IMPACT OF INDUSTRIAL POLLUTION ON HEALTH AND ENVIRONMENT: A STUDY OF URBAN SLUMS IN ROURKELA

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Amarjeet Singh

Roll No- 411HS1011

UNDER THE GUIDANCE OF

Dr. R.K Biswal

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

NATIONAL INSTITUTE OF TECHNOLOGY,

ROURKELA-769008, ODISHA

Dr. R.K. Biswal
Assistant Professor
Department of Humanities and Social Sciences
National Institute of Technology, Rourkela

CERTIFICATE

This is to certify that the dissertation entitled "IMPACT OF INDUSTRIAL POLLUTION ON HEALTH AND ENVIRONMENT: A STUDY OF URBAN SLUMS IN ROURKELA" submitted by Amarjeet Singh for the award of the degree of Master of Arts in Development Studies of NIT Rourkela, is a record of bona-fide research work carried out by him under my supervision and guidance. The contents of this thesis, in full or part, have not been submitted to any other university or institution for the award of any degree.

Date-6/5/2013 Dr. R.K. Biswal

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ABSTRACT

The present study focuses on the impact of industrial pollution on health and environment in the western belt of Odisha, especially Rourkela, where there exist a steel plant spanning over six decades and some other small industries. Industry and development are complementary to each other. Rapid industrialization has generated employment opportunities and modern amenities for people. While one side of the story is so good, the other side of the story is not that impressive. The objectives of the present study are impact of industrial pollution on health and environment. A purposive sample from two areas having 126 households altogether were included in the study out of which there were 84 households in the experimental area (industrial area i.e., Sheetal pada) and 42 households in the control area (non-industrial area i.e., Lauwakera). The findings revealed that in the experiment area maximum people are suffering with diseases like tuberculosis, gastric etc. whereas in control group the numbers of sufferer are less. Though specific information regarding the air and water quality could not be obtained from the study areas, it can be inferred that the occurrence of various diseases in the experimental area may be attributed to contaminated air and water for a long time. The study has also certain limitations in terms of the sample and variable selections that need to be reexamined in future studies of such kind.

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CHAPTER I

INTRODUCTION AND REVIEW OF LITERATURE

1.1 The progress of a nation is also calculated by its industrial progress. Country will be physically powerful when it is industrially superior. Agriculture has its own significance because it provides the basic supplies of life, but it cannot take a nation ahead. Even to revise and advance agriculture, industrialization is necessary. The modern device used by farmers is also shaped by industries. Industries add big amount to the national income; many products like medicines, processed foods, and outfits are produced by industries which are used in our everyday life. The inhabitants are so huge in India that we need more industries to sustain the demand and supply in reasonable prices. Goods are produced by industries and healthy standard quality goods are exported by many industries in India, and progressively capturing global market. To carry on surviving in the world every country desires to be noticed and esteemed for what it manufactures and adds to the world market. The single problem which has to be looked behind is the pollution that results from industrialization, which causes impact on environment and health as well.

1.2 As per Environment (Protection) Act, 1986, environment includes all the physical and biological surroundings of an organism along with their interactions. Environment is thus defined as "the sum total of water, air and land and the inter-relationships that exist among them and with the human beings, other living organisms and materials."

Components of Environment: Primarily, there are three components of environment. They are:

Abiotic or Non-living Component

Biotic or living Component

Energy Component

The abiotic components are again subdivided into three categories

a) Lithosphere or Solid Earth

b) Hydrosphere or Water Component

c) Atmosphere or Gaseous Envelope

The abiotic or non-living component includes medium (soil, water, air and bodies of other organisms in case of parasites) and climate (temperature, light, wind, rainfall, snow, humidity etc.) The biotic component of environment consists of flora and fauna including man as the important factor. Abiotic and biotic components constitute together the Biome environment. The energy component includes the solar energy, geochemical energy, thermal energy, electrical energy, hydroelectrical energy, nuclear, atomic energy and all other form of energy which plays an important role to maintain the real life of organisms. In all the components of environment a number of complex, self generating cycles are going on. Moreover there exists equilibrium among all the components of environment which makes the balances in nature. But due to some human activities the equilibrium in nature is disturbed which causes the environmental pollution (Naik, 2005).

The four principle components of the environment Spheres Lithosphere Hydrosphere Biosphere Atmosphere: Lithosphere is the earth's outer layer. It includes the top part of the mantle and all of the crust. It is approximately 100km thick .The hydrosphere is the zone on earth in which water in its various forms is found. The biosphere includes the thin layer below, on, and above the earth's surface where life forms exist. The atmosphere refers to the mixture of gases, mainly hydrogen and oxygen, found above the earth's surface. The atmosphere extends for hundreds of kilometers until its density reaches that of outer space (Langford, 2013).

Types of Environment: The environment can be divided into two categories; they are

a) Natural Environment

b) Man-made or Anthropogenic Environment

Natural environment operates through self regulating mechanism i.e. any change in natural ecosystem brought about by natural process is counter balanced by changes in the other component of the environment. This mechanism is known as homeostatic environment. Thus there exists a reciprocal relationship among various components of the environment. These components are water, air, noise, soil, forest, wild life, flora and fauna etc.

In man -made environment, man is the most important environmental agent, super headed by modern technologies capable of modifying the environment according to his needs. Man made

environment includes technology transportation, housing etc. So, it is concluded that environment consists of an amalgamation of different systems like physical, chemical, biological, social and cultural - 4 -elements and any change in the environment caused due to natural process or man-made process can affect the living organism adversely or beneficially (Naik, 2005).

Factors affecting Environment

The four important ecological factors which are affecting the environment are as follows: 1.Topographic or Physiographic Factors, which consists of altitude, direction of mountain chains, plateaus, plains, lakes, rivers, sea level and valleys etc.

2. Climate Factors or Aerial Factors, which include atmosphere, light, temperature and humidity etc.

3. Edaphic Factors, which comprise lithosphere or soil.

4. Biotic Factors, which include all types of interactions between different forms of life, for example men, animals, plants, and micro-organisms etc. (Naik, 2005).

1.3 Environmental Pollution: For normal and healthy living a contributory environment is required by all living beings, including humans, livestock, plants, micro-organisms and the wildlife. The favourable unpolluted environment has a specific composition. When this composition gets changed by addition of harmful substances, the environment is called polluted environment and the substances polluting it are called pollutants. Environmental pollution can, therefore, be defined as any undesirable change in the physical, chemical or biological characteristics of any component of the environment (air, water, soil), which can cause harmful effects on various forms of life or property (Velan, 2011).

Pollution-Pollution is defined as a deviation from the natural composition of a part of the environment, resulting in adverse effects on life. Pollution is usually brought about by the addition to the environment of waste products of human activity. When the waste products are not efficiently assimilated, decomposed or otherwise removed by the natural, biological and physical processes of the biosphere, adverse effects may result as the pollutants accumulate or are converted to more toxic substances.

Types of pollutants: Primary pollutants are defined as those substances emitted directly from an identifiable source. **Secondary pollutants** are substances derived from primary pollutants by chemical reactions. Pollutants need not be material substances. Noise can be a pollutant and even electromagnetic waves can be pollutants. Most of today's problems are due to man as a pollution source. There is no way for nature to decompose many manmade materials and return their elements to the cycle of nature. Such substances will just remain and will cause whatever harmful effects they can until they are somehow dispersed or diluted so that their action is no longer noticeable.

With the increase in population, arose the problem of balanced and clean environment. In large industrialized countries with large cities the problem of disposal of sewage and industrial wastes has become severe and polluted the air, water and soil (Kaushik & Kaushik, 2010). Some of the major types of pollutions are Air pollution; Land pollution; Sound pollution; Dust pollution; Radiation; Thermal pollution; Light pollution etc. (Bheem, 2012)

Environmental pollution can, therefore, be defined as any undesirable change in the physical, chemical or biological characteristics of any component of the environment (air, water, soil), which can cause harmful effects on various forms of life or property.

