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# A Review of Industrial Waste Management to Conserve Marine Ecology: A Case of Coastal Industrial Cluster

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## I. INTRODUCTION

Industrialisation is at its peak. In the present scenario solid and hazardous wastes generated from the industries have resulted in a great threat and concern for the environment, because their improper disposal, without proper engineering methods can put a very disastrous impact on the environment and ecology by polluting air, water and soil. As the industries are present near the sea, the marine ecosystem and aquatic life is also quite much vulnerable to get affected by the pollution. Hence the study focused on overall industrial pollution impacts on the ecology and environment with respect to solid and hazardous waste management and treatment. Hence proper planning methods should be implemented for suitable and efficient disposal and management of solid wastes

Solid and hazardous waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. Waste management is all about how solid waste can be changed and used as a valuable resource. Solid waste management should be embraced by each and every household including the business owners across the world. Industrialization has brought a lot of good things and bad things as well. One of the negative effects of industrialization is the creation of solid waste.

Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants. These industries produce solid waste in form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes. The solid and hazardous wastes can mix or get discharged into water and flow into natural water bodies even due to rain causing water pollution, improper landfills can cause soil pollution and burning of wastes can cause air pollution.

## II. METHODS OF SOLID & HAZARDOUS WASTE MANAGEMENT

### *A. Landfill*

This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam. Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand. This liner protects the ground water from being contaminated because of leaching or percolation. When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

### *B. Incineration*

This method involves burning of solid wastes at high temperatures until the wastes are turned into ashes. Incinerators are made in such a way that they do not give off extreme amounts of heat when burning solid wastes. This method of solid waste management can be done by individuals, municipalities and even institutions. The good thing about this method is the fact that it reduces the volume of waste up to 20 or 30% of the original volume.

### *C. Recovery and Recycling*

Recycling or recovery of resources is the process of taking useful but discarded items for next use. Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills.

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*D. Composting*

Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting. Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes.

*E. Pyrolysis*

This is method of solid waste management whereby solid wastes are chemically decomposed by heat without presence of oxygen. This usually occurs under pressure and at temperatures of up to 430 degrees Celsius. The solid wastes are changed into gasses, solid residue and small quantities of liquid. In summary, proper solid waste management is an integral part of environmental conservation that should be observed by individuals and companies globally. This will keep the environment clean and reduce health and settlement problems.

*F. Sale*

Selling the wastes to authorized bodies (may be through auction) which can be recycled or used for any other purpose or can be used as a raw material for any other industry. Hence, for the appropriate management of solid, hazardous and other wastes an occupier should first follow the following steps: prevention, minimization, reuse, recycle, recover, safe disposal.

*G. Study Area*

PARADEEP, ODISHA

Paradeep is a major sea port of India present in Jagatsinghpur district in eastern state of Odisha, famous for trade activities along with an emerging industrial corridor of eastern India. The enchanting beauty of the sea, a wonderful sea beach & marine drive, beautiful creeks, estuaries and evergreen forests of estuarian islands of the river Mahanadi, make the place a tourist attraction too.

As per 2011 India census, Paradeep had a population of 73,633. Males constituted 58% of the population and females 42%, due to rapid migration of young industrial workers to the area. Paradeep has an average literacy rate of 73%, higher than the national average of 59.5%: male literacy is 79%, and female literacy is 65%.

The rapid growth is attributed to the migration of workers following the expansion of the port, and establishment of major industrial projects, like Indian Oil's Paradeep Refinery, PPL & IIFCO.

## III. METHODOLOGY

The basic methodology included primary survey by visiting each concerned major polluting industries at Paradeep in person, interviewing the officials in charge of the environmental section. Touring the sites within the industries such as solid & hazardous wastes disposal units, water treatment plants, effluent treatment plants, air quality monitoring systems, landfills etc., collecting data about the details of the plant such as its area, green cover maintained, its category according to pollution and buffer zone. then information regarding the environmental aspects were studied and datas collected such as measures taken by the industries to reduce the intensity and effects of pollution, raw materials used by the industry, type of waste and amount generated per day, per month and per year, disposal methods, analysing the data and comparing it with the government specified norms and then preparation and presentation of the report to the project guide and officer at OSPCB.

