahmedabad. Gujarati and Hindi are the common spoken languages. Major agricultural produce of the state includes cotton, groundnuts (peanuts), dates, sugar cane, milk and milk products. Industrial products include textiles, dye, cement, crude oil etc. Sabarmathi River flows through in Gujarat which its 48 km of the river length is in Rajasthan while 323 km is in Gujarat..

Rajasthan known literally as "Land of Kings" is India's largest state by area (10.4% of India's total area). It is located on the north-western side of the India, where it comprises most of the wide and inhospitable Thar Desert and shares a border with the Pakistani provinces of Punjab to the northwest and Sindh to the west, along the Sutlej-Indus river valley. Its capital and largest city is Jaipur. Other important cities are Jodhpur, Udaipur, Bikaner, Kota and Ajmer. Marwari and Hindi are the common spoken languages.

During my industrial internship tenure in JK Lakshmi Cement Limited (JKLCL), I visited aspects of sustainability at Kalol and Surat Cement grinding units and integrated cement plant in Udaipur, Rajasthan.

*Source: Wikipedia, Google

1.2 J.K. ORGANISATION



J.K. Organisation which founded over 125 years ago, is a group having multi-business, multi-product and multi-location operations. J.K. Organisation is one of the top private business houses in terms of sales and assets in India. J.K. Organisation came into existence driven by the passion and long-term vision of founding fathers Shri Late Lala Juggilal Singhanian and his son Late Lala Kamalpat Singhanian. They were motivated to start a business unit by Indians, which the products can be used by Indians. It has various businesses such as JK Paper, JK Tyre & Industries, JK Lakshmi Cement, Clinirx, JK Agri-Genetics and Fenner India Ltd. J.K., etc. Organisation has three pillars of sustainability which are environment, empowerment and health. It has business footprint in 6 continents, 100 countries and has 29 manufacturing facilities in India.

1.5 JK LAKSHMI CEMENT LTD.



JK Lakshmi Cement Ltd. (JKLCL) is a well-established name in Indian Cement industry. The company came into existence in year 1982, with initial installed capacity of 0.5 million tonnes per annum. Keeping its sustainable approach to growth, company today has total installed capacity of more than 13.0 Million tonnes per annum, with 2 integrated cement plants at Sirohi ,Rajasthan and Durg , Chhattisgarh, and 3 standalone grinding units at Kalol and Surat, Gujarat and Jhajjar, Haryana. Apart from cement company also produces two value added products, i.e. Autoclaved aerated Concrete (AAC) Blocks and Ready Mix Concrete (RMC). The company operates in five states of India supplying various grades of cement and currently exploring opportunities to tap overseas markets. The company is a Listed Public Limited Company. The company is the member of Cement Manufacturers' Association (CMA), The Federation of Indian Chambers of Commerce & Industry (FICCI),

Associated Chambers of Commerce of India (ASSOCHAM), Indo-American Chamber of Commerce, Rajasthan Chamber of Commerce, Udaipur Chamber of Commerce etc.

1.4 OVERALL ENVIRONMENTAL SUSTAINABILITY IN JK LAKSHMI CEMENT LTD.

The company can be said upfront runner for sustainability. The company conceptualize sustainability through its own six diverse dimensions:

- a) Environmental sustainability
 - Focus areas including specific energy consumption reduction, increment of renewable energy usage, water footprint management, water conservation initiatives, waste management and circular economy, Green House Gases (GHG) emissions tracking and monitoring, compliance to regulation, etc
- b) Social sustainability
 - Consist of healthcare, education, drinking water, infrastructure and skill development among others.
- c) Business sustainability
 - Proper governance structure, operating strategies, assurance of investor return and constituent performance
- d) System sustainability
 - Continuous operational improvements, systems re-engineering, linkages across various process assured.
- e) Health and Safety
 - Ensuring workforce health and safety, follow international standards besides national norms
- f) Technological sustainability
 - Constant improvements, innovation across stages of production, in house process automation, process optimisation
 -

The core six domains are instilled among the occupants of JK Lakshmi Cement Ltd. through activities, initiatives, awareness programmes, trainings and informational materials. The company also met national and international standards as per following table:

Location	Integrated plant-Sirohi	Integrated plant-Durg	Grinding Unit- Kalol	Grinding Unit-Jhajjar
Certification				
ISO 9001 (Quality Management System)	√	√	√	√
ISO 14001 (Environment Management System)	√	√	√	√
ISO 50001 (Energy Management System)	√	√	√	√
OHSAS 18001 (Occupational Health and Safety Management system)	√	√	√	√
ISO 14064-1 (Green House Gas Inventory)	-	-	√	√
NABL Accreditation (National Accreditation Board for Testing and Calibration Laboratories)	√	-	√	√