1.4 Industrial Pollution and Environment

Environmental pollution be defined as any unwanted change in the physical, chemical or biological characteristics of any component of the environment (air, water, soil), which can cause dangerous effects on various forms of life or property. The most rigorous pain of industrialization is environmental pollution that has affected our land, water and air. Poisonous gases and particulate substance from industrial emissions and vehicular exhaust have contaminated the atmosphere. Release of greenhouse gases into the atmosphere has enhanced global warming. Release of chlorofluorocarbon has been accountable for reduction of protective ozone layer in the stratosphere, which makes our earth more prone to exposure of the harmful ultra violet radiations. Release of oxides of nitrogen and sulphur from power plants and industries is answerable for causing acid rain in many regions of the earth. Most vital rivers of the world have suffered huge losses due to water pollution. Big rivers adjacent to large industrial cities have been converted into open sewers. Even the groundwater is getting impure due to unlawful drilling of industrial waste water. Contamination of the land with toxic heavy metals is

rendering it fruitless. Movement of heavy metals and pesticides through food chain has become a foremost cause of alarm for human health as well. Human behavior and the technological advances have not only caused regional impacts but have also resulted in global environmental instability. Technological advancement coupled with improved life style has resulted in production and emission of uninvited substances into the environment which are causing global environmental problems such as acid rain, ozone layer depletion, global warming and climate change (Kaushik & Kaushik, 2010).

1.5 Industrial Pollution and Health

Health is a state of complete physical, mental and social well-being and not merely the absence of diseases or infirmity (WHO, 1948). Health is a state of being free from any disease; Health is a state of perfect harmony between all the organs and systems of the body. The first definition of health has a basic fault in it – it tries to define a primary state through a secondary state. Health is a primary state. It cannot be fully defined through a secondary phenomenon, disease. And then there is a larger question. Does being free from any disease which can be given a name, makes one healthy. There are many people who have no known disease and yet they are not healthy.

Health is an indefinable word. Most people who consider themselves healthy are not. And many people who are suffering from some known disease may be relatively healthy. Health is a concept which does not merely relate to the absence of disease, of healthy working of organs, or having good thoughts. Health is a holistic concept. It relates to a person as a whole. Not just the person you see, but also the person you feel (Bhatia, 2009).

Various aspects concerning protection and promotion of healthy human environment including water, air, food, shelter and working areas are known as public health aspects. For promotion of public health, varied information inputs from a variety of fields like ecology, microbiology, pathology, entomology, epidemiology, human physiology and engineering are required. Public health basically deals with water supply, sewerage and sewage disposal, drainage system, refuse sanitation, ventilation, air conditioning, and air pollution abatement and prevention of outbreak of diseases like malaria, dengue, encephalitis etc. The engineers of public health department apply engineering principles for sanitation of the environment.

All our public water supplies should be free from various types of impurities and the water should meet the drinking water quality standards prescribed by agencies like Bureau of Indian Standards (BIS).World Health Organization (WHO) or Indian Council of Medical Research (ICMR).In ancient times mainly ground water was used that was derived from wells or springs. Since groundwater moves through porous strata of sediments of the soil, it was largely filtered and pure. When surface waters were to be used, these were made to stay in impounding reservoirs so that the impurities settled down. Then, filtration through beds of sand and gravel was used followed by flocculation using alum. This process was known as coagulation. However, the filtered and coagulated water is still not free of microbes responsible for spreading various diseases like cholera, typhoid, dysentery etc. Therefore, disinfection of water becomes a very important step in public water supply systems. (Kaushik & Kaushik, 2010).

1.6 Industrial solid waste

It consists of a large number of materials including factory rubbish, packaging material, organic wastes, acids, alkalis and metals etc. During some industrial processing large quantities of hazardous and toxic materials are also produced. The main sources of industrial wastes are chemical industries, metal and mineral processing industries. Radioactive wastes are generated by nuclear power plants. Thermal power plants produce fly ash in large quantities. Solid wastes from other types of industries include scrap metal, rubber, plastic, paper, glass, wood, oils, paints, asphalt, tars, dyes, scrap leather, ceramics, abrasives, slag, heavy metals, asbestos and batteries. In some of the developed countries environmental laws and safety laws are becoming more severe due to which disposal of hazardous wastes is becoming a problem. Cost of disposal of such wastes is increasing. Therefore, these wastes are being exported to developing countries which do not even have sufficient knowledge or technique for their disposal.

1.7 Water pollution

It can be defined as change in physical, chemical or biological characteristics of water making it unsuitable for designated use in its natural state. Water is an important commodity for survival. We need water for drinking, cooking, bathing, washing, irrigation, and for industrial operations. Most of the water for such uses comes from rivers, lakes or groundwater sources. Water has the property to dissolve many substances in it; therefore, it can easily get polluted. Pollution of water can be caused by point sources or non-point sources. Point sources are specific sites near water

which directly discharge effluents into them. Major point sources of water pollution are industries, power plants, underground coal mines, offshore oil wells etc. The discharge from non-point sources is not at any particular site, rather, these sources are scattered, which individually or collectively pollute water. Surface run-off from agricultural fields, overflowing small drains, rain water sweeping roads and fields, atmospheric deposition etc., are the non-point sources of water pollution. Ground water forms about 0.6% of the total water available on planet earth and is about 30 times more than surface water (streams, lakes and estuaries). Ground water seems to be less prone to pollution as the soil layer through which water passes helps to retain various contaminants due to its cation exchange capacity. However, there are a number of potential sources of ground water pollution. Industry (textile, chemical, tanneries), deep well injection, mining etc., are mainly responsible for ground water pollution, which is irreversible. Industrial effluents, Industrial wastes containing toxic chemicals, acids, alkalis, metallic salts, phenols, cyanides, ammonia, radioactive substances, etc., are sources of surface water pollution. They also cause thermal (heat) pollution of water. Ground water pollution with arsenic, fluoride and nitrate are posing serious health hazards. (Kaushik & Kaushik, 2010).

Water pollution diseases

Toxic substances polluting the water ultimately affect human health. Some heavy metals like lead, mercury and cadmium cause various types of diseases. Mercury dumped into water is transformed into water soluble methyl mercury by bacterial action. Methyl mercury accumulates in fish. In 1953, people in Japan suffered from numbness of body parts, vision and hearing problems and abnormal mental behavior. This disease called Minamata disease occurred due to consumption of methyl mercury contaminated fish caught from Minamata Bay in Japan. The disease claimed 50 lives and permanently paralyzed over 700 persons. Pollution by another heavy metal cadmium had caused the disease called Itai-itai in the people of Japan. The disease was caused by cadmium contaminated rice. The rice fields were irrigated with effluents of zinc smelters and drainage water from mines. In this disease bones, liver, kidney, lungs, pancreas and thyroid are affected. Lead in water may be released from water pipes as lead is used in plumbing. Lead poisoning affects kidneys reproductive system, liver, brain and central nervous system. It also causes anemia and mental retardation in children. Nitrate ions present in the water are harmful to human health. From nitrogen fertilizers, nitrate ions seep into water bodies from where these may bioaccumulate in the bodies of the consumers. In the stomach nitrate is reduced

to nitrite and is responsible for blue baby syndrome and stomach cancer. Young children less than 1 year of age when ingest excessive nitrate, nitrite is formed in their stomach by microbes as the stomach is not acidic to the extent to inhibit the microbes. Which bring about these conversions. Nitrite reacts with hemoglobin which is converted into non-functional oxidized form. Due to diarrhea and vomiting child becomes slate blue, giving the baby blue baby syndrome or methaemoglobinaemia. Nitrate in the stomach of adult humans partly converts into nitrite. Nitrite interacts with secondary amines to produce N-nitrosamine which in experimental animals have been shown to cause stomach cancer. In human beings, however, evidences do not show association of nitrate with cancer. Fluoride pollution causes defects in teeth and bones, a disease called fluorosis. Pesticides through drinking water reach humans and are known to cause various health problems. The organophosphorus and carbamate pesticides are more toxic. Organochlorine pesticides accumulate in the body and affect various organs especially the central nervous system. These pesticides stimulate liver enzymes which results in rapid metabolism of drugs in the person who is on medication. The effectiveness of medicines will be reduced. (Kaushik & Kaushik, 2010).

