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Study on Ill Effects Caused by Air Pollutants on People at Cement Manufacturing Unit

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ABSTRACT

The cement industry is one of the most polluting industries in the world. It is responsible for emission of pollutants such as particulate matter, carbon dioxide, carbon monoxide, sulphur oxide and nitrogen oxide. It adversely affects the environment and health of the people. It is emitted by burning of pet coke and is higher in concentration due to coalmine wastes and scrap tires. The health effects on people are eye and skin irritation, head ache, respiratory problems, cardio vascular problems and cancer. It also affects pregnant woman which have negative effects such as low birth weight, defects in respiratory system, asthma and allergies. In this paper, the effect of air pollutants from cement manufacturing unit is studied. The areas around cement industry are identified and survey by direct observation is conducted. The pollutants and effects are listed from the observation. The impacts of air pollution on people and their awareness on air pollution are observed. The remedies are suggested to reduce impact on humans.

Keywords: Cement Industry, Air Pollutants, Direct Survey, Impacts.

INTRODUCTION

Air pollution has been raised as local, regional and global issues for decades. According to WHO, 9 out of 10 people are affected by air pollution? It is a global health threat and causes millions of human deaths annually. It is estimated that more than 6.5 million deaths occurs due to the effect of air pollutants every year. The air pollutants have complex chemical and physical features dependent on the source of pollutants. They are derived from human activities such as industrial emissions, road traffic, residential heating, shipping, air traffic, construction, agricultural activities, fire accidents and natural hazards such as earth quake, tsunami, volcanic eruption and forest fires. Construction of buildings contributes 39%, industrial activities contribute 29% and transportation contributes 33% of air pollution.

The air pollutants are present in the form of vapour and they are carbon monoxide, carbon dioxide, hydrocarbons, particulate matter, nitrogen oxide, sulphur oxide. Exposure to air pollution causes long term and short term effects. The long term effects include heart and lung disease, cancer, cardio vascular and cerebrovascular diseases. The short term effects include eye irritation, head ache and cough. It affects children and pregnant women than others. It also increases bronchitic syndrome and asthma among children and increase morality rate. Apart from physiological impacts, it also generates psychological impacts on individuals and groups.

Air pollution From Cement Industry: The cement industry is one of the main sources of pollution. India's cement industry accounted over 6% of total world's annual cement production. The major

air pollutants from cement industry are particulate matter, carbon dioxide, carbon monoxide and nitrogen oxide. The minor air pollutants are lead, mercury, cadmium, cobalt, arsenic, manganese, nickel, vanadium and copper. The children's exposure to air pollutants during fetal development and early postnatal life is associated with many types of health problems including low birth weight preterm birth, growth restriction and congenital defects. The environmental changes include climate change, global warming and increase in surrounding temperature.

II. LITERATURE REVIEW

Air pollution is one of the growing problem which leads to lot of environmental and health effects. It leads to respiratory disorders like asthma, bronchitis, heart disease and cancer [3, 7, 14, 23, 26, 28]. It also affects pregnant woman which results in low birth weight, growth restriction and preterm birth [9,22]. It also causes bronchitis, pneumonia and upper respiratory disease in children [24]. The sources of air pollution in construction industry are excavation, dumps, tips, conveyor belts crushing mills and kiln mills [8]. Cement industry contributes around 7% of carbon dioxide around the world [1,10,34]. Raw material production and clinker production are the major process which contributes air pollutant emission [5]. The pollutants which affect environment and people are CO_2, NO_2, PM, CO and SO_2 [4, 11, 16, 21, 25,29]. The other pollutants emitted from cement factory are metals like cadmium, mercury, copper, vanadium, manganese, nickel and lead. These are released during burning of pet coke [33]. Higher concentrations of air pollution emitted from cement plant may affect the health and property of house owners living adjacent to the plant. The problems include odour, blasting, noise, respiratory problem and corrosive dust on cars [31]. The energy efficiency in cement industry is achieved by adopting high efficiency motors and fans, use of alternative fuels, clinker substitution, replacing ball mill and improved grinding media in ball mills [2, 6, 12, 15, 17, 18, 19, and 20]. By imposing denitration, desulfuration and recovering waste heat in cement factory can reduce air pollution emission [32]. The benefits of using alternative fuels are lowering the use of non renewable fossil fuels and lowering emissions of greenhouse gases [27].