Source: JK Lakshmi Cement Ltd's Sustainability report 2014-2016

1.3 CEMENT INDUSTRY OVERVIEW IN INDIA

India is the second largest cement producer in the world after China with almost installed cement manufacturing capacity of 410 million tonnes per annum. Cement industry in India observed paradigm shift from wet manufacturing processes to the dry manufacturing processes which uses least water and energy efficient. It is observed that the industry is one of the most energy efficient cement industry in the world.

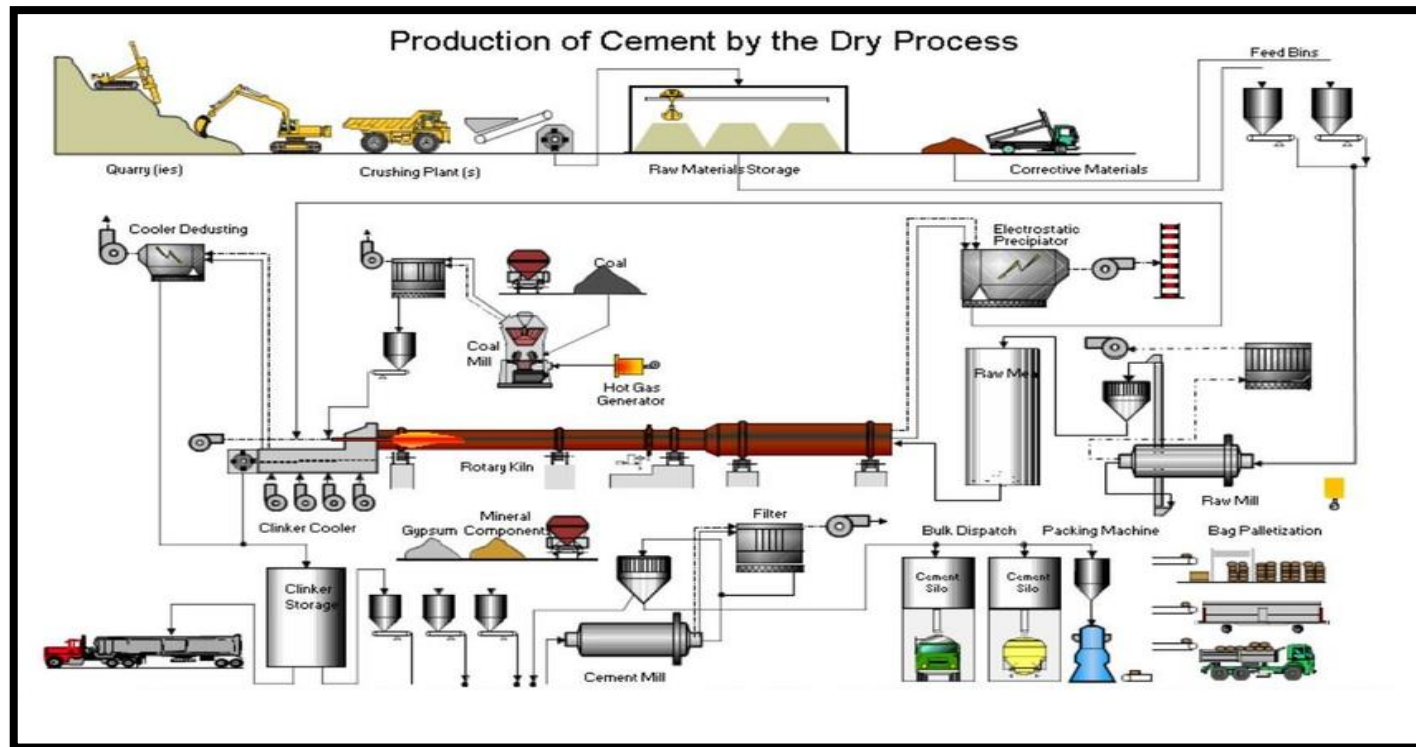
Various forms of cements like Portland Pozzolana Cement (using fly ash) and Portland Slag Cement (using waste-slag) are being produced to reduce the utilization of clinker, thus saving natural resource limestone. The Industry is observed to be among the largest consumer of fly ash generated from coal based thermal power plants in India. Various companies are also accredited based on International Management Systems like ISO 14001, 14064, OHSAS18001, 50001, and 15001, etc. The cement industry have utilized the waste

heat of the process systems to generate electricity through installing Waste Heat Recovery Systems (WHRS) within their respective premises, thereby reducing carbon footprint and saving coal resource. The units have their own in-house Sewage Treatment Plants (STP) to treat respective domestic wastewater as least water is being used in dry cement manufacturing processes. Besides this, the units established good rainwater harvesting systems to be used for internal purposes and recharging ground water resource. The composting initiatives were observed in units as part of managing solid waste especially organic waste.