Robb (1994) discusses the Environmental Consequences of Coal Mine Closure. He pointed out over 30,000 job loss as social consequences and run down of mine buildings, the abandonment of spoil heaps and leakage of mine waters from the unused pits as environmental consequences. The Study reveals with evidences how Mining has altered the natural underground hydrological conditions. Author suggested possible solution to tackle the problem of acidic, metal-laden waters. These treatments include raising the alkalinity by liming and allowing the settlement of metal precipitate in lagoons or ponds. This method requires much land for the lagoons.

Woodley and Moore (1967) discusses about the pollution resulting from both surface and underground mining in Indiana. Study prescribes some measures to tackle pollution. These are surface mine excavations, clarification of wash water in settling ponds, reuse of wash water, soil coverage of acid-producing refuse-disposal sites, and soil coverage of roads containing acid-producing material.

1.8 Air pollution

Air pollution has adverse effects on living organisms and materials. Air pollutants affect plants by entering through stomata (leaf pores through which gases diffuse), destroy chlorophyll and affect photosynthesis. During the day time the stomata are wide open to facilitate photosynthesis. Air pollutants during day time affect plants by entering the leaf through these stomata more than night. Pollutants also erode waxy coating of the leaves called cuticle. Cuticle prevents excessive water loss and damage from diseases, pests, drought and frost. Damage to leaf structure causes necrosis (dead areas of leaf), chlorosis (loss or reduction of chlorophyll causing yellowing of leaf) or epinasty (downward curling of leaf), and abscission (dropping of leaves). Particulates deposited on leaves can form encrustations and plug the stomata and also reduce the availability of sunlight. The damage can result in death of the plant. sulphur dioxide causes bleaching of leaves, chlorosis, injury and necrosis of leaves. Nitrogen dioxide results in increase dabscission and suppressed growth. Ozone causes flecks on leaf surface, premature aging, necrosis and bleaching. Peroxyacetyl nitrate causes silvering of lower surface of leaf, damage to young and more sensitive leaves and suppressed growth. Fluorides cause necrosis of leaf-tip while ethylene results in epinasty, leaf abscission and dropping of flowers. Air pollutants mixing up with rain can cause high acidity (lower pH) in fresh water lakes. This affects aquatic life especially fish. Some of the fresh water lakes have experienced total fish death. Industrial air Pollutes materials, Because of their corrosiveness, particulates can cause damage to exposed surfaces. Presence of sulphur dioxide and wetness can accelerate corrosion of metallic surfaces due to formation of sulfuric acid. Metal parts of buildings, vehicles, bridges, wires and metallic railway tracks are affected. Sulfuric acid also damages buildings and causes disfigurement of statues made up of marble and limestone. Sulfuric acid formed by the atmospheric Sulphur dioxide and water vapours damages the leather binding of books. The pages of the books also become brittle. Sulphur dioxide can affect fabric, leather, paint and paper. Ozone in the atmosphere can cause cracking of rubber. Nylon stockings are weakened and ultimately damaged. Tyres of various vehicles are also damaged. These days chemicals are added to prevent damage to tyre rubber by ozone. Oxides of nitrogen and ozone can also cause fading of cotton and rayon fibres (Kaushik & Kaushik, 2010).

Air pollution diseases

Air pollution has adverse effects on living organisms and materials. Human respiratory system has a number of mechanisms for protection from air pollution. Bigger particles (> 10 μm) can be trapped by the hairs and sticky mucus in the lining of the nose. Smaller particles can reach trachea bronchial system and there get trapped in mucus. They are sent back to throat by beating of hair like cilia from where they can be removed by spitting or swallowing. Years of exposure to air pollutants adversely affects these natural defences and can result in lung cancer, asthma, chronic bronchitis and emphysema (damage to air sacs leading to loss of lung elasticity and acute shortness of breath). Suspended particulates can cause damage to lung tissues and diseases like asthma, bronchitis and cancer especially when they bring with them cancer causing or toxic pollutants attached on their surface. Sulphur dioxide causes constriction of respiratory passage and can cause bronchitis like conditions. In the presence of suspended particulates, can form acid sulphate particles, which can go deep into the lungs and affect them severely. Oxides of nitrogen especially can irritate the lungs and cause conditions like chronic bronchitis and emphysema. Carbon monoxide (reaches lungs and combines with hemoglobin of blood to form carboxy hemoglobin. Carbon monoxide has affinity for hemoglobin 210 times more than oxygen. Haemoglobin is, therefore, unable to transport oxygen to various parts of the body. This causes suffocation. Long exposure to Carbon monoxide may cause dizziness, unconsciousness and even death. Many other air pollutants like benzene (from unleaded petrol), formaldehyde and particulates like polychlorinated biphenyls (PCBs), toxic metals and dioxins (from burning of polythene) can cause mutations, reproductive problems or even cancer. Many other hazardous materials like asbestos, beryllium, mercury, arsenic and radioactive substances cause lung diseases and/or affect other vital organs like kidney, liver, spleen, brain and some may also cause cancer (Kaushik & Kaushik, 2010).

Bhopal, Phillimore, Moffatt and Foy (1994) examine the harmful effect of coking work of the people living nearer to it. The methods applied in the study include the analysis of routinely collected mortality, cancer registration, and birth statistics; community survey using self-completed postal questionnaires; retrospective analysis of general practice (GP), tests of respiratory function; and analysis of available environmental data. The study reveals that routinely available indicators failed to provide convincing evidence that the coking works had

harmed health. Self-report and GP consultations indicated that respiratory ill health in the people living close to the works was worse than expected. The health effects of relatively low level but intermittently high air pollution from a point source may be subtle, contributing to respiratory morbidity, but not apparent in analysis of routine health indicators.

David E. Kromm (1973) discusses about the emissions from home heating units, vehicles, and factories which combine with adverse atmospheric and topographic conditions to produce a serious hazard in Ljubljana, Yugoslavia. Institutional barriers to effective control of include inadequate legal restraint and a social emphasis on productivity. Author find out that Residents are reasonably aware of the existence and distribution of air, but fail to understand its components and natural relationships, or the important contribution made by home heating. People who perceive a local problem are more willing to make adjustments to reduce or its negative effects. A long-shared experience with a chronic hazard reduced the variations in awareness and individual adjustment. Information on the existing status of public knowledge and ways of coping suggests specific areas of concentration in designing a community response to air.

Karina Acevedo-Whitehouse and Amanda L.J. Duffus (2009) examines and dicusses wildlife and other species in their biological system and other problems due to changes in environment. The diseases found problems in immune system which can lead to the risk of acquiring disease. Some case studies are used such as urogenital cancer in sea lions, ultraviolet rays and skin cancer, climate change and scarcity of food due to drought. Environmental change has negatively affected most biological systems on our planet and is becoming of increasing concern for the well-being and survival of many species. At an organism level, effects encompass not only endocrine disruptions, sex-ratio changes and decreased reproductive parameters, but also include teratogenic and genotoxic effects, immuno-suppression and other immune-system organisms will strive to maintain by recognizing and resolving abnormal situations.