## IV. FIELD STUDY AND OBSERVATIONS / DISCUSSIONS

Field study included the primary filed survey and industrial visits to collect data on the environmental aspects, that is on pollution caused due to solid and hazardous/toxic wastes from industries. Their improper disposal, without proper engineering methods can put a very disastrous impact on the environment and ecology by polluting air, water and soil. As the industries are present near the sea , the marine ecosystem and aquatic life is also quite much vulnerable to get affected by the pollution.

**INDUSTRY: 1**

**Name:** Paradeep Phosphates Limited (PPL) **Area :** 2282.40 Acres

PPL is situated at the Port town of Paradeep in Jagatsinghpur District of Orissa and was initially established to manufacture Di-ammonium Phosphate (DAP) fertilizer in four streams. Commercial production started in the year 1986. PPL is one of the largest Phosphatic Fertilizer manufacturers in India.

**Production:** Sulphuric acid from 2000 TPD to 2400 TPD and fertilizers from 2400 TPD to 5000 TPD

**Category:** RED , Highly polluting industry.
**Influence / Buffer zone radious:** 10 kilometers , Includes about 52 villages
The settlements and biosystem present in the influence or buffer zone of any industry is always under the vulnerability of getting maximum affected by any environmental pollution, industrial failure or mishaps , hence much care is taken while discharging the wastes and pollutants from any plant. If any kind of public complaint is received immediate action and inspection is done. Provisions for compensation is made.
According the past records a fertilizer company named OSWAL in Paradeep came into news because of discharge of hazardous/toxic emissions from the industry resulted in the destruction of agricultural fields in the buffer area which brought severe damage to economy , livelihoods and property.

*A. Raw Materials used by the Industry*
*1)* Rock Phosphate : 4600 TPD
*2)* Sulphur : 800 TPD
*3)* Ammonia : 1150 TPD
*4)* Phosphoric Acid : 2350 TPD
*5)* Sulphuric Acid : 5000 TPD
*6)* MOP : 1100 TPD
*7)* Filler (sand) : 250 TPD (TPD : Tonnes per day)

*B. Environmental Aspects*
PPL has a well-organized Environment department to take care of various environmental issues of the industry, which includes but not limited to compliance of statutory provisions of environment legislations. Operation of STP, ETP, solid waste management, pollution control measures & regular monitoring of environmental parameters and coordination with different departments in the plant for effective environmental management. PPL is having a well-equipped laboratory to carryout day – to – day analysis of environmental parameters. PPL has installed a Weather Station to monitor ambient temperature, wind speed, wind direction, rain fall and relative humidity.
Green cover maintained : 37% i.e. 854 Acres
Source of water for the industry : Taladanda canal ( 15000 M3 per day use by the industry )
Solid & hazardous waste management :
The solid waste generated in PPL can be classified into solid waste from the processing plant and domestic refuse from the township colony. Major Solid wastes from the plant are by-product phosphogypsum, sulphur muck, spent catalyst, phosphoric acid tank sludge, ETP sludge. Effective arrangements are made in every unit in the factory for the treatment of wastes and effluents due to the manufacturing process carried on therein so as to render them harmless before disposal.
By-Product Phosphogypsum : Rock phosphates are treated with sulphuric acid producing phosphoric acid and calcium sulphate. The slurry from the reactor is routed through the filtration unit where calcium sulphate is obtained as a filter cake. This is called by-product phosphogypsum. It is slurried with recycle pond water and pumped to the gypsum pond. There is two compartments in gypsum pond. It is located within the factory area. The area occupied by the pond including perimeter ditches and dykes is 77 hectares. The pond is provided with compacted embankments. The supernatant flows out of the pond and is collected in a perimeter ditch. From the perimeter ditch, the supernatant is pumped and reused in the process according to the requirement. It is utilized to slurry the gypsum and also to wash the filter cake. The quantity of phospho gypsum generated at present is 8000 tones / day. Considerable quantity of it is sold to outside parties for cement manufacturing and also as calcium supplement. PPL is planning to put a granulation plant to utilize phosphogypsum. Initially the plant will be set up as a trial unit.
Spent Catalyst: Spent vanadium catalyst is generated occasionally from the sulphuric acid manufacturing process. Spent catalyst ($V_2O_5$) is being stored in a covered shed inside the plant premises in ETP area and finally will be sold to authorized reprocessor.
Sulphur muck is obtained during melting of sulphur ore in melting pit and subsequent filteration of molten sulphur. The impurities are obtained as residue. Daily generation of sulphur muck is 5 Metric Ton. It is used in the DAP plant as filler.
ETP sludge is produced during the wastewater treatment facilities. About 1500 ton of sludge is generated per annum. Sulphur muck and ETP sludge are stored in a covered shed and reused in the process.
Phosphoric acid sludge removed from the storage tanks are being utilized in DAP plant or pumped to gypsum pond. The tanks are cleaned once in two years.