In India, all the industries are subject to Section 135 of the Companies Act, according to which, each company must allocate at least 2 percent of their average net of last three years profit for Corporate Social Responsibilities (CSR) activities. This makes the industries to have solid sustainability policies at top management with vision and mission being translated in every activity at their respective industries. This is a good model which others can learn where industries are subjected to contribute to environmental practices when being guided by national goal or legislations. Industries seen to be having voluntary contribution besides mandatory rule as environment blended so deeply with the culture since ancient times, preserving natural practices and heritage of the nation.

Industries also observed to have incorporated main three pillars of sustainability which are Environment, Social and Economy, in a balanced model. Economical costs reduced together with better production and efficient usage of natural resources. Cement industries particularly have various forms of environmental practices be it macro level or micro scale, it makes good case studies for others to learn and implement those practices at their respective countries or regions.

1.6 CEMENT MANUFACTURING PROCESS BY DRY PROCESS



Flow chart of dry cement production process (Source: <http://www.engineeringintro.com>)

In nutshell, cement is made by heating limestone (calcium carbonate) with other materials at around 1450 °C in a rotary kiln which the process known as calcination. A molecule of carbon dioxide is liberated from the calcium carbonate to form calcium oxide, or quicklime, which is then blended with the other materials that have been included in the mix to form calcium silicates and other cementitious compounds. The resulting hard substance, called 'clinker', is then grinded with a fixed proportions of gypsum and other additives to produce the final product, which is cement.

2.0 CEMENT GRINDING UNIT IN KALOL, GUJARAT

2.1 INTRODUCTION

JK Lakshmi Cement Ltd's grinding unit in Kalol was established in year 2009 at Village Motti Bhoyan, Kalol District, Gandhinagar, Gujarat. It has cement manufacturing capacity of 1.0 million tonnes per annum. The main products of this grinding unit are Ordinary Portland Cement (OPC) and Portland Pozzolana Cement (PPC). The plant stands to all the defined dimensions of sustainability, adhering to companywide existing sustainability policy. Plant excels in maintaining and practicing both environmental and technological aspects of sustainability, like innovative rainwater harvesting, greenbelt, water positivity, in-house automated company gates, automated unmanned weigh bridges, innovative windmill, etc..



JK Lakshmi Cement -Kalol Grinding Unit, Gujarat, India

2.2 ASPECTS OF ENVIRONMENTAL SUSTAINABILITY

Mr. Jitesh Singh Darmwal, senior engineer (Environment Sustainability) from JKLCL was the guide person for my internship in India and briefed on the processes and culture aspects in JKLCL. I noticed various number of environmental sustainability aspects which

can be seen in both macro and micro scale. Macro scale aspects can be seen in plants' overall management as well as features to conserve environment, while micro scale aspects represented by minute detailed environmental aspects applied during cement production processes are well to be looked for. The plant is the 1st unit in state of Gujarat to be Green Co Certified, for 10 diverse aspects of environment sustainability, besides being certified for ISO 9001, ISO14001, ISO 50001, ISO18001, ISO14064-1, ISO 14046 and NABL. The plant has latest art of technology air pollution control equipment such as bag houses, bag filters as well as both ambient air and stack monitoring. These are the important features to prevent source and fugitive emissions especially in a cement plant. Also, the plant has continuous online emission monitoring system installed for cement mill stack and has scheduled programme for ambient air quality monitoring.



Bag filter fan



Filter bags of Bag filters

The plant has 6 of scientifically designed rainwater harvesting units that are connected to artificial ground water recharge wells that helps augment ground water and can increase water table, thus creating balance between water abstraction and water recharge. The rainwater harvested is also used for cooling system within the plant. Most of the roof top area is inclined and Galvanized iron (GI) sheets are used as covers as they have high rainfall coefficients, thus can results in effective harvesting of rainwater.