Changhua Wu et al., (1999) discuss the China's inadequate investment in basic water supply and treatment infrastructure, have resulted in widespread water. In China today maximum people drink drinking water contaminated with levels of animal and human excreta that exceed maximum permissible by rural areas and urban areas. Study is reviewed and analyzed Chinese

reports on public and water resources to shed light on what trends imply for China's environmental risk transition. Conclusions, the critical deficits in basic water supply and sewage treatment infrastructure have increased the risk of exposure to infectious and parasitic disease and to a growing volume of industrial chemicals, heavy metals, and algal toxins. Second, the lack of coordination between environmental and public objectives, a complex and fragmented system to manage water resources, and the general treatment of water as a common property resource mean that the water quality and quantity problems observed as well as the threats identified are likely to become more severe.

Charles Daly (1959) explains indicators of air pollution from domestic and industrial sources and been calculated, using information about fuel consumption in defined built-up areas. These indices have been correlated with death rates from various respiratory and other diseases among middle-aged males. The results show a relatively close association between these measures of air pollution and bronchitis, and a relatively low association between air pollution and lung cancer. Study describes a connection between air pollution and respiratory and other causes of death, six groups of causes of death have been studied: Bronchitis, Pneumonia, Respiratory Tuberculosis, Lung Cancer, Other Respiratory Diseases, and All Non-Respiratory Diseases. So they measured the quantity of different fuels burnt annually in each town, to know the meaningful measure of the air pollution to which the inhabitants of any town have been exposed. The result shows a relatively close association between these measures of air pollution and bronchitis, and a relatively low association between air pollution and lung cancer.

Werner Pfennigstorf (1979) examines the compensation of damages caused by pollution reviews the existing sources of compensation in the United States: the common law of torts, federal and state statutes, and various forms of commercial insurance coverages. It shows industrial development and economic growth over physical comfort, and how increasing concerns about the long-term health effects of environmental pollution have created a trend in the opposite direction. There is need of proper evaluation for liability and compensation which relies on individual actions and case-by-case adjudication., is not ideally suited for everywhere. This indicates a need for a comprehensive approach that would not only coordinate the rules concerning liability and those concerning insurance and other sources of compensation but

would also make the compensation of pollution damages an integral part of a thoroughly rational and consistent environmental policy.

Bhikkhu Vivekananda (2009) the negative impact caused by factories in the Lumbini, negative impact of industrialization involving regular air sampling, and testing the quality of water, soil, health etc. is needed. It has threatened the health of the general public, and the integrity of the environment. In pursuing their manufacturing activities, these factories must live up to responsible standards of Corporate Social Responsibility to Lumbini, the surrounding population, and the environment. For years Kathmandu has had major air pollution problems caused by brick kilns and other point source polluters and it has been very difficult to reduce the air pollution. The World Heritage Site Lumbini, the Birthplace of the Buddha, deserves to be free of industrial pollution.

J.Gutberlet (1996) World industry has treated the environment in Brazil as provider of resources and as receiver for residues from production and consumption. This attitude has caused widespread environmental destruction and contamination of air, water and soil. Industry can prevent further environmental degradation by being a positive agent providing the economic basis for sustainable development. The spotlight should be production which enhances quality of life and that reduces quality of life and poverty without generating negative environmental impacts. The new paradigm of sustainable production, widely discussed as industrial ecology, offers solutions to existing problems. A shift from the linear perception of manufacturing production towards a closed systems approach is required. The challenge remains that how to promote a change of attitudes and values among the industrial sector the public, stakeholders and consumers as well as other policy and decision makers.

Radim J.Sram et al, (1996) discuss about the Teplice program investigation and assess impact of air pollution on the health of the population in the district of Teplice; due to air pollution of fine particles of the coal when it is burned or for making power are contaminated in to air and creating major health diseases among the people. These mining and industrial wastages are creating health problem among the school children and they are diagnosed with adverse respiratory symptoms and problem in lungs. It has also deeply impacted on the mothers during

their pregnancy. Exposure to high levels of air pollution is associated with temporary decrements in semen quality.

Dewaram A. Nagdeve (2004) discuss about Delhi environmental pollution with the increasing population, urbanization and industrialization, Delhi is one of the most polluted cities in the world, caused by vehicular growth and industrial pollution. In order to restore the air quality, Delhi government has taken some measures to such extent and these have helped to reduce the levels of pollution to a large extent such as for water pollution, waste water treatment plants be established in accordance with the need of time and heavy penalty be imposed on industries disposing off the wastes into the river. Landfills are to be properly managed to prevent ground water contamination. Government should make extraordinary efforts to bring about awareness among the people for a collective action to solve this problem. Only leg islation may not be able to protect the environment.

Liam Downey and Marieke Van Willigen (2005) discuss and examines whether the poor, the working class are disproportionately likely to live in environmentally hazardous neighborhoods. This literature assumes that environmental characteristics such as industrial pollution and hazardous waste are detrimental to human health, an assumption that has not been well tested. Drawing upon sociology of mental health and environmental inequality studies, we ask whether industrial activity has an impact on psychological wellbeing. We link individual level survey data with data from U.S census and the toxic release inventory and find that residential proximity to industrial activity has a negative impact of mental health. This impact is both direct and medicated by individual's perceptions of neighbour hood disorder and personal powerlessness, and the impact is greater for minorities and the poor than it is for whites and wealthier individuals. These results suggest that public health officials need to take seriously the mental health impacts of living near industries.

Jung Wk Kim (2006) discusses about the East Asian fast growing economy in recent years, and environmental stresses. Transboundary air pollution, water shortages, drinking water contamination, fresh water and marine pollution, deforestation, climatic disasters, and other environmental problems are becoming serious threats to the well-being of people in this densely populated region. The ESI (environmental sustainability index) reported by the World Economic

Forumin 2005 is a good indicator of the environmental status of the region; most East Asian countries ranked at the bottom. East Asia is not moving toward a sustainable society, and the environment will not sustain the current rate of economic development for long. The traditional culture of East Asia used to be sustainable, so we can learn much from our traditions. Land uses should be planned from an ecological point of view so as to best preserve the land's productivity and stability.

Panda and Barik (2010) discuss about Mining consequences and its effective management and public welfare, mining is an important sector that boosts the economy as it creates huge business and employment opportunities. Mining is associated with different central problems like dust, traffic, road, communication and other related problems. The mining directly affect the carrying capacity of the local area. The transportation of iron ore from mines to different locations creates dust laden and polluted the air. Due to mining severe communication problem is faced by the common people in their day to day life. This problem can be addressed by bringing effective management systems such as new advanced capital intensive techniques and development of peripheral area and plan for wellbeing of local people.

1.9 Land Pollution: Soil is the upper layer of the earth crust which is formed by weathering of rocks. Organic matter in the soil makes it suitable for living organisms. Dumping of various types of materials especially domestic and industrial wastes causes land pollution. Domestic wastes include garbages, rubbish material like glass, plastics, polythene bags, metallic cans, paper, fibres, cloth rags, containers, paints, varnishes etc. Leachates from dumping sites and sewage tanks are harmful and toxic, which pollute the soil. Polythene does not degrade and becomes brittle in due course. It affects the porosity of the soil. Industrial wastes are the effluents discharged from chemical industries, paper and pulp mills, tanneries, textile mills, steel industries, distilleries, refineries, pesticides and fertilizer industries, pharmaceutical industries, food processing industries, cement industries, thermal and nuclear power plants, mining industries etc. Thermal power plants generate a large quantity of 'Fly ash'. Huge quantities these wastes are dumped on land which cause land pollution. Pesticides are used to kill pests that damage crops. These pesticides ultimately reach the soil and persist there for a long time. Pesticides which are persistent in nature are chlorinated hydro carbon insecticides *e.g.,* DDT,

HCH, endrin, lindane, heptachlor, endosulfan etc. Residues of these pesticides in soils have long term effects especially under the temperate conditions. Industrial wastes also contain some organic and inorganic compounds that are refractory and non-biodegradable. Industrial sludge may contain various salts, toxic substances, metals like mercury, lead, cadmium, arsenic etc. Agrochemicals released with the wastes of pesticide and fertilizer factories or during agricultural practices also reach land and pollute it. Land also receives excreta from animals and humans. The sewage sludge contains many pathogenic organisms, bacteria, viruses and intestinal worms which cause pollution of the land. Sources of radioactive substances in soil are explosion of radioactive devices, radioactive wastes discharged from industries and laboratories, aerial fall-out etc. Isotopes of radium, uranium, thorium, strontium, iodine, calcium and of many other elements reach land and persist there for a longtime and keep on emitting radiations (Kaushik & Kaushik, 2010).

