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A STUDY ON ENVIRONMENTAL IMPACT OF CEMENT FACTORIES IN THE VALLEY OF KASHMIR

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ABSTRACT

A study was conducted on the various cement plants of the valley of Kashmir India to find out the effect of the cement plants on the local environment. Different tests were done during the course of research. Tests to find the pH of soil around the cement plants, Air Quality Index and Health tests of the workers and local residents were done to find the impact of pollution caused by these cement plants. Upon the study it was found that waste products that were not dumped properly lead to have negative impact on the health of soil of that particular air. It was also found that Air Quality Index was worst within the vicinity of the cement plants and at the same time health tests suggested that the workers and local residents of the area were susceptible to various health related disorders.

KEY-WORDS: Cement, production, pollution, health, Air Quality.

INTRODUCTION

Cement is an important construction material. Infact broadly speaking cement and construction go side by side. In most of the construction works cement is the main construction material that is to be used. On the Ultra Tech cement website there is an article and facts of the world's tallest building Burj Khalifa. On the website it is mentioned that in the construction of Burj Khalifa around 11 lakh tonnes of cement concrete were used for its construction. There are other articles on this website about the great constructions of the World. Dome of Pantheon which is in Rome has been constructed hundreds of years ago with cement concrete and is still there. This speaks that cement concrete has been in construction from long times and at the same time tells about the durability of cement concrete.

Cement is usually first choice for starting any construction because of the following reasons:

- 1. Malleability:** It is an important property of the cement concrete by which it can be casted in any shape.
- 2. Strength:** As compared to other construction materials cement concrete offers good amount of compressive and flexural strength.

3. **Uniformity:** Cement structured are monolithic and adds to the beauty of the construction
4. **Economy:** Cement is generally cheap and is easily available in different grades. It can be mixed with aggregates with any proportion to achieve desired strengths.
5. **Availability:** There are a number of cement brands available worldwide and is cheaply and easily available in the market at desired rates.

Keeping the above discussion in mind it can easily be understood that Cement is the King of Construction materials and has worldwide acceptance.

CEMENT AND INDIA

As per Indian Brand Equity Foundation (IBEF) report on Cement Industries of India, India is the second largest producer of cement in the world after China. In the financial year FY 2020 around 329 Million tonnes of cement were produced by the Indian cement industries. The huge availability of raw materials like Limestone and coal that is needed for the production of cement is abundantly available in India. Recently some big giant companies of the world viz Lafarge-Holcim, Heidelberg Cement, and Vicat have invested in the India. The cement Industries in India are flourishing day by day as recently in June 2021 Ambuja Cement and ACC Cements which are among the top brands of the Country have signed an impact to start production of cement jointly with more emphasis on quality and under much safer conditions. Government is also helping eastern states of the country to contribute to the cement production. It is being estimated that by the year 2025 the cement production capacity of the country is expected to reach 550 MT which is around 60 % more from the current production.

India is the second largest producer of the cement in the world because of the following reasons:

1. **Availability of Raw Materials:** The key raw materials that are needed for the construction of the cement are available in abundance. Limestone, Iron ore and Bauxite are available in huge quantities.
2. **Market:** India is a developing country. Here construction is a continuous process. Buildings, rigid pavement, bridges and fly overs are constructed. For that high amount of cement is required.
3. **Labour:** Since India is a young country. Here skilled as well as unskilled labour is available at cheap rates. It is also an important factor.
4. **Production:** As mentioned earlier the production capacity of India is very high. A reasonable amount of cement is exported to different nations and fetches good profit for the industry owners.
5. **Others:** Apart from the above reasons there are several other reasons which is the main reason for India being the second largest producer of Cement.

TOP CEMENT BRANDS OF INDIA

Our country, India is the home to many cement industries. There are as many as 185 cement plants in the country. Majority of the cement plants are situated in the Southern Areas like Tamilnadu and Andhra Pradesh and in the Northern areas of Rajasthan, Gujarat and Madhya Pradesh. As per the recent details available Madhya Pradesh is the largest producer of the cement in the whole country with around 23 cement plants. Major areas where these cement plants are located are Katni, Jamul, Satna, Durg and Maihaar. Similarly Andhra Pradesh has 19 plants while as Rajasthan has 15 plants that cater to the cement needs of the country. The famous brands of the cement in country are as follows:

1. **Ultra Tech Cement:** With the annual production of 60 million tonnes of cement it is one of the Asia's largest cement plant producer and exporter. It was founded in 1983 and with 12000 employees they are presently the top cement industry of the India.
2. **Ambuja Cement:** Founded in 1983 with head quarters in Mumbai, Ambujacemet is one among the popular brands of cement in India. They have around 2200 operating sites in India and have their presence in around 80 countries of the world.
3. **ACC Cement:** With market share of 6 % and production capacity of 28.6 million tonnes of cement per year ACC cement is also the famous brands of the cement in the country. It is worth to note that ACC Cement has been used in the construction of BhakraNangal dam in 1960.
4. **Shree Cement:** With 29 Millon ton production capacity per year Shree Cement rules the Indian market and is among top 5 cement industries of the country.It was founded in 1985.
5. **Others:** Apart from the above there are many other cement brands in India like Dalmia Cements, JK Cements, Banguar Cements, Birla Cements, Ramco Cement and others.

TOP CEMENT BRANDS OF JAMMU AND KASHMIR.

- a. **Khyber Cement:** Founded in 1994 and located in the Khrew area of Pulwama. They produce around 400 tonnes of cement per day.
- b. **TCI Max:** This is also one of the famous cement brands of the UT of J&K. The plant is equipped with German based Polysius technology same that is being used by the big cement giants of India like Ultra tech and Ambuja. Pertinent to note that this plant is registered among one of the modern cement plants of Asia.
- c. **Saifco Cement:** Founded in 1997 this is also among the cement plant giants of the J&K. It is capable of producing 100 MT of cement per day. The plant is equipped with technology from Teheiyo (Nihon), the first of its kind rotary kiln plant in the valley.
- d. **Arco Cement:** This is one among the cement brands of Valley and produce 70 MT of cement per day. It is headquartered at Srinagar, the summer capital of UT of J&K.
- e. **Jehlum Cement:** This is a government owned cement plant. It is the oldest cement plant of the J&K which was founded in 1982. It produces only 43 grade OPC. It has capacity of 600 tonnes per day.
- f. **Dawar Cement:**Dawar cement was founded in 2002 and the plant is located in Srinagar area. It also caters the cement demand of the valley.
- g. **HK Cement:** With headquartered in Athwajan area of Srinagar HK cement has a daily cement producing capacity of 800 tonnes.
- h. **Cemtac Cement:** It is located at Sulnar and is one of the top brands of cement in the J&K. It produces 450 Tonnes of cement per day.

PRODUCTION OF CEMENT AND ITS EFFECTS ON THE ENVIRONMENT

Since cement plants are among the mega factories that produce tonnes of cement per day however the amount of environment pollution caused by these plants cannot be neglected. As per United States Environmental Protection agency 3 Cement Industries are the third largest sources of Industrial pollution which emit 5 lakh tonnes of sulphur dioxide, Carbon dioxide and other hazardous effluents in the environment. Similarly other agencies also report the same data regarding pollution caused by the Cement industries.Every year lakhs of persons die to the air pollution.

Asthma, Heart attacks and other serious ailments are caused by these cement producing industries.

LITERATURE REVIEW

Although the body of literature, on Cement and its environmental impacts is quite large, the majority of studies have conducted by many researchers. The goal of this literature review is to summarize the results of several hundred articles relevant to the topic of research.

Potgieter Johannes et al, 2012 have done a research on the impacts of cement plants on the environment and it was predicted that cement industries pose a great threat to our surroundings as around 5-6 % of carbon dioxide is emitted from these plants.

Rajasekhar et al, (2001) studied the suspended particulate matter (SPM) concentration in ambient air of cement industry and reported air pollution by lime kiln and cement dust, deteriorated air quality about, 100m, of area. The cement productions smelter emits sulphur dioxide (SO₂) in excessive concentrations

Yingbo Hoe et.al has done research on the effects of cement factories on environment.. According to them cement factories are responsible for causing different health related issues to the human beings. It was found that cement by products released in the water cause different health related issues and also pollute the water which when passes through the pipes lead to their corrosion.

Madhab Chandra Jena et al2020 has done a research on quality of air in the surrounding areas of Cement plants in Bihar. According to them the present study clearly indicates that during the night the amount of suspended particles were high in the air while there during day time they were significantly low. The plants were violating the WHO and local government pollution norms.

A research done by **Arshad H Rahmani et al 2018** on the impact of cement dust on the worker suggests that most of the workers were suffering from the chronic respiratory ailments like asthma, cough and lung infection. Few workers were diagnosed with more serious ailments like diabetes, back pain and others.