The plant is also identified as water positive unit (1.35 times), certified by an external certification agency, which the water generated from within plant through rainwater harvesting with smart practices are greater than water consumed by the plant. Water pipeline is constructed above the ground for easier spot of water leakage or for any other issues. The plant also has its own packaged sewage treatment plants (STP) to treat the wastewater and the treated water is used for development of greenbelt and plantation.



Mr. Jitesh Singh explaining effective water management in the unit



Rainwater harvesting unit

Besides water, the plant also has good waste management initiatives such as composting pit and vermicomposting facilities. The final compost is used as organic fertilizer for nursery and other plants in the premise. Approximately 3500 Kgs of vermicompost is produced per annum. The plant also has solar yard, of which electricity generated is used for internal usage especially in processes. This in turn reduces the dependence on coal-based power plants as well as marks the plant as renewable energy utilizer. The plant has the total capacity of 500 kW, that reduced carbon footprint of about

815,649 Kgs of CO₂ The unit has 24766.75m² (34.35%) of total area covered under green cover which has number of shrubs, trees and climbers.

In view of environmental microscale manner, the plant produces two types of cement. Portland Pozzolana Cement (PPC), a major product is produced together with Ordinary Portland Cement (OPC) of which, the earlier only consumes 65% clinker compared to 95% clinker used in OPC. This in turn shows, that the company practices sustainable natural resource utilization and gypsum and fly ash, which are the waste -derived-products from other industries used as raw material for cement production. This helps JK Lakshmi Cement to close the loop of by-products of other industries thus prevents otherwise landfilling of wastes. The whole plant operates referring to Total Productive Maintenance (TPM) which helps the company to conserve environment through detailed and efficient management of production. The trucks movement into the plant is automated and routed so that can reduce possibilities of congestion within premise, at the same time, lead to reduced carbon footprint, associated to fuel burning. The triplers carrying clinker to premises are covered with sheets to prevent fugitive emissions of dust and loss of material. Even the rubber belt sheets from scrap conveyor belts are used to cover the tripler, hoppers and other storage yards that is again is utilization of , waste products. The whole process facility at all the material transfer points, has installed bag filter to prevent the fugitive emissions of dust as well as to clean the air. Prior to mixing and grinding in the ball mill, clinker is crushed in pre-crusher to increase surface area to volume ratio, thus better rate of grinding, it also reduces the energy consumption for ball mill. The belt conveyors are covered and fitted with rubber sheets as well to prevent fugitive emissions. Hi-chrome steel balls act as grinding media in the ball mill as their sizes determined together with retention time to achieve maximum rate of grinding and power consumption.

The plant also has both stack monitoring and ambient air quality monitoring systems. Stack monitoring data is real time and is monitored by regulatory bodies. Ambient air quality monitoring is done twice a week. The cement quality tested in several aspects such as shrinkage test, expansion test, strength test and setting time, etc. The tested cement blocks are used back in constructing pathway and used for landscaping purposes in the plant. There is no waste exits the plant. The plant also uses polypropylene bags to pack the cement. The company prefers loose cement packaging through bulkers as it reduces consumption of packaging bags, thus reduces solid wastages in terms of bags.

The inhouse engineering team with intern students developed wind mill adjacent to bag filter to generate electricity, that is used to light up bulbs and fans in the management office. Overall, the plant has its own minute environmental best practices in each of its processes.



Polypropylene bags that are used to pack cement at Auto Bag Placer Machine

3.0 JK LAKSHMI CEMENT GRINDING UNIT IN SURAT, GUJARAT

3.1 INTRODUCTION

Being the unit that just commissioned in 2017, the plant is still in under refurbishment process. The plant has capacity of 1.5 million tonnes per annum, higher than Kalol unit. This plant situated in Surat, the city known as diamond city of India, for large scale polishing and cutting of diamonds.



Cement grinding unit in Surat, Gujarat

3.2 ASPECTS OF ENVIRONMENTAL SUSTAINABILITY

However, this plant can be recognized as the unit that set strong environmental aspects even from its earlier stages. Again, the environmental aspects can be observed in both macro and micro manner. The plant has latest art of technology air pollution control equipment such as bag filters, bag houses, , ground water monitoring as well as both ambient air and stack monitoring systems. The plant practices number of green construction practices. It uses refurbishment in terms of retrofitting some of the existing small infrastructure for office purposes, thereby boosting resource efficiency. This reduces natural resources and enhances energy efficiency. The un-manned weigh bridge can be seen done together for trucks to move in and out, as one single venue reduces the cost and time again saves resources. The buildings are made up of Autoclaved Aerated Concrete (AAC) blocks, which are considered as green building blocks. The pathway is completely made up of paver blocks which were also being manufactured in house, that utilises zero steel and less cement compared to cement-concrete roads. Plant has bigger solar yard than Kalol Unit with power generation capacity of 2.4MW, reducing about 1882720 Kgs of CO2 emission per year. Rainwater harvesting system also can be observed in this unit.