Wastes generated and disposal for a ordinary year is given in the following table:

| Sl No | Description of Waste generated | Unit | Generation of Waste | | Method of Storage in Plant | Disposal Quantity | Disposal methods |
|---|---|---|---|---|---|---|---|
| | | | Source | Characteristics | | | |
| 1 | Sulphur Muck | MT | SAP | Solid | Under Shed | 2286 | Reused as filler in DAP plant |
| 2 | Spent Catalyst | MT | SAP | Solid | Under Shed | 591.3 | Safely stored under shed in lime silo. Spent catalyst disposed to M/s Jaiswal Pigment Pvt. Ltd, Korba, Chhattisgarh |
| 3 | Used Oil | KL | SAP/PAP/CPP/DAP | Liquid | Under Shed with containment | 8.0 | Stored in drums under covered shed./ Sold to authorized reprocessor |
| 4 | Waste containing oil(Oily Cotton) | Kg | SAP/PAP/CPP/DAP | Solid | Closed drums | 10 | Reused as partial supplement for fuel in DAP furnace. |
| 5 | Oily sludge | Kg | Offsite/ Store | Slurry | Under Shed | 0 | Reused as filler in DAP plant |
| 6 | Drain and ETP Sludge | MT | ETP | Wet Solid | Sludge yard/ Engineering Landfill | 2947.5 | Reused as filler in DAP plant |
| 7 | Spent Resin | KL | DM Plant | Solid | Closed drums | 7.2 | Disposed off in Engineering Landfill |
| 8 | Acid residue obtained during cleaning of acid storage tanks | m3 | Offsite | Wet Slurry | Directly recycled to PAP | 2045.803 | Recycled in PAP. |
| 9 | Reactor Scales | MT | PAP | Solid | Engineering Landfill | 36 | Engineering Landfill |
| 10 | Discarded Barrels/Containers | Nos | SAP/PAP/CPP/DAP | MS / Plastic | Designated location | 0 | As and when required sold along with used oil |
| 11 | Sludge from waste water treatment plant(ETP) | m3 | ETP | Wet Solid | Sludge yard/ Engineering Landfill | 0 | Reused as filler in DAP plant |
| 12 | Cooling Tower sludge | M3 | CT | Semi solid | Directly recycled to DAP | 0 | Reused as filler in DAP plant |

Table 1 : Showing details of wastes generated from the PPL , Paredeep

Gypsum is no more considered as a waste as it is being sold to cement industries.
Engineering Landfills along with leachate technology are present within the industrial boundary so that the solid and hazardous wastes are not carried or discharged out of it. The treated leachate can only be disposed off to the inland surface water, landfills or into public sewers according to the government formulated norms. hazardous wastes are usually stored, sold , recovered , recycled , transferred, pre-processed or co processed. Where standard operating guidelines are not available for a specific utilisation and disposal the approval has to be sought from the CPCB.