Claudio Durastanti et al (2020) did research on environmental impact of cement industries on the environment. According to their research, a sample of 193 different recipes of gray cement produced in Italy from 2014 to 2019 was taken. This paper identifies the consumption impact categories (e.g., fossil fuels, renewable and non-renewable secondary fuels) that explain the assessment of the Global Warming Potential, one of the most crucial impacts of cement production in the Italy.

BiolaBalogun et al 2016 in their research stated that major pollutant to air from cement production are Methane, Fume, Dust, Nitrogen oxide, Sulphur oxide, Carbon oxide, and Carbon dioxide, which are responsible for global warming potential, which can harm the environment and are also harmful to human and plant health, through respiration. The dust flying from cement production process are transported through the air and are deposited in an area close to the manufacturing plants and or far away to distanced places. This includes villages, towns, green area, recreational places, natural vegetation and agricultural land. The depositions interfere with the natural metabolic system of agricultural production, which ultimately affect food quality and quantity. The cement industry is listed by the Indian central pollution control board, as one of the 17 most pollutant industry in India.

RESEARCH METHODOLOGY

During the course of research different cement plants of the valley have been visited by me. Due to approval limitations from the cement factories only three top three brands of the valley were chosen and data collection was initiated.

After doing the recce of the areas it was decided that the research work will be divided into three parts. First of all after seeing the heaps of wastes coming from the cement plants and their inefficient way of dumping the same had damaged the serenity of the area and also on talking with the local population they were claiming that their crop productivity had got reduced from the time when these plants were installed there, it was decided that the soil tests will be done in and around the vicinity of plants. Secondly out of the 3 plants I have seen 2 plants dumping waste nearby water bodies, So testing on water quality was also decided to be checked. Majority of the research papers suggested about direct relation between the poor air quality in the nearby areas of plants so that too was checked. Last but not the least health tests were done on the workers working in the cement plants to know the impact of pollution on the workers.

DATA COLLECTION

After visiting the sites and seeing their way of dumping the waste products in the nearby vicinity it was decided to do the soil testing of the area first to find the impact of the same on soil. In consultation with the Officials of Government Agriculture Soil Testing Office Bijbehara whom I am highly thankful, different samples of the soil were collected from the areas and tests were done on them in the laboratory.

pH tests.

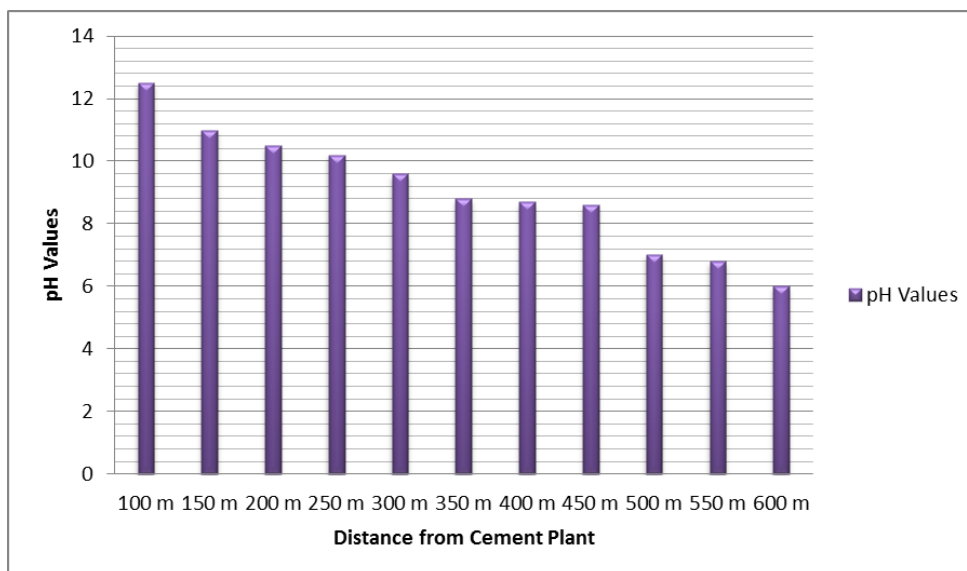
As all of us know that there is a direct link between the vegetation and the pH of that soil. Ideal pH of the soil for the growth of plants is between 5.5-7.0. Although pH is not an indication of the fertility yet it gives an idea about the ingredients of the soil.

pH Testing procedure for Soil.

After taking the sample from the site and packing it following steps are done in the laboratory to find the pH of soil.