The offices are made up of AAC blocks and supported by roof-top rainwater harvesting system

The unit has its packaged type STP as well similar to Kalol grinding unit. The signboards on Sustainable Development Goals, for creating awareness can be seen in important locations such as visitor room, canteen, and offices, similar to Kalol unit. The unit also have long greenbelt established in side and currently in the process of adding more plants.

Besides environmental friendly features, I noticed colourful traditions infused in most of the places in plant to represent cultures of India and at the same time creates sense of ownership among the employees.



Traditional art of cement production on the wall of offices

In microscale manner, the plant has vertical roller pre-grinding mill (VPRM) to give better mixing as well as grinding efficiency before the raw materials enter the ball mill. The plant also has a lot of area covered with sheets and waste utilized rubber belts sheets to prevent fugitive emissions of dust. The solar panels have vegetables planted underneath, to utilize the water used to clean the solar panels' surfaces, similar to Kalol grinding unit. The unit also displays its stack monitoring data at plant main gate entrance for good transparency.



2.4 MW Solar Power generation plant at JK Lakshmi Surat Grinding Unit



Covered channels to prevent fugitive emissions of dust

4.0 JK LAKSHMI CEMENT INTEGRATED CEMENT PLANT IN UDAIPUR, RAJASTHAN

4.1 INTRODUCTION

Integrated cement plant in Udaipur, Rajasthan is the subsidiary unit of JK Lakshmi Cement Limited. The plant is better known as Udaipur Cement Works Limited (UCWL) and JK Lakshmi Cement owns major stake of the plant and currently finalizing the progress of refurbishing and retrofitting. The plant has its colonies for staffs and other facilities within the plant. Plant has its own captive limestone mines too.

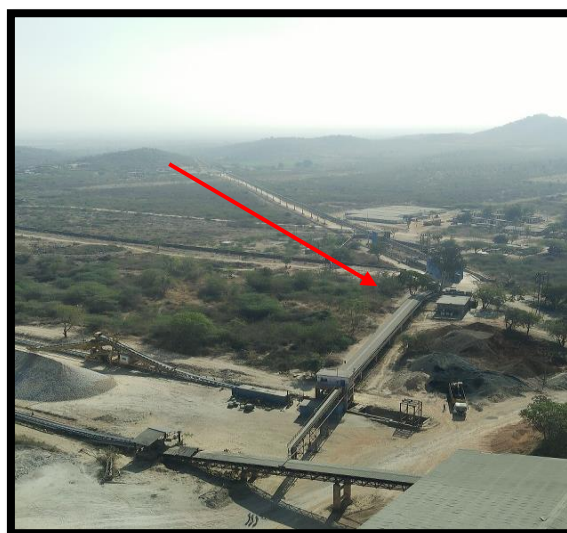


Udaipur Cement Works Limited (UCWL), Udaipur, Rajasthan, India

4.2 ASPECTS OF ENVIRONMENTAL SUSTAINABILITY

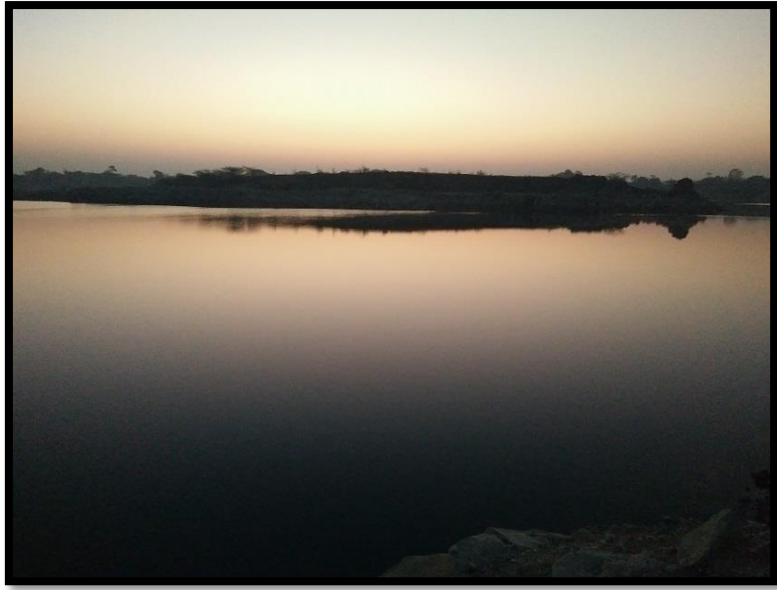
Integrated cement plant is different than grinding units in which it has mining area, raw materials processing places and then grinding units. The grinding units are part of the integrated cement plant. So, being the bigger unit with vast amount of land area, the environmental aspects were observed and recorded in both mine and within plant. The mining area is about 900 hectares.