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## V. EFFLUENT TREATMENT IN PPL

The plant focuses on the zero or minimum discharge of water, the waste water generated from entire plant is completely recycled into the system whereas of CPP is separately treated in the neutralization tank, which can be reused. Total waste water generated is about 6000m3/day. Occasional leakages / overflow from PAP, DAP plant, offsites and entire effluent from SAP are taken to ETP for treatment. The said ETP has been installed based on the feasibility study carried out by NEERI, Nagpur and comprises of a collection sump, grit chamber, oil & grease trap, equalization basin and physio-chemical treatment units like clarifloculators, thickener, filter press etc. ETP process is based on double stage lime treatment. The treated effluent is neutralized using sulphuric acid before discharge.

**INDUSTRY: 2**

**Name :** ESSAR **Area :** 110 acres

The ESSAR is a 6 MTPA pellet plant is located at Paradeep in the iron ore-rich state of Odisha . The plant has an assured supply of high-quality iron ore from the beneficiation plant at Dabuna, Orissa. The Paradeep Pellet plant will add another 6 MTPA to its capacity in the next financial year, bringing Essar's total pelletization capacity at Paradeep to 12 MTPA.

**Catergory :** RED

**Influence / buffer zone radius :** 5-7 kilometres

The settlements and biosystem present in the influence or buffer zone of any industry is always under the vulnerability of getting maximum affected by any environmental pollution, industrial failure or mishaps , hence much care is taken while discharging the wastes and pollutants from any plant. If any kind of public complaint is received immediate action and inspection is done. Provisions for compensation is made.

According the past records , pollution at Paradeep came into news because of the emissions of hazardous gases and lot of dust from any industry resulted in the many severe health issues and loss of life.

**Production :** Iron Pellets

**Raw materials used by the industry :** Iron ore

**Environmental aspect :**

Green cover maintained : 36% vegetation out of the total plant area

Source of water for the industry : the slurry water ( 7:3 ratio of the iron ore + water slurry )

Solid / hazardous waste management

The major and only waste generated by the industry is the waste oil

| SL NO. | YEAR | WASTE OIL GENERATED (IN KL) | DISPOSAL METHOD |
|---|---|---|---|
| 1 | 2017 - 18 | 16.17 | e-auction, sale to authorised body only |
| 2 | 2016 - 17 | 14.04 | - do - |
| 3 | 2015 - 16 | 7.98 | - do - |
| 4 | 2014 - 15 | 8.4 | - do - |

Table 2 : Showing details of the per year waste generated ESSAESSAR plant

Besides the waste oil the major issue is the dust generated from the industry but thankfully the dust is not being considered as a waste anymore as maximum portion the dust is being regained back and reused by the industry, because the dust generated from the plant contains iron only, hence they collect it back hence the anticipated pollution caused to the dust emissions is largely minimized.

The plant has no landfill as no such wastes is produced except the waste oil.

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## VI. ANALYSIS AND RESULTS

### A. *Advantages and Disadvantages Of The Industrial Development*

*1)* The disadvantages of Industrialization are discussed below:

*a)* The immediate result is in the gradual disappearance of many natural resources, the pollution of land, water and air.

*b)* The increase in vehicular traffic, the incessant working of machines in factories have brought in traffic congestion and pollution.

*c)* The general dirty and unhealthy conditions in and around the industrial sites have affected human health and happiness. Diseases, unheard of before, are spreading far and wide.

*d)* There have been instances of child labor in factories.

*e)* The exploitation of the poor by the rich has increased simultaneously the crime-rate, isolation and sense of loneliness.

*f)* The gradual displacement of manpower in industries by installation of machineries is ultimately leading to unemployment.

*g)* People from the nearby backward areas and villages are heading or migrating towards to industrial towns for occupation and better livelihood but results in formation of slum and those backward areas remain underdeveloped and the primary activities such as farming reduces.

*h)* Increase in water, air, dust, noise and soil pollution leading to many social and environmental hazards and global threats of ecological imbalances.

*i)* Inflation sets in, the value of money goes down and the poor working class becomes poorer. Class conflicts, strike, and then lockouts cause hardship and unrest. Society faces their impact in various ways.