III. METHODOLOGY

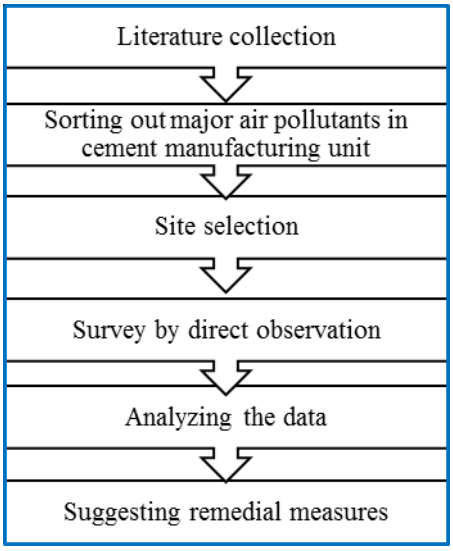

Fig1. *Methodology*

The desired objective was obtained by sequencing the flow of work into a typical methodology. Figure 1 represents the methodology adopted for successful completion of the project.

IV. Air Pollutants from Cement Manufacturing Unit

Major air pollutants:

Pollutants from cement industries are classified into gaseous and particulates pollutants. The gaseous emissions include oxides of nitrogen, sulphur, carbon, volatile organic compound and hydrogen sulfide.

Carbon dioxide and CO

Cement industries are the major source of CO_2 emissions. It is estimated that 5% of total CO_2 emission is from cement industries. It is produced from fuel combustion and decarburization of raw materials. It is emitted directly by heating lime stone and indirectly by burning fossil fuel to heat the kiln. The direct emission accounts for 50% of total CO_2 emission. The indirect emission accounts for 40% of total CO_2 emission. It is responsible for global climate change and different respiratory sickness and asthma on human being. CO causes health effects by reducing oxygen delivery to human body and causes effect on cardiovascular and central nervous system.

Nitrogen oxide

The production of cement clinker or lime in rotary kiln or other furnace accounts 6% of total nitrogen oxide emission. The production of clinker is the most energy intensive and emission intensive process, accounting for more than 80-85% of overall impact score. NO_x is formed due to thermal oxidation which happens in the temperature range of 1200-1600℃. It reacts with water to form various acidic compounds. These acidic compounds acidify lakes and water streams which creates difficulty for survival of aquatic animals. It is also responsible for global temperature increase. The smog created by NO_x when breathed causes respiratory diseases. It creates difficulty in breathing and chronic lung diseases. It may ultimately result to cancer diseases.

Particulate matter

Particulate matters are fine particles that can be suspended in air such as: dust, soot and liquid droplets. It reduces visibility and decreases the quality of air in the environment. Particulate matter consists of toxic metals and compounds such as: chromium, lead, barium and nickel. These compounds when inhaled through respiratory tracks cause various health effects. It increases the risk of cardiovascular and respiratory diseases. It also causes eye, skin and throat irritation.

Sulphur oxide

Sulphur is basically present in all cement raw materials and also in fuel. By combustion of fuel, sulphur oxide is emitted. It decreases agricultural productivity and increases death of plants. It also cause respiratory problem called as bronchitis.

Minor air pollutants

Metals which are naturally found in the raw materials, fuels, and wastes which are fed to the kiln have ended up partially in the air emissions. Exposure to these metals may be by digestive route, respiratory route, inhalation of dust, or through the pores of the skin. Constant and high dose exposure to HMs has adverse effects and can cause health problems such as cancer. Young children and pregnant women are particularly vulnerable to this type of intoxication. Metals are classified into three classes Class I: Cd, Hg, and Tl; Class II: As, Co, Ni, Se, and Te; and Class III: Pb, Cr, Cu, Pt, V, Sn, Pd, Sb, Mn, and Rh. Those in class I are the most toxic HMs and those in class III the least toxic ones.

V. Study Area

The cement industry selected for the study is located in Tamil Nadu. The surrounding villages up to 5 Km radius are also included for study. The total area of the company is around 8

acres. The annual production is about 0.72 million tonnes. They procure raw materials from Ariyalur and from their own mines within 5-6 Km.

VI. Data Collection

The data are collected by direct observation in and around the cement factory.