A 6 km long covered belt conveyor is used to transport the crushed limestone from mine crusher to plant site. This in turn saves the need of truck movements, thus reduces carbon consumption.



Covered belt conveyors that brings crushed limestone from mines

The limestone mine area itself served as big hotspot for fauna especially birds and flora. During site visit with Mr. Jitesh Singh at 6.30 a.m. morning on 25th January 2018, we observed various kinds of avi-faunal and floral species. There exists three old exhausted mining pits which are currently serving as natural rainwater ponds, under sustainable mining closure plan. The water is being abstracted for villagers' use, contributing to society as well as usage for plant in cooling and utilities. This again shows good water conservation practices especially in plant.



The mining pit served as natural rainwater pond



Limestone mining area



White throated King-Fisher (*Halcyon smyrnensis*) found near mining pit
(Photo by Jitesh Singh, JKLCL)



Peafowl (*Pavo cristatus*) found near mining pit
(Photo by Jitesh Singh, JKLCL)



Adjacent villages that looks greenish surrounding mining pits

Besides mining area, there were number of environmental aspects noticed within the plant. The plant is fully equipped with latest pollution control equipment like other units. The plant is operating with one rotary Kiln and is energy efficient by having preheater system before full heating take place, within the kiln. The coal/ petcock is only used for firing at Kiln and calciner. The plant also has 12 MW waste heat recovery system (WHRS) in place to convert waste heat into power. The Kiln is also equipped with low NO_x burner installed to reduce generation of NO_x. The fugitive emissions too maintained through covered storage yards, covered conveyor belts, regular water sprinkling at mine haulage roads, parking and colony premises. There are lot of trees planted and being planted within the unit. The plant is also manufacturing its paver blocks, in-house to be used within the plant for better pervious nature of surface. The plant utilizes most of old materials and structures to form new materials and applying retrofitting aspects to save resources.



Hot air Recirculation duct connecting to Waste heat recovery system (WHRS)

5.0 ASPECTS OF SOCIAL CONNECTION IN JK LAKSHMI CEMENT LTD.

Besides best environmental practices in industry, JK Lakshmi Cement is also observed to be championing good social practices in voluntary manner. The units are mostly surrounded by villages which comes with incomplete facilities and requires development. This makes JK Lakshmi Cement to perform their role and help to uplift the livelihood of communities.

The key areas of intervention are through health and sanitation, education, skill development & livelihood, environment and social upliftment. Some of the industry's social intervention projects explained in following phrases. Around 1100 smokeless cooking stoves were provided to the villagers staying in close to Sirohi and Kalol plants (Source: JKLCL Corporate Sustainability Report, 2014-2016). The industry is also actively promoting 'Adult Education' which focuses on providing educational options to adults who passed the age to receive formal education. The communities are exposed to life-oriented skills to help themselves to overcome environmental and social barriers. Besides this, the industry also supports adoption of Government Community Healthcare Centre at Pindwara, Sirohi and providing infrastructure facilities. Moti Bhojan village at Kalol unit supported on installation

of street lights, school library etc. Nearby Govt. primary Schools are also being supported on various aspects of environmental sustainability. I visited three schools supported by industry during my internship.



Handicrafts made by community placed at entrance of Kalol unit, under unit's "Vama Lakshmi" Corporate Social Responsibility Initiative

6.0 PROJECTS UNDERTAKEN AT JK LAKSHMI CEMENT LTD.

In view of delivering something meaningful out of the Industrial Internship, few projects were undertaken at JK Lakshmi Cement Ltd., I visited three different places managed by JK Lakshmi Cement Ltd. They were Kalol Grinding Unit, Surat Grinding unit and Integrated Cement Plant in Udaipur, Rajasthan respectively. I had opportunities to give suggestions for improvements and to have some small projects to be worked on during my stint of 15 days in JK Lakshmi Cement Ltd. This is one noble approach by industry which makes visitors and interns to be part of them, which gives mutualistic benefits.