*j)* Large scale heavy industries lead to a sharp fall in the number of cottage industries and their gradual disappearance. Regional and local artisans and workers of various trades and professions suffer a great deal.

*2)* The advantages of industrialization are given below:

*a)* The growth of industries has resulted in large scale production of goods which are available to the consumer to meet their demands at cheaper rates.

*b)* There is saving of time and labor.

*c)* Industrialization has resulted in a considerable rise the standard of living of the people.

*d)* A number of substitutes in consumer goods are available. The customer gets wide variety of choices.

*e)* There are means to control and check the colossal wastage of human energy that can be used otherwise.

*f)* Industrialization creates new job opportunities, leading to the removal of poverty to a great extent.

*g)* Industrialization has also resulted in the development of new modes of transport making quick export and import possible, bringing the world closer.

### B. *Issues With Respect To Pollution And Solid/Hazardous Waste Generation*

Industries, in general where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance, the men, materials and machines are the basic inputs. Along with the boons, the industrialization generally brings several problems like pollution, occupational health and safety hazards. The various issues in an industry can be ;

*1)* Many industries do not have proper provisions adopted for water conservation and storage, specifically they lack the rain water harvesting system.

*2)* Many industries except the large scale ones do not have proper and well advanced and engineered effluent treatment plants.

*3)* Most of the industries are not giving much emphasis regarding the maintenance of the green cover and towards the conservation of ecological system.

*4)* Some of the industries lack proper bypass roads access to national highways, conveyer belt and long route pipelines/ conduits for easy transport and communication among industries and ports / disposal units, which results in more vehicular movement, transportation cost , dust pollution in the residential settlements.

*5)* Some of the industries lack proper and adequate measures to reduce the noise generated from the machineries and movement of the heavy vehicles inside the plant

*6)* Fertilizers industries have a great issue in the disposal of gypsum by product, although it is being sold to various cement industries but the quantity of gypsum produced per day is so huge that even the sale is not enough adequate to dispose of and overcome it. Huge manmade gypsum dunes/ hills are created.

7) Most of the industries have STP for townships only, but no STP installed for the daily wastes generated from the industrial canteen and toilets used by the workers.
8) Although most of the industries have taken some measures to control water pollution but the wastes mixed with the storm water runoff during heavy rains can pollute the natural water bodies nearby the plant, so for to handle this major issue maximum of the industries have no such provisions taken.
9) No Proper coordination and cooperation among the company, Govt authority and the concerned the buyer of the wastes from the industries. This process lacks proper documentation and administration
10) Most of the industries especially in coastal areas, lack a separate meteorological and geology department of their own in accordance with the IMD.
11) Almost all the industries lack a well-equipped and trained rapid action team/ force of their own to deal and fight with any kind of industrial disaster caused within
12) Industries have a well organised environment department but lack well equipped mobile inspecting team of their own to check and handle the pollution, interact and take feedback of the people in the neighbourhood and take appropriate and immediate action in flaws within the plant and along with in the buffer zone
13) Lack of efforts taken by most of the industries to have a scientific approach to generate electricity from the heat energy produced during the working and processing of the plant and to use renewable sources of energy.
14) Maximum of the industries have taken good measures to reduce air pollution and discharge of fugitive and toxic emissions such as SO2 , CO, Nitrogen Oxides etc. , to the atmosphere but still few lack behind in this approach and also regarding proper incineration and control for dust pollution management
15) . Most of the industry have only single but large landfills and maximum of them lack proper leachate tanks.