1.10 Summary of the reviews

Robb (1994) studied how Mining has altered the natural underground hydrological conditions. Woodley and Moore (1967) discussed and prescribe some measures to tackle pollution which is resulting from both surface and underground mining in Indiana. Moffatt and Foy (1994) explore the harmful effect of coking work of the people living nearer to it. David E. Kromm (1973) discuss about the emissions from home heating units, vehicles, and factories which causes serious hazard and people participation to change the situation. Karina Acevedo-Whitehouse and Amanda L.J. Duffus (2009) examine wildlife and other species in their biological system and other problems due to changes in environment. Changhua Wu et al., (1999) discuss China's inadequate investment in basic water supply and treatment infrastructure, Charles Daly (1959) a relationship between air pollution and respiratory and other causes of death. Werner Pfennigstorf (1979) examines the compensation of damages caused by pollution reviews the existing sources of compensation in the United States. Bhikkhu Vivekananda (2009) Bhikkhu Vivekananda (2009) the negative impact caused by factories in the Lumbini Road, Nepal and suggest factories must live up to responsible standards of Corporate Social Responsibility to Lumbini. J.Gutberlet (1996) discusses environmental pollution due to industry and suggests industries to exist with sustainable development. Radim J.Sram et al, (1996) discuss about the Teplice program investigation and assess impact of air pollution on the health of the population in the district of Teplice. Dewaram A. Nagdeve (2004) discuss about Delhi

environmental pollution due to huge population, urbanization and industries. After studying suggest people for a collective action to solve this problem. Liam Downey and Marieke Van Willigen (2005) discuss and examines whether the poor, the working class have impact on mental health due to living near industrial activity. Jung Wk Kim (2006) discusses about the East Asian fast growing economy in recent years, and environmental stresses. After studying suggest that traditional culture of East Asia used to be sustainable, so we can learn much from our traditions to improve the situation. S.R. Panda and Anil Barik (2010) discuss about Mining consequences in Odisha and its effective management and public welfare.

1.11 Significance of the study

To create awareness among people what are effects of industrialization weigh down the environment, it also explains to what extent health is affected by industrialization. So therefore government should introduce some guidelines, policies laws and programmes in order to control the pollutants from the industries so that balance should be maintained between environment, health and development.

1.12 Research objectives

Based on the reviews above, the following objectives have been formulated for the present study.

First, to find out the impact of industrial pollution on health; and

Second, to find out the impact of industrial pollution on environment

1.13 Chapterization

The chapterization of the thesis is as follows. In the first chapter introduction and literature review which consist of introduction to environment, impact of industrial pollution on health and environment, water pollution, air pollution, land pollution with its related literature review, summary of review, significance of study and research objectives. In the second chapter methodology which consist of selection of study area, sample, tools and technique, data collection and data analysis. In third chapter results and discussions which consist of demographic composition analysis, industrial pollution and its impact on health, industrial

pollution and its impact on health. In fourth chapter conclusion and future direction which consist of conclusions and limitations.

CHAPTER II

METHODOLOGY

2.1 Selection of Study Area

The present study was carried out in two different areas of Rourkela in Sundargarh district. The areas, i.e., Sheetal pada and Lauwakera have different socio economic backgrounds as well as different ecological environment. In Lauwakera, mostly Oraon and Munda tribes reside, and in Sheetal pada mostly people are Odia those who are migrated from different districts of Odisha.

RSP was established in 1950 by the first Prime Minister Pundit Jawaharlal Nehru, who believed that the industries were the temple of development. The construction of the Steel Plant required a large area but as most of the areas were inhabited by the tribals they had to be vacated from the area for the work to start. This led to the tribals being displaced and scattered to different places. Most of them took shelter in what is today known as Sheetal pada. Sheetal pada consists of a population of about five thousand people with lots of bastis and slums within the Pada like bolangir basti, sheetal pada one basti and so on. Most of the populations of the area are migrants from different parts of Odisha like Puri, Bolangir, Jajpur, Keonjhar, Birmitrapur, sundergarh etc. and even from other parts of the country such as Bihar, Jharkhand, and Chhattisgarh etc. The rest others are of tribal origin. The maximum people living in Sheetal pada area are poor and have low standard of living due to illiteracy. Most of the people have kuchha houses and semi pucca houses. A very small number of people have semi standard house and that can be easily counted on fingers. Majority of the people in the area are daily wage laborers whereas some earn their living through small business, working as drivers, from small private jobs, and some are even truck owners but they are very few in numbers. People who work as daily wage laborers come from adjoining villages named hattibadi, bagbudi, kalunga etc. The reason of their coming to Sheetal pada is to search for work on daily wage basis which is cheaply and readily available through RSP. RSP disposes ash near Sheetal pada area in huge quantity which contains small bits of iron. The Sponge Iron Companies in the nearby area give tender to some persons to find and collect small iron bits from the dump which can be utilized by the petty companies for their production process. The tenderers or the people who have got the tender

engage people from Sheetal pada area on daily wage basis for the purpose. The daily wage is set as Rs. 120 or Rs. 150 according to the requirement which tempts the people of or from around Sheetal pada. After that the work is to collect the needful things out of the ash which is done in ground level by the people who are working as daily labor and living near Sheetal pada area and also coming from outside localities, they earn a wage of Rs 120 and sometimes Rs 150 as per the suitability. The collected iron is then delivered to the adjoining Sponge Iron Companies and others for the production of TMT iron bars, iron products, road construction materials etc. The issue presented here is that on the one hand the companies provide livelihood to the poor living in the area and on the other hand creating threat to the health of those people whom they give a means of living. Moreover, this has also posed a threat to the environment. The Sheetal pada area being in the periphery of the RSP town ship is vulnerable from all sides. On one side it receives the harmful gases like sulphur dioxide and nitrogen oxide emitted by the RSP and on the other side gets the waste water with harmful chemicals drained into the place by the plant. Besides the ash dump yard invites the dumpers and trucks on regular basis for either dumping or for lifting bits of iron sifted form the yard making the place polluted and dangerous for not only human habitation but also for other living creatures and habitats. It has resulted in water pollution, land contamination, noise pollution, air pollution which has become absolutely unhygienic a place for the poor to live in.

If we go for a comparative study between the Sheetal pada an industrial area and Lauwakwera village a non industrial area we can conclude that the non-industrial area is far better than the industrial one. Lauwakwera village is a place where more than 90% population is native of that village. Most of the houses there are kuccha houses and semi pucca houses, and most of the people are either Christian or Hindu. The maximum population of the area would be 3000 people approximately. It is a village where there is no steel or iron factory and is away from the touches of the industry i.e. with no dumping yards of waste matter either of smoke, ash or of water. People there are engaged in agriculture work, civil construction work, private jobs etc. The village is full of natural resources. It has a river which provides surplus of water to the village and even provides for fishing activities. The river bed provides ample of sand for civil activities and its bank is fertile enough for the farmers for cultivation of food products sufficient for villagers. It also has a huge forest reserve with plenty of trees and green grasses which is the

source of forest products like fruits, vegetables, grass for the domestic animals, wood for fuel, and free fresh oxygen resource. The village is full of greenery and is away from any kind of pollution.