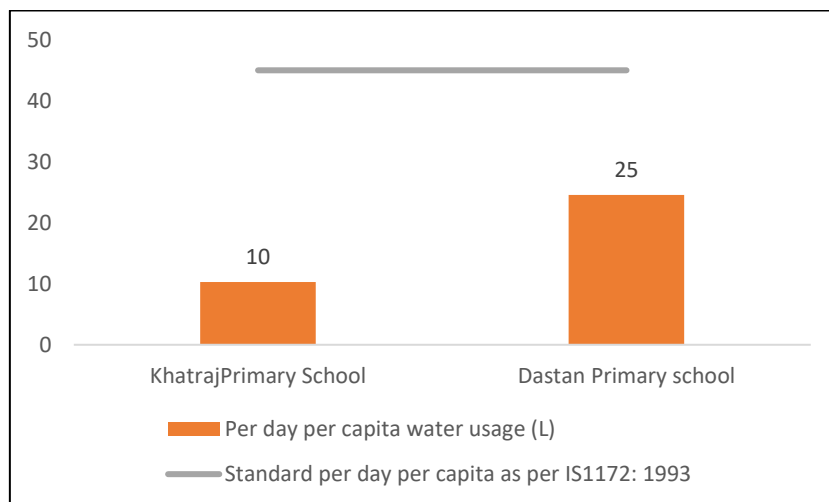
Project 1: Biodiversity Zoning

After looking into aspects of high biodiversity value at Kalol grinding unit, a practical and desktop assessment was conducted and suggestions were made to have flora zones in Kalol unit and same can also be replicated in other plants. This is because Kalol unit had more than 34% of total land area covered under green belt and plantation. Indian golden cane bamboos were found to be planted in vast quantities besides other shrubs and trees. Bamboo plays a

significant role in carbon sequestration as one hectare of bamboo on average stand absorbs about 17 tonnes of carbon per year (Seethalakshmi et al., 2009). The unit can develop and establish various zones of plants as bamboo zones, fruit trees zones, vegetable zones together with one environmental education zones. Environmental education zone at Kalol proposed to be covering vermicomposting facilities, nursery, and STP as all these facilities placed near to each other. The solar yard in Kalol unit can be established as trees zone. Solid waste management practices for instance recycling corner will add value to the existing facilities. The environmental education zone will serve as teaching environmental aspects for visitors coming to plant and will motivate other industries to replicate the process at their respective premises. The different flora zones will create their own ecosystem in upcoming years. Besides this, the current composting initiative also can be relooked with addition of holes for better air ventilation. Addition of green and fresh waste vegetables was also proposed to be added together with existing dry materials and final compost quality to be tested for internal satisfaction.

Project 2: Water Auditing at Govt. Primary Schools

I also had the opportunity to visit two primary government schools in Kalol and one government primary school in Surat respectively. Water auditing was carried out at those schools and the assessment process and findings were shared with the company’s management team in detailed presentations. These are the some of the schools that are supported by JKLCL on both social and environmental sustainability elements. Khatraj primary school near Kalol grinding unit being the school promoting water stewardship observed to be having consuming around 10 litres of water per capita per day, compared to Dastan Primary school (25 litres of water per capita per day), near Surat Grinding unit. However, specific water consumption at both the schools were found lower than national recommended standard (Source: IS 1172, 1993) of 45 litres per capita per day school, given by Bureau of Indian Standards.



Water usage per capita per day comparison between two govt. primary schools

There were interesting findings observed during water auditing exercise at schools. Girls observed to be more water cautious than boys. Gardening observed to be among the highest activity that contributes to total water usage in the schools. It was proposed that water auditing to be taken as the baseline for monitoring and planning on water conservation initiatives. Unit's management is also suggested to replicate water auditing at other schools to have average water usage per capita per day at school.



Water auditing at govt primary schools

Other suggestions/possible future projects:

I been informed that there is a temporary stream running across Surat Grinding Unit boundary wall. The stream is outside the boundary, but the river water is currently being abstracted for some of the minor usages in plant. It was suggested to the unit that the small stretch of this stream can be adopted by JK Lakshmi Surat Grinding unit with involvement of other industries, villagers and government agencies. The stream proposed to be rehabilitated to have better water quality and biodiversity, if rehabilitation actions are undertaken. The stream rehabilitation can be done by some deepening and widening of the stream together with minor trimming of plants at the stream bank. The treatment of river on site also will help villagers to get better water source for their farming activities and the grinding unit also will have benefits especially on reducing the cost of treatment for abstracted river water.