1. Weigh 20 g of soil sample into a 100 mL beaker.
2. Add 20 mL of deionized (DI) water and place on a stirrer to mix for 30 minutes.
3. Cover and let stand for an hour.
4. For the most accurate measurements, allow the buffers and the soil sample both to come to room temperature. (A difference in temperature will add error to your measurement.)
5. A 2-point calibration with a pH 7 and a pH 10 buffer solution is recommended. The electrode slope should be between 92 and 102%.
6. Rinse electrode and ATC with DI water and blot dry. Place probes in soil sample and measure pH and record measurement.

Case Study No. 1 (Khyber Cements Khrew)

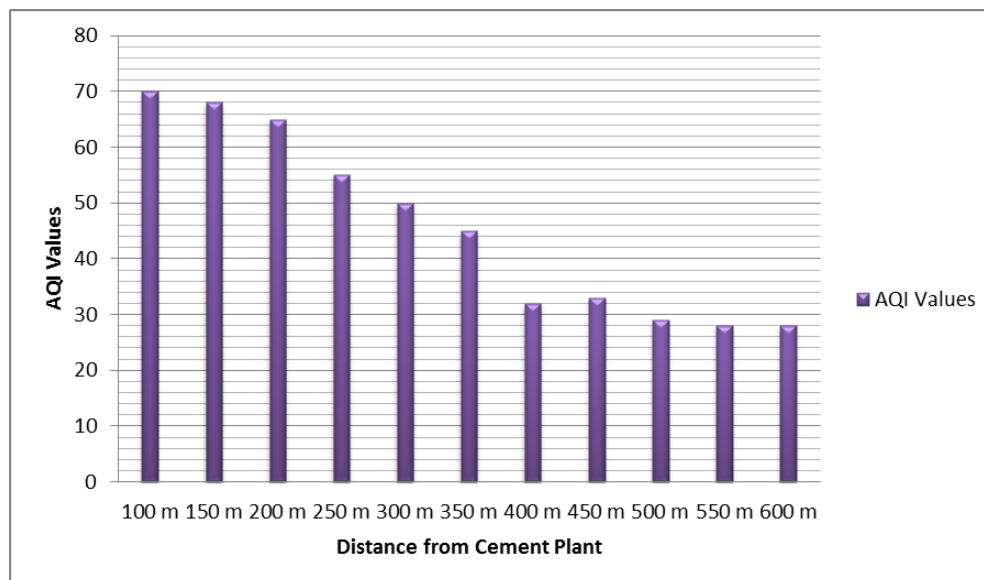


*Relation Between pH and soil Samples taken from Case Study 1
Figure 1*

Different samples of the soils were taken and it was found that the pH value of the soils that were in the vicinity of the cement plants were raised to a great extent. A soil sample taken within 100 m from the plant was highly alkaline in nature which confirmed the negative effects of waste effluents on the soil. At the same time the samples which were taken a few distance from the plant showed relatively good values of pH that are suitable for the growth of plants and other vegetation.

AIR QUALITY

Air quality is a measure of how clean or polluted the air is. Monitoring air quality is important because polluted air can be bad for our health—and the health of the environment. Air quality is measured with the Air Quality Index, or AQI. The value range from 0 to 500, where 0-50 means good quality, 51-100 means air quality is acceptable however unusual to sensitive persons, 101-150 means members of sensitive group may experience health effects, 151-200 means everyone is going to experience various health impacts, 201- 300 means health alert for the whole population and 301-500 which is termed as hazardous air quality. Indoor air quality instrument from Xiaomi was used to calculate the AQI and at the same time help of popular mobile application like Accu Weather and Weather bug were used to record the values of AQI.