In short we can conclude that the Lauwakera village (i.e. the control area) has fewer reasons to be polluted and is full of natural resources such as forest, mountains full of trees, river, green fields and open space within its boundaries. But in Sheetal pada (the experiment area) it is just the opposite where there are many reasons for pollution: by the steel plant and its waste dumping activities and the pollution made by the loading and unloading activities carried on by the dumpers and trucks.

2.2 Sample

A purposive sample from two areas having 126 households altogether were included in the study out of which there were 84 households in the experimental area (industrial area i.e., Sheetal- pada) and 42 households in the control area (non-industrial area i.e., Lauwakera). The participants of experimental area were326 in number out of which 165 were males and 161 were females. The average ages of the male participants were 25.79 years and of the female participants were 26.72 years. In the control area, the total numbers of participants were 182, out of which there were 93 males and 89 females. The average age of the male participants were 28.60 years and of the female participants were 26.66 years.

2.3 Tools and Technique

Based on the review of literature and expert consultation a semi-structured questionnaire was designed for the present study. The same instrument was pilot-tested prior to the finalization of the items. Initially there were 39 items in the questionnaire. After the pilot testing 12 items were dropped because of incoherent response from the participants. The final questionnaire was prepared with 27 items which is given in the appendix. Prior to collection of data the people of the area were contacted for an informal talk with the researcher. After establishing a good rapport with the locals, the formal interview process started. The semi-structured questionnaire captured both the qualitative and quantitative information regarding the participant's environment and health status. The questionnaire also included demographic information like age, sex, caste, religion, occupation, income, etc. Other issues that were addressed in the

questionnaire include migration, source of water and its purification, toilet facilities, health status, treatment facilities, and coking sources etc.

2.4 Data Collection

The present study was based on primary data, collected from each household, relating to various parameters of health status and environment, through well designed and structured questionnaire and interviews.

2.5 Data Analysis

The data were analyzed both quantitatively and qualitatively. Percentages were calculated for various questions and graphical reports were prepared. Interview data were also analyzed qualitatively and incorporated along with quantitative reports.

CHAPTER III
RESULTS AND DISCUSSION

The results of the present study are based on the information obtained by taking help of questionnaire, focus group discussion and observation, from two different areas, one is control area which is a non-industrial area, and another is experimental area which is an industrial area. Results reveled that the two different areas are having different health and environmental problems.

3.1 Demographic Composition Analysis

The tables give information regarding age-structure, religion, caste, income of family, occupation, migration and BPL card holder families,

AGE CATEGORY	EXPERIMENTAL GROUP	CONTROL GROUP
1-15 Years	102 (31%)	42 (23%)
16-30 Years	116 (36%)	76 (42%)
31-45 Years	66 (20%)	37 (20%)
46 and above Years	42 (13%)	27 (15%)
TOTAL	326	182

Table -3.1 Table showing the age category in both the groups

Table 3.1 represents age-distribution of the participants in experimental and control areas the percentage of men and women in the young, adult and old age are given in the table. In both experimental and control groups the young population is higher than any other age group followed by children and middle age people. People above 46 years constitute the least i.e. 13% in experimental group and 15% in control group suggesting a lower longevity of the people residing in those areas.

SEX CATEGORY	EXPERIMENTAL GROUP	CONTROL GROUP
MALE	165 (51%)	93 (51%)
FEMALE	161 (49%)	89 (49%)
BOTH	326	182

Table-3.2 Table showing the sex category in both the groups

From the table 3.2, So far as the distribution of males and female participants of the study is concerned, an equal percentage of males and females have participated in the study from both experimental and control areas.

RELIGION	EXPERIMENTAL GROUP	CONTROL GROUP
CHRISTIAN	82 (25%)	63 (35%)
HINDU	244 (75%)	119 (65%)
BOTH	326	182

Table-3.3 Table showing different religious affiliation of people

From the table 3.3, it is clear that Hindus outnumber Christians in both experimental and control area.

CASTE CATEGORY	EXPERIMENTAL GROUP	CONTROL GROUP
SC	85 (26%)	60 (33%)
ST	165 (50%)	115 (63%)
UR	64 (20%)	7 (4%)
OBC	12 (4%)	0 (0%)
TOTAL	326	182

Table-3.4 Table showing caste distribution of people residing in both the groups

From the table 3.4, it is evident that scheduled tribes dominate other castes. Scheduled caste comes to be the second where as unreserved and other backward castes com as third and fourth dominant groups. This finding is true for both experimental and control groups.

OCCUPATION	EXPERIMENTAL GROUP	CONTROL GROUP
DAILY WAGE LABOUR	89 (80%)	33 (62%)
RATION SHOP	1 (1%)	4 (7%)
FARMER	1 (1%)	4 (7%)
PETROL PUMP WORKER	0	4 (8%)
ANGANWADI WORKER	1 (1%)	3 (6%)
PRIVATE JOB	10 (9)%	1(2%)
BANK EMPLOYEE	0	1 (2%)
SAIL EMPLOYEE	0	3 (6%)
FAST FOOD STALL	2 (2%)	0
BUSINESS	1 (1%)	0
DRIVER	5 (4%)	0
TAILOR MASTER	1 (1%)	0

Table-3.5 Table showing occupation in both the groups

Table 3.5 shows the Occupation of the people in both experimental area and control area shows that maximum people are daily-wage laborers, followed by more number of people in private jobs in the experimental group only. In experimental group, 80% people are daily wage labor, 1% is people having grocery shop, 1% is farmer, 1% anganwadi worker, 9% is having private job, 2% is having fast food stall, 1% is doing business, 4% people is driver and 1% people is cloth tailor. In the control group 62 % people are daily wage labor, 6% people are is sail employee, 2% people is bank employee, 2% people is doing private job, 6% people are working in anganwadi,8% people is working as a petrol pump worker, 7% people is farmer and rest 7% having small grocery shop.

FAMILY INCOME	EXPERIEMNTAL GROUP	CONTROL GROUP
Rs 0.00-1000	1 (1%)	0
RS 1001-5000	42 (50%)	28 (67%)
RS 5001-10000	32 (38%)	10 (24%)
RS 10001-15000	4 (5%)	1 (2%)
RS 15001-20000	4 (5%)	3 (7%)
RS 20001-25000	0	0
Rs 25001 and above	1 (1%)	0
Total family	84	42

Table-3.6 Table showing income distribution of families

Table 3.6 represents income distribution of the families in experimental and control areas. Most people in both areas earn somewhere between Rs. 1000 to Rs. 10000. However, percentage of people in the experimental area who earn within 1001 to 5000 is less than the people in the control area. But, the number is reversed, once it comes to Rs.5001 -10000, where percentage of people in experimental area is more than the people in the control area. In experimental group table, 50% of family income is Rs 1001-5000, 38% family income is Rs.5001 -10000, 5% family income Rs 10001-15000 ,0% of family income is Rs 20001- 25000, 5% of family income is Rs 15001-20000 and 1% family income is within Rs1000 and 1% family income is above Rs 25000. In control group table, 67% family having income of Rs 1001-5000, 24% of family having income of Rs, 5001-10000, 2% family having income of Rs 10001-15000, 7% of family having income of Rs 15001-20000.

BPL CARD HOLDER	EXPERIMENTAL GROUP	CONTROL GROUP
HAVING	Do not have BPL card.	31 (74%)
NOT HAVING	Do not have BPL card.	11 (26%)

Table-3.7 Table showing the number of household having BPL cards

Table 3.7 represents that, in control group table 74% of people have BPL card and rest 26% do not have it, and in case of experimental group no one have BPL card.