Water stream adjacent to boundary wall of JK Lakshmi Surat grinding unit

During the visit to Integrated Cement Plant in Udaipur, it was suggested to the management that, biodiversity zones in unit with plants labelling could be done. Since it is old unit with having a lot of waste scraps, chairs and tables, therefore recreational zones can be created utilizing those waste scrap materials/items. The unit can have water auditing practices as well as composting facilities. It was also suggested to have rapid bio- diversity assessment study at mining area to have better rehabilitation of mining pits. The staffs were also promoted to bicycle to the plant instead of using bikes and cars. Together, Me and Mr. Jitesh Singh had the opportunity to brief industrial environmental practices to the management and engineering staff of UCWL.



Sharing session with employees of UCWL

7.0 LESSONS LEARNT

I spent 15 days in India especially in JK Lakshmi Cement Ltd. I had the opportunity to know diverse and colourful traditions of India. The impact of diverse culture is also noticed in businesses of JK Lakshmi Cement Ltd. JK Lakshmi Cement Ltd. Is being the one among the top 10 cement industries in India had its own principles that gave strong foundation for growth of its people, stakeholders and nation at large. The company excels in management, engagement, services and so on. This enlighten me that a company that goes by strong and well-defined principles only will be able to survive in today's competitive market.

On environmental point of view, I have noticed, that the company is doing more than needed or recommended due to the top managements acknowledgement environmental sustainability as part of driving force of the company. The three units I had visited were rich of environmental features and amazed me on a cement plant or unit can be equipped with so much of flora and fauna besides having other inbuilt conservation measures. Industries in Malaysia can learn from JK Lakshmi Cement on how a company can infuse environmental elements in its operations, through both top-down as well as bottom-up approaches.

Industries in Malaysia mainly regulated by Department of Environment, Malaysia (DOE) under Environmental Quality Act 1974. Currently, DOE promoting Guided Self-Regulation (GSR) to initiate projects related to environmental conservation among industries. Mostly, industries in Malaysia are driven by either CSR or effluent management systems as their commitment towards environmental conservation. There are industries in Malaysia doing more than needed, but still the numbers are in very small scale. Hope my internship report can serve as reference or motivational factor for industries, be it developers, corporates or SMEs to infuse needed and well planned environmental features in their respective management as well as operational processes.

This study internship taught me a lot on best practices in industry be it environmental or management aspects. Having research and NGO background, this industrial training programme exposed to me working cultures in a big industry and showed the importance of step by step processes. Good hospitality as well as efficient industry-NGO partnership also enlighten me. Within 15 days, besides learning, I also able to contribute to the company through suggestions and small projects.

8.0 CONCLUSION

JK Lakshmi Cement Ltd is a member of JK Organization. JK Lakshmi Cement Ltd known to be the company with lowest carbon footprint in terms of Kgs of CO₂ equivalent per ton of clinker and rupee of revenue based on study published by IIM-Ahmedabad in year 2010. The company had its own environmental policies at top level as well as actively engage with employees and play key role in social connections too. The units had both macro scale and minor scale environmental features. Macro scale environmental features are such as complete air pollution control equipment, rainwater harvesting system, packaged STPs, and so on. Micro scale aspects are such as covered conveyor belts, covered trucks, automated systems, utilization of used and old materials, green construction materials and so on. I am very proud that I had the opportunity to have my internship at one of the renowned cement industry in India. In my point of view, JK Lakshmi Cement Ltd is a living cement industry that rich with environmental practices, flora and fauna.



Living cement industry

9.0 REFERENCES

IS 1172. 1993. Code of basic requirements for Water supply, Drainage and Sanitation. India. Retrieved from http://dasta.in/wp-content/uploads/2015/04/CB_Code_2002.pdf

JK Lakshmi Cement Ltd. (2016). *Corporate Sustainability Report*. Retrieved from http://www.jklakshmicement.com/%3Fpage_id%3D31757

JK Organization. (2016). Sustainability. Retrieved from <https://www.jkorg.in/>

Seethalakshmi KK, Jijeesh, C.M. and Balagopalan, M. 2009. Bamboo plantations: an approach to Carbon sequestration: Conference paper: Kerala Forest Research Institute, Kerala.