### *C. Recommendations And Possible Interventions*

An industrial planner has to properly plan and take the steps to minimize the impacts of industrialization and to control pollution & ensure appropriate waste management occupational health, safety including fire plans. For the management of solid, hazardous and other wastes an occupier should first follow the following steps : prevention , minimization , reuse , recycle , recover , safe disposal. Hence the various proposals and recommendations can be as follows:

1) Provisions for rain water harvesting should be mandatory in every small, medium or large-scale industries & it can be treated & used as drinking water purpose for the workers in the industry and recharging the ground water table. It will help in water conservation.
2) All industries should develop a network of underground sewers for segregated collection of various wastewater streams, which are subjected to precise treatment in well-designed effluent treatment plants (ETP) facilities involving physical, chemical and biological processes. hence mandatory ETP: effluent treatment plants should be installed with well equipped with, Tilted Plate Interceptor (TPI), Dissolved Air Floatation (DAF), Bio-tower, sludge basins, dual media filters etc. in all type of industries to treat the waste water and reuse in the industrial processing, gardening purposes. Minimum waste water discharge should be made and maximum emphasis should be given for waste water recycling.
3) It should be mandatory for all the industries to have collecting ponds and tanks so that during rains, the wastes mixed with the storm water runoff should get collected there and do not reach or get discharged/ mix with to any natural water body and then the collected storm water should be treated to separate the wastes and then can reused by the plant, it will help in ground water recharge and reduction of water pollution.
4) Some amount out of the huge quantity of water conserved, recycled by various industries in a region can be diverted and devoted for social cause and welfare, to provide irrigation to the fields by treating them as per the suitable scientific standards for agriculture in the in-buffer areas. Provisions can also be made for water supply for other use besides irrigation, provided that the area which lacks proper irrigation system by the government and has water scarcity.
5) All large-scale industries should have mandatory animal husbandry, fish rearing ponds & ecological park developed and maintained of their own where the indigenous species of both flora and fauna of that particular area can be reared. It can help in many ways such as; it will give more employment, economic advantages by selling plant and animal products, manure and fish, conservation of ecology, reduction of pollution, recharge ground water, it will help in testing how the discharged water or wastes to natural environment affects the flora and fauna kingdom, the growth and behavioural pattern of the animals will act as an indication of the impacts of the plant.

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*6)* All industries should have an independent STP of their own besides the one for the township, the industrial STP can be small or large according to the wastes production but it should treat the daily wastes generated from the toilets used by the workers and wastes from the canteen to generated manure and water which can used for the gardening purposes.

*7)* All large-scale industries must have more than one landfill, size according the wastes generated per day, within the industrial boundary to reduce the pressure on one. All industries having landfills should be advanced are bound to have leachate technology regardless of the amount and kind of solid and hazardous wastes produced, installed to minimize soil and ground water contamination and pollution.

*8)* The treated leachate can only be disposed of to the inland surface water, landfills or into public sewers according to the government formulated norms. hazardous wastes are usually stored, sold, recovered, recycled, transferred, pre-processed or co processed. Where standard operating guidelines are not available for a specific utilisation and disposal the approval has to be sought from the CPCB.

*9)* Use of less noise producing machines, vehicles, maintenance of machines/equipment/vehicles in good condition, suitably designed enclosure for both source and receiver, Use of sound absorbing material, use of ear muffs or other protecting device or sound proof cabins to employees near noise generating source. In addition, there should be development of green belt barriers through plantation. It will reduce the noise pollution.

*10)* Control measures to reduce air pollution can be made by DCDA process , candle Filters, continuous pollution monitoring systems, alkali Scrubber, wet Grinding System, fumes scrubber, cyclones, ventury Scrubbers, Mist Eliminators and back filters used to control of fugitive emissions , Use of floating roof tanks for crude and other light product services & Mechanical seals in pumps for minimizing fugitive emission of hydrocarbons in refineries , use of closed blow down vessels & safety release to flare system for arresting any emission of hydrocarbons during all situations, normal, abnormal as well as emergencies ,continuous reduction in fuel consumption by ENCON measures, heat integration and increased use of hot feed in downstream processing units & Flare gas recovery systems. burning of wastes should be avoided and proper engineered and advanced incineration should be practiced.

*11)* Proper planning and construction of flyovers, conveyer belt, pipelines and bypasses for all the industries which can directly connect to NH or EH without interfering the residential areas. It will reduce transportation cost and dust generation. Black topping of all internal roads, avoiding over loading of trucks, green belt development around the plant area, provisions for vegetation by the govt. i.e., afforestation should be developed by the industry according to category of pollution and area. Development of green belt intermixed with dust filtering trees alongside the roads will also reduce dust pollution.