PEOPLE CAME FROM DIFFERENT PALCES IN SEARCH OF EMPLOYMENT TO BOTH THE AREAS.	EXPERIMENTAL AREA	CONTROL AREA
ANCESTORS	56	100
CHHATIGARH	2	
BIHAR	1	
KOIDA	1	
KENDRAPADA	1	
BOLANGIR	1	
SUNDERGARH	1	
SIMDEGA	1	
PURI	3	
PATNA	1	
BARHAMPUR	3	
KUTRA	2	
SUBDEGA	1	
BIRMITRAPUR	2	
JHARKHAND	7	

Table-3.8 Table showing the Migration to Rourkela

Table 3.8 In experimental group, people came from different districts of Odisha and also from other states in search of livelihood, due to increase in population and due to addition of different people from different places can be the cause of different new diseases which they bring with them and also the population of the area rises. In the control group, all people are local who have been staying for generation in those areas.

3.2 Industrial Pollution and its Impact on Environment

For normal and healthy living a favorable environment is required by all living beings, including humans, livestock, plants, micro-organisms and the wildlife. The favourable unpolluted environment has a specific composition. When this composition gets changed by addition of harmful substances, the environment is called polluted environment and the substances polluting it are called pollutants. Environmental pollution can, therefore, be defined as any undesirable change in the physical, chemical or biological characteristics of any component of the environment (air, water, soil), which can cause harmful effects on various forms of life or property (Velan, 2011).

Serial no		DISCRIPTION	EXPERIMENT AREA		CONTROL AREA
1.		Name of the area.	Sheetal pada area		Lauwakera village
2.		Type of area.	Industrial area		Non industrial area
3.		Distance from the steel industry.	Approx 1 kilometers near to Rourkela steel plant		Approx 10 kilometers near to Rourkela steel plant
4.		Population of the area.	Population approx 5,000 people.		Population approx 2,000 people
5.		Solid waste material disposal by RSP to the area.	Ash is disposed by RSP, approximate 500 meters from people residence.		No waste material is disposed.
6.		Drainage of waste water RSP to the area.	Waste water drain in between the area which is very near to people residence.		No waste water drainage in the village.
7.		Vehicle emission due to which air pollution get more exceed.	Four wheeler vehicles such as truck and dumper are frequently running in that area because of loading and loading of ash dumping.		Very less number of vehicles, that to mostly two wheelers and three wheelers only.
8.		Natural resources in the area which help to decrease the impact of pollution.	River is more than approx 12 to 15 km from Sheetal pada. No forest nearer to the area.		A huge forest area near to the area approx 2km.

Table-3.9, Table showing the differences of environment between experimental and control area.

The above table on the distinctive features of experimental and control area report the type of area, distance from the industries, population, solid waste management system, drainage system, vehicular emission and availability of natural resources in both areas. The data clearly shows that the experimental area is more prone to pollution as a result of which people living in Sheetal pada suffer more from diseases like TB, gastric and joint pains than people from Lauwakera area.

3.3 Industrial Pollution and its Impact on Health

Bar diagrams showing the results for health status of the people staying in both the areas

Precautions and treatment taken by people to keep themselves healthy

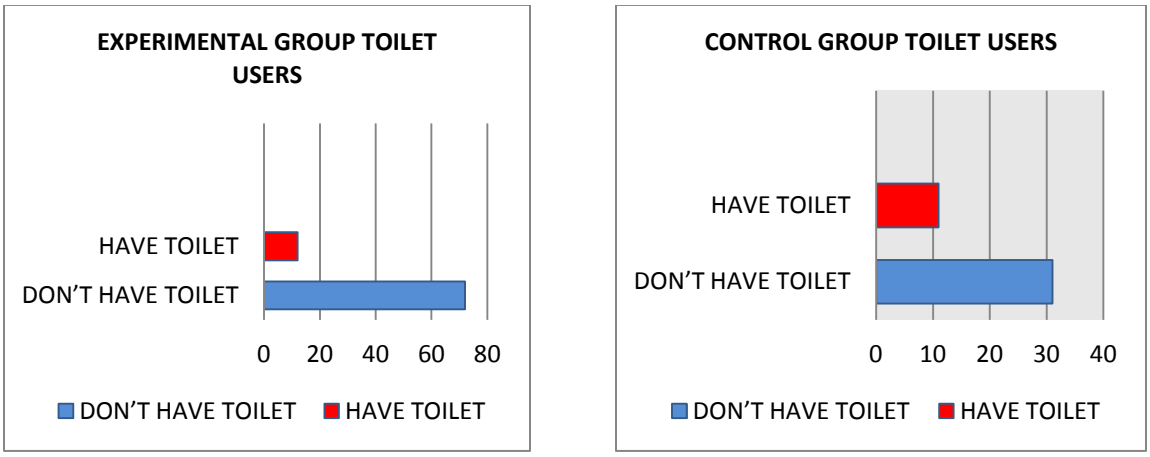

Figure -3.1 Bar diagram showing the families having toilet in their house.

Bar graph 3.1 represents that in both the groups' maximum households are not having toilet facilities. In experimental group- 86% people do not have toilet facility in their house, and rest 14% people have it. In control group-74% people do not have toilet facility in their house, and rest 26% have.

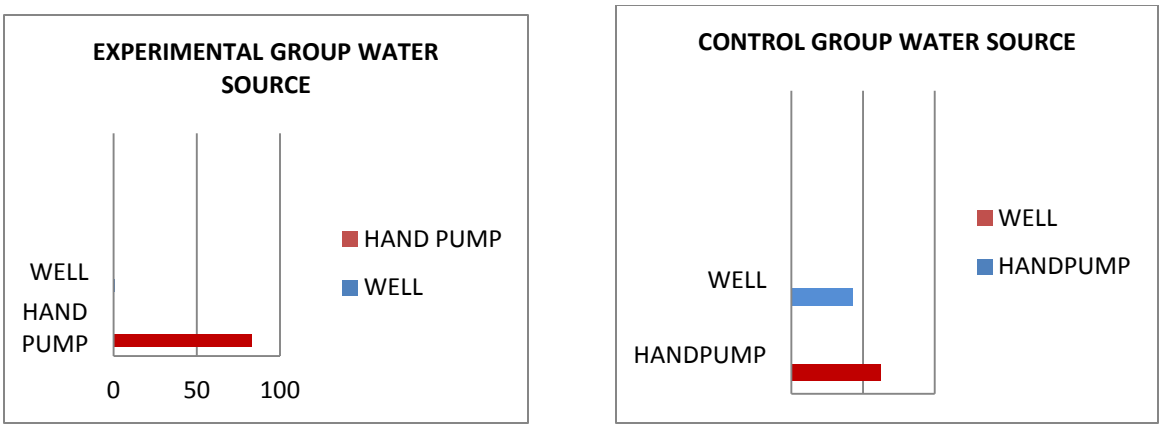

Figure-3.2 Bar diagram showing the people having different sources of water

Bar graph 3.2 represents that in both the groups maximum people are using water from hand pump. In experimental group, 99% people use hand pump, and rest 1% use well, for source of water. In Control group, 60% people use hand pump, and 40% people use well, for source of water.