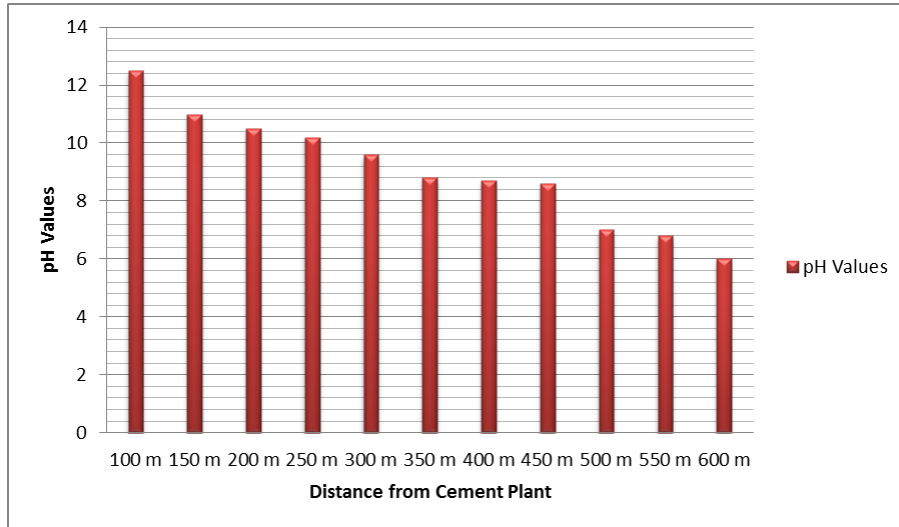


Relation Between AQI and distance from Case Study 1
Figure 2

HEALTH CHECKUP OF THE INHABITANTS AND WORKERS

The quality of life is greatly affected by good air, water and other things. Around the world, nine out of 10 people breathe unhealthy air. Air pollution is now the biggest environmental risk for early death, responsible for more than 6 million premature deaths each year from heart attacks, strokes, diabetes and respiratory diseases. Similarly millions of people die due to water borne diseases. According to the UN, every year, approximately 297,000 children under five die from diseases linked to poor sanitation, poor hygiene, or unsafe drinking water. So to check the impact of pollution caused by these cement plants it was decided that health tests will be taken to find the relation between the pollution and health of the workers. *In this regard I am highly thankful to Dr Qadri's Haematology Diagnostic centre Karanagar Srinagar that provided infrastructure for conducting the tests at no gain no loss.* Workers that have been working in the plant from last 10 years were chosen and Pulmonary function test and Tuberculosis tests were done. Out of 250, 79 were positive for lung disorders. So from the above survey it can be concluded that cement plants which act as bread earners for hundreds of workers, same cement plant acts as a passive killer for these innocent workers.

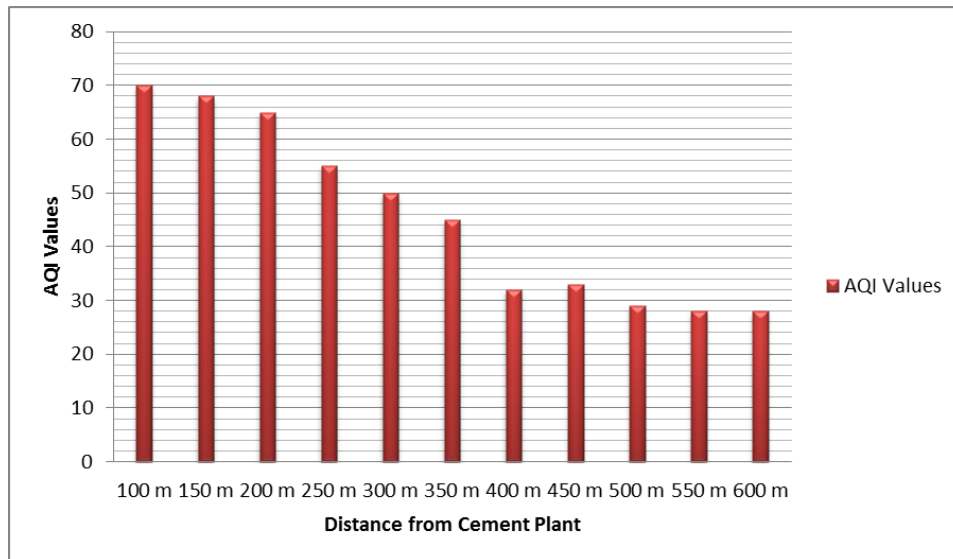
Case Study No. 2 (Saifco Cements)



Relation Between pH and soil Samples taken from Case Study 2
Figure 3

From the chart it is clearly depicted that as every time we move 100 m away from the previous location the pH of the soil shows improvement in the pH values that are healthy for soils to support vegetation.