*12)* Every industry regardless of the size and scale should have their own trained and well-equipped rapid disaster response team, to look after the safety measures taken and to fight any mishap especially fire safety and Installation of on-line flow-meters, pH meters, leak detectors with alarm. Regular interactions for education/awareness creation amongst all employees. Development of a health unit and ambulance facilities within the plant, Installation of smoke & Fire detection system at strategic locations of the plant.

*13)* Industries must follow a sustainable approach and should focus on the maximum use of renewable sources of energy and should also consider scientific approaches to produce of electricity from the heat energy generated in the processing of the plant.

*14)* Formation of special and well-equipped inspection team or squad by every industry, which will look after the issues in the own plant as well as will perform the AAQ monitoring in the neighbourhood by means of mobile van. They will also take the feedback and interact with people in the buffer zone. The squads of various industries can be exchanged among one another for inspection within a particular industrial area in a fixed time interval / period, decided by the concerned governing body the industrial area and then final inspection by govt officials, it may give rise to conflicts but can be effective in many ways.

*15)* Gypsum produced in large quantities from fertilizer companies may be considered in scientific approach for road laying and construction purposes. Besides gypsum, industries can also use waste plastics for the construction of roads within the industries for more strength and longevity.

*16)* Every industry especially in coastal areas, should have a separate meteorological and geology department of their own in accordance with the IMD, to analyse the threats related to high wind speed, heat, rainfall etc. which may have the probability to affect the plant and worker’s safety and hence to take precautions early to avoid any mishap or waste / pollution.

*17)* Proper record and investigation must be made regarding the authorised buyer of the industrial products, by both govt and concerned company with periodic assessment and fulfilling the documentation and formalities requirements. Proper coordination and cooperation must be established among these three bodies.

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## VII. CONCLUSION

The objective of training internship is to get into a practical exposure to live planning projects and experience working environment. I am privileged of getting the same at the office of SPCB, Bhubaneswar and CMCE Paradeep. The current summer training internship course has been a whole new experience gained. My study and assignments mostly dealt with industrial pollution and solid/hazardous waste management which included; primary survey, interaction and interviews for data collection, GIS based software application & mapping, analysis, proposal formulation and report presentation. Overall, it was a good internship experience and I am thankful to all the staff members and officials, especially the mentors who constantly supported through their invaluable guidance and advices. I am thankful to SPCB for giving me this opportunity. Looking forward for further enclosure with the authority.