Data collected from factory

As per the company rules all the workers are checked for the personal protective equipments daily at the entrance. It includes helmets which is compulsory for truck drivers, shoes, masks and ear plugs. Periodical health check up is done in two categories i.e occupational health check up and yearly check up. There is hospital inside the campus where government certified health officer is available for 24 hours. The doctor is assisted by a nurse in that hospital. For safety, they follow Integrated Management System where safety trainings and safety interviews are conducted. Both theoretical session and practical session is conducted for safety trainings. The practical session is conducted on site for the real experience. The person appointed for the job must undergo training and he will be a trainee for 2 years. After completion of 2 year training, he will be appointed as a permanent worker. Every year 12 labour trainings are conducted. They follow Total Productivity Management system where onsite training, class room training and external training are provided. The accommodation is provided inside the campus for all the officers. The workers from the surrounding places are provided with pick and drop facility. They achieve plastic free environment inside the campus by avoiding plastics.

Data collected from surrounding areas

As per the data collected from surrounding occupants and company workers, the people near to the factory has higher level of respiratory diseases, skin infections and cancer. The surrounding environment of each house within 500 m is covered with heavy dust. The house ranging between 500 m to 2 km moderate dust and the house ranging more than 2 km have no cement dust. During early days the dust released by the company is high. After the complaints received from the people, they automated their manufacturing to reduce dust. The people around the industry don't know about ill effects of air pollutants. Few people know about air pollution but not in detail. Many occupants don't know that air pollution directly affects human health.

VII. Analysis of Direct Survey Data

The primary data was obtained by direct survey in which the details are collected through direct observation. Through the direct survey, respondent's personal data along with issues related to the health and information's were obtained. The data collected from the direct survey was analyzed. This gave a general knowledge of public on air pollution and its effects on. By analyzing the data, the result for the study was obtained which was useful for suggesting appropriate remedial measures.

VIII. Result and Discussion

Air quality:

The quality of air was rated as good, moderate, unhealthy and toxic based on their characteristics. The response from the people was analyzed and finally the quality of air defined by the public is shown in figure 2.

Air pollution effect on people:

By direct observation, we noticed that many of the occupants were affected by air pollution. They had both direct and indirect health effects. After analyzing the data, majority of the occupants had direct effect on health which is shown in figure 3.

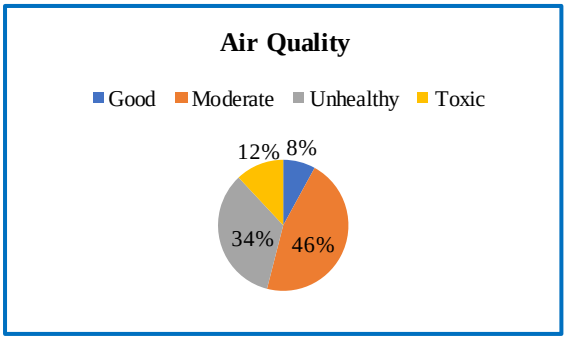

Fig 2. *Air quality around the factory*

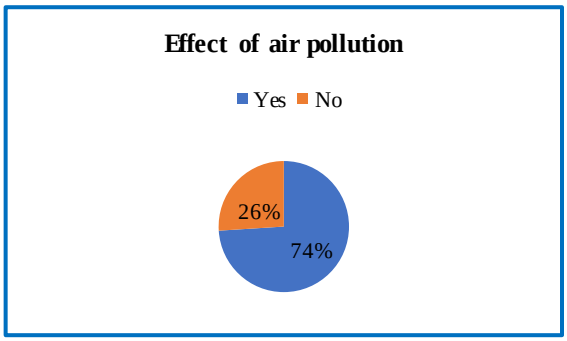

Fig 3. *Effect of air pollution on people*

Health checks up:

The affected people were asked whether they were taking regular health check up. The response from the people was quite shocking that many of them were not taking regular check up. This shows people concern on their own health. Their response is shown in figure 4.

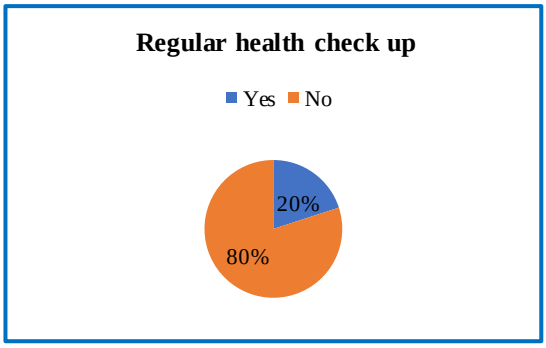

Fig 4. *People taking regular health check up*

Knowledge on air pollution:

People were asked whether they know about air pollution and its effects in detail. They didn't have a basic knowledge about air pollution and its effects. They didn't know the effect of air pollution on human health and surrounding environment. Only few people in that area was aware of pollution and taking steps against pollution which is shown in figure 5.