AIR QUALITY



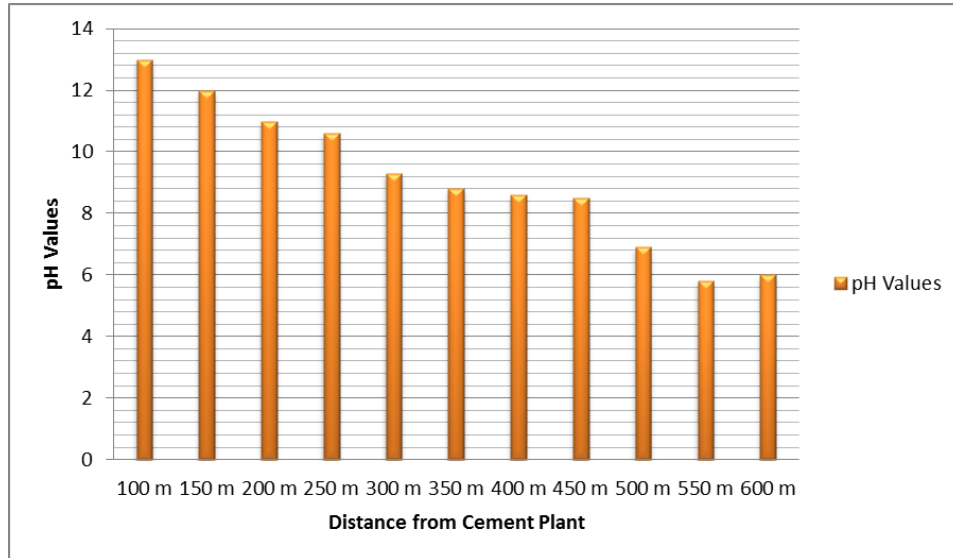
Relation Between AQI and distance from Case Study 2
Figure 4

From the chart it is clearly depicted the more we go away from the plant the AQI is getting more good.

HEALTH CHECKUP OF THE INHABITANTS AND WORKERS

Out of 125, 85 were positive for lung disorders.

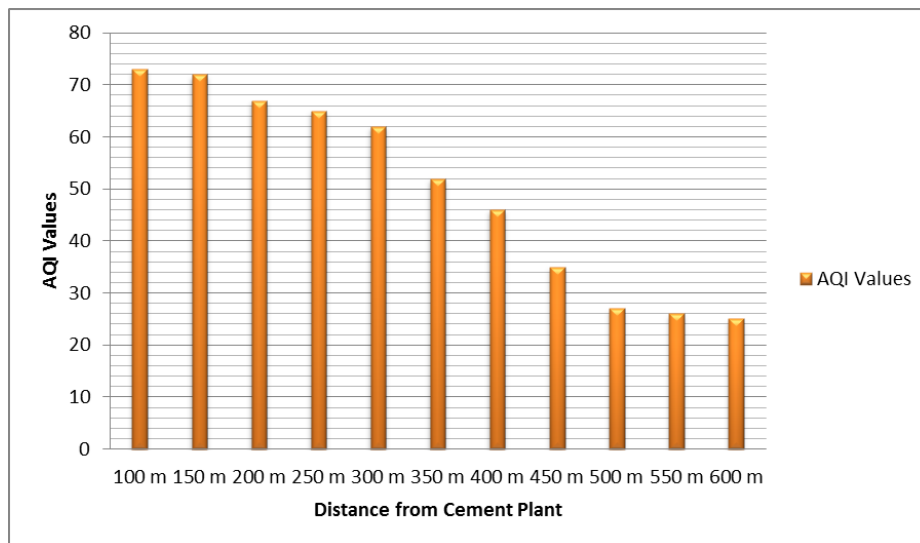
Case Study No. 3 (Max Cements)



Relation Between pH and soil Samples taken from Case Study 3

Figure 5

AIR QUALITY



Relation Between AQI and distance from Case Study 3

HEALTH TESTS

Out of 125, 68 were positive for lung disorders

RESULT AND CONCLUSIONS

The conclusions derived from the study are highlighted below

1. The waste products that are dumped at the nearby location poses a great threat to the soil of an area. There is a great rise in the pH of the soils seen in the vicinity of all the three plants.
2. AQI was also an important deciding factor and it was revealed that with the radius of 150m around these cement plants the quality of air is extremely poor and can pose health issues to the children and elderly persons.
3. The PLT tests and T.B tests done on the various workers and patients revealed that more than 60 % of the workers are positive to lung damage
4. The noise pollution caused by the trucks and dumpers that carry the raw materials and cement to and from the plants are also affect the quality of local residents.
5. There is a increase in the pollution in the areas of these cement plants to a great extent and needs to be minimized.

RECOMMENDATIONS

The outcome of the whole research may be pointed as follows:

1. The Government should act strict against the cement plant owners for causing the soil and air pollutions.
2. Proper methods must be employed to dump the waste material coming from these plants.
3. Use of high quality machinery may be employed in the cement plants that have low rates of emissions.
4. Cement factories must not be granted N.O.C that are going to be set up in the residential areas.
5. Regular inspection must be done to these plants to check if there is violation of pollution norms.

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