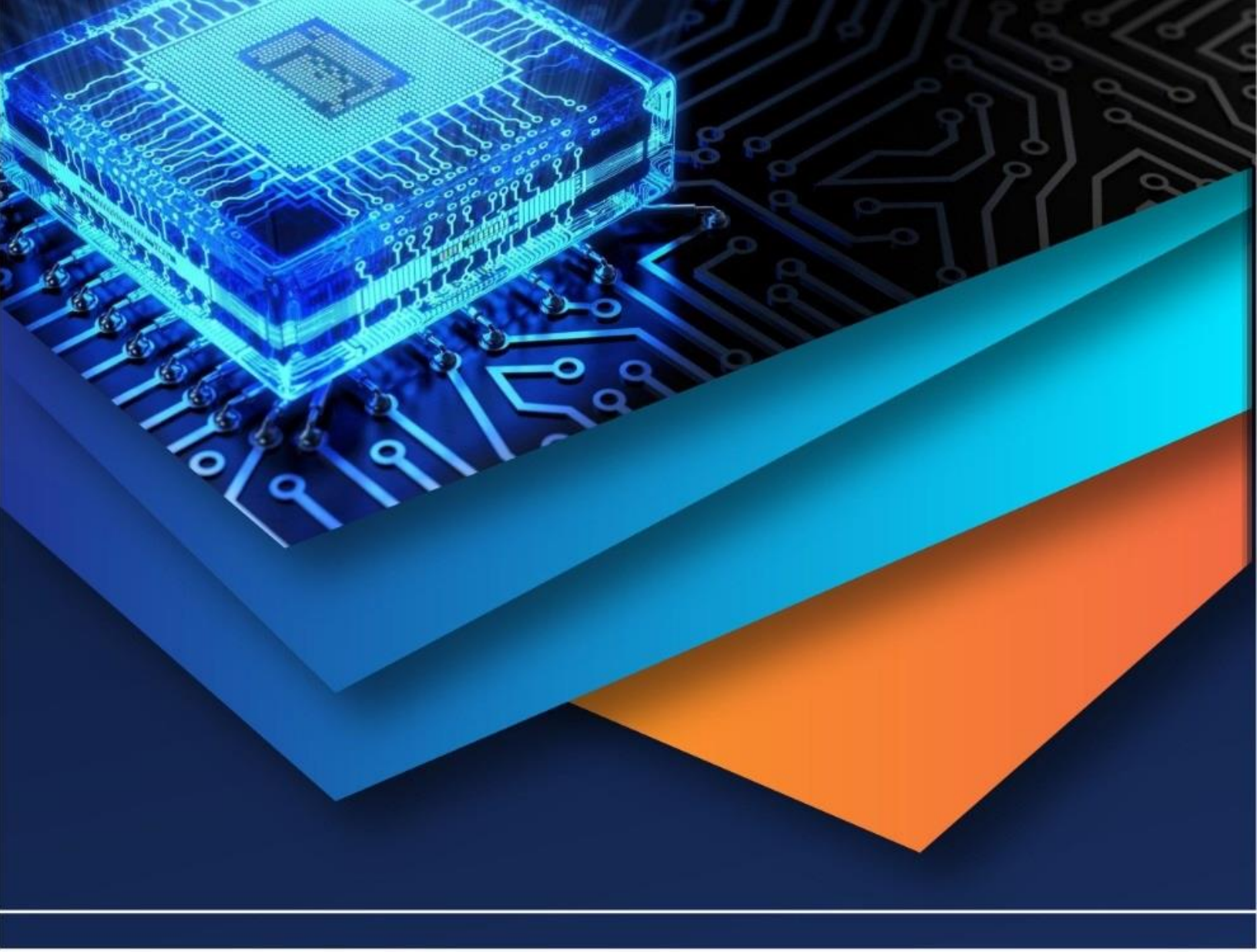
Through my study the ideas I concluded is that; the time has come to put emphasis on a planned and balanced industrialization keeping in view the preservation of environment, so that sustainable development would be possible. It would be a move in the right direction. The development of science and technology has resulted in the growth and spread of Heavy Industries. Human progress now-a-days is measured in terms of industrial potentialities and prosperity. But it is unfortunate that we have not yet realized the evils of industrialization due to unplanned growth in our time. The ecological imbalances and greenhouse effects have posed serious threat to human kind and its survival is questioned. Man must learn to accept industry not as an end in itself but as a means to the end of social, economic and environmental well-being and up-liftment. Industries, in general where multifarious activities are involved during construction, erection, testing, commissioning, operation and maintenance, the men, materials and machines are the basic inputs.

Along with the boons, the industrialization generally brings several problems like pollution, occupational health and safety hazards it can be concluded that most of the industries have taken adequate measures regarding the control of pollution and meeting the norms and standards formulated by the government but still lack in many important and vital aspects such as; collecting the wastes in storm water runoff , to have rapid action force of their own , own meteorological and geology department , proper functioning of effluent treatment plants, separate and individual STPs of respective industries besides township, use of the gypsum for laying of roads , using the heat energy for the production of electricity, to have ecological parks developed by own and its proper maintenance etc. , reduce , recycle , reuse and recover should be the prime aim and motive of the industries to attain a significant control over various anticipated and expected hazards and issues in a plant.

## SOURCES

*Odisha State Pollution Control Board*
*Paradeep Phosphates Limited,*
*ESSAR Steel*
*Primary survey*

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