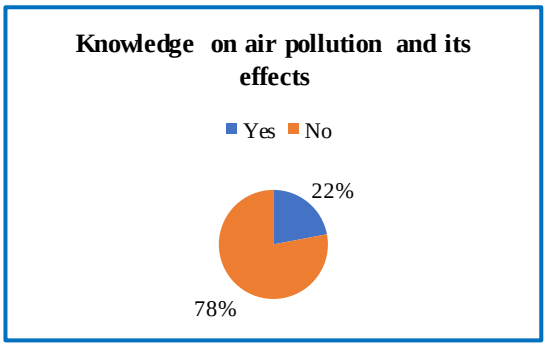

Fig 5. *Percentage of people having awareness in air pollution*

Reason for Living near to factory:

The main reasons for living near to the industry were job in nearby areas and the land where they were living was their native land. Few of them were living near to the industry because of their job in the industry. Because of these reasons they continue to live in that area even though the area was polluted. The reasons are shown in figure 6 with percentage of people accepting it.

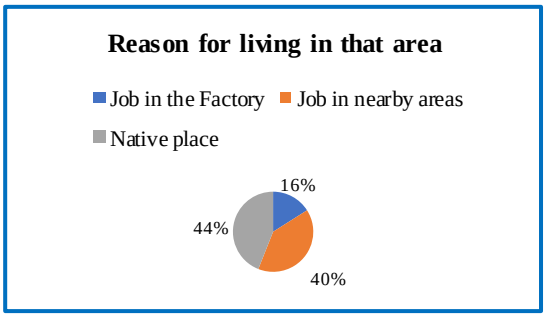

Fig 6. *Reason for living near to factory*

Health effects on people:

From the collected data, we found many health effects in people. The health effect shown in figure 7 includes eye and skin irritation, asthma, dust allergy, breathing problems, heart problem and cancer. The prevalence of allergic respiratory diseases has increased in recent years around the industrial areas. The increase in diseases is due to genetic predisposition which happens mainly due to polluted environment.

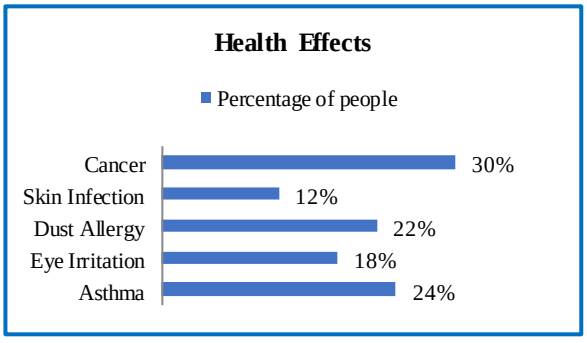

Fig 7. *Health effects on people*

Discussion

From the analysis it has been observed that people living in the areas around factory has been facing severe health problems due to pollution. But the awareness level of people is found to be very less which shows their least knowledge on air pollution. The study indicates that there are significant health impacts due to cement air pollution on the people living within 3 km of the cement factory. People should take regular checkups and proper medication to control the health problems. The factory should take effective steps to control air pollution.

IX. Conclusion

- The air pollution is increasing day by day in the areas around the cement manufacturing unit which affects human health.
- Inadequate treatment and emission of untreated air from the industry has been affecting surrounding people and environment.
- The emitted air consists of several harmful gases which affects respiratory system of humans and also affects the plants around the factory.
- The heavy metals and dust particles are present in the air which is harmful to human health.
- These components are responsible for the skin problems, cancer, low fertility rate, birth of disabled children and also unhygienic conditions.
- The people who are living around the factory with 3 km surrounding are highly affected.
- In order to overcome these effects the cement manufacturing unit should adopt suitable remedial measures.
- The government should create awareness on air pollution among the public.
- The government should take appropriate action on the factory until the environmental condition is stabilised.

X. Suggestions

- Sprinkling of water along the internal roads in the plant in order to control dust arising due to movement of vehicular traffic.
- Thick green belt is developed around the plant to arrest dust emissions.
- All the conveyors should be provided with conveyor covers and hoods to offset any trapping of material in wind stream.
- The cement kiln has to be designated as best available control technology for the control of SO_2.
- Regular monitoring and continuous auto regulation of fuel and air by automatic combustion control system is encouraged in order to ensure complete combustion and to reduce emission of CO.
- Recirculation of flue gases like CO_2, CO, SO_2 and NO_x can reduce emission of air pollutants in cement manufacturing unit.
- Creation of buffer zone around the cement industry would safeguard environment and human health.

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