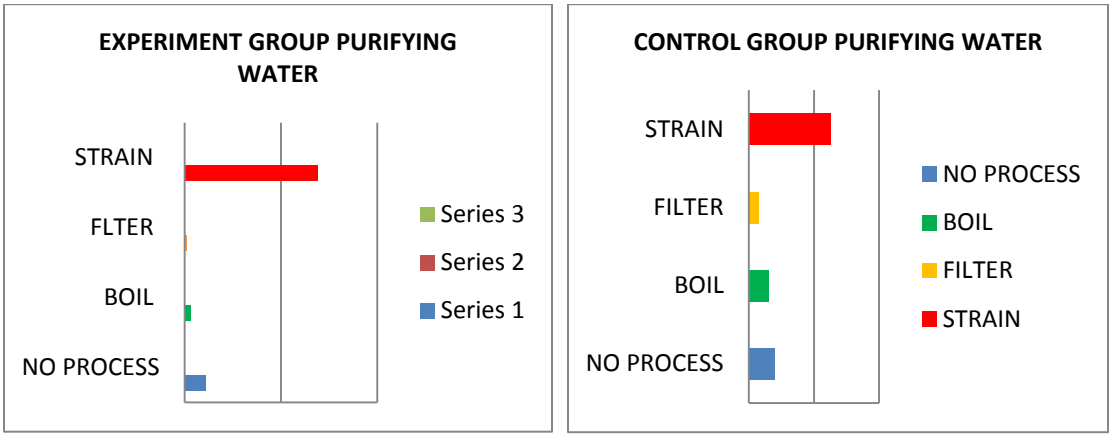

Figure-3.3 Bar diagram showing the people using different methods to purify the water

Bar graph 3.3 represents that in both the areas maximum people use to strain the water before drinking, In experimental group, 82% people strain the water, 1% people they filter the water, 4% people they boil the water, 13% people they do not use any purify in process. In control group, 60% people strain the water, 7% people they filter the water, 14% people they boil the water, 19% people they do not use any purifying process.

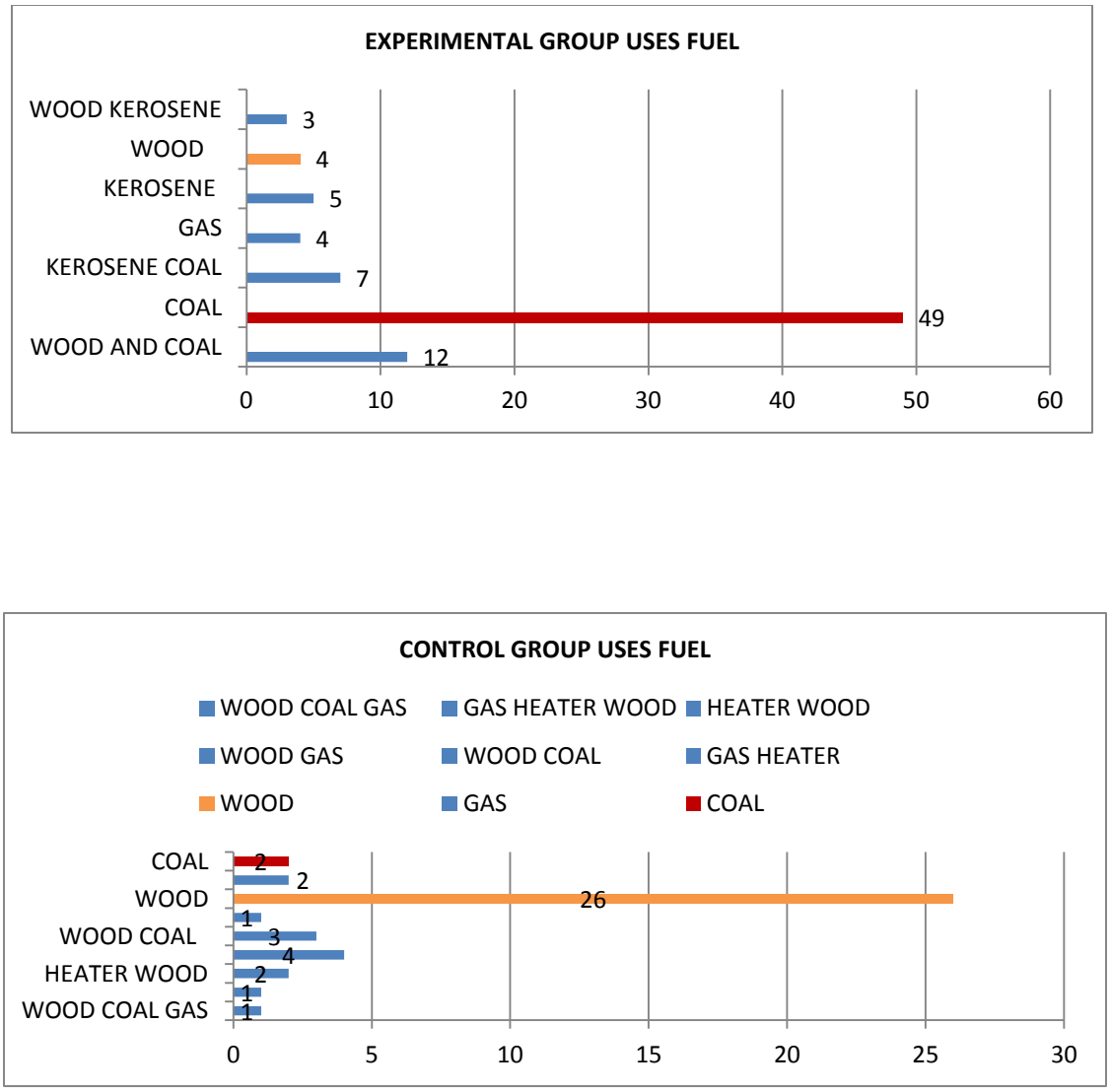

Figure 3.4 Bar diagram showing the types of fuel used by people

Bar graph 3.4 represents that in control group maximum people use wood but in experimental area maximum people use coal. Experimental group- wood and coal-14%, wood and kerosene-4%, coal -58%, wood-55, gas-5%, kerosene-6%, kerosene and coal-8%. Control group- Gas and heater-2%, wood and coal-7%, wood and gas-10%, heater and wood-5%, gas, heater and wood-2%, wood, coal and gas-2%, coal-5%, gas-5%, wood-62%.

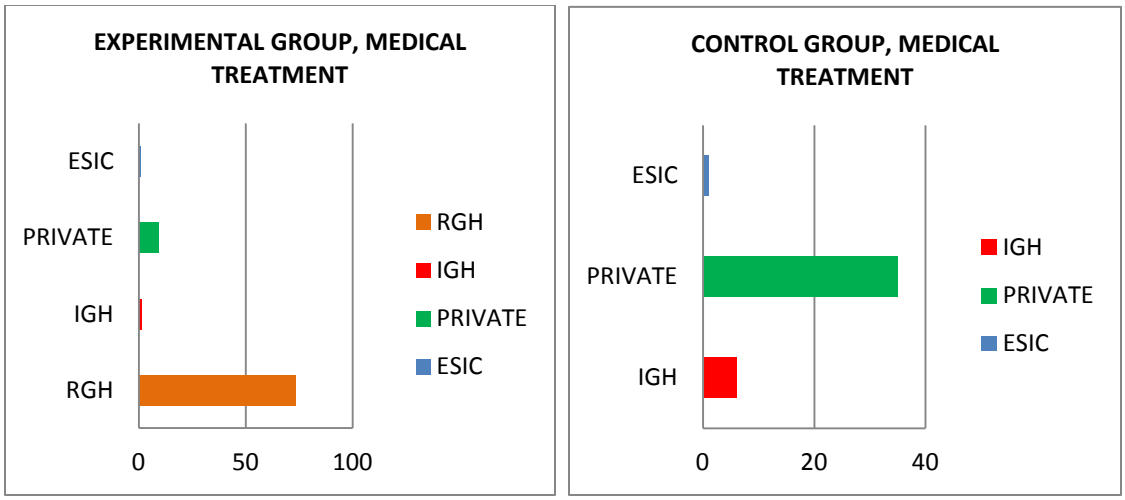

Figure 3.5 Bar diagram showing the people opt for medical treatment facility

Bar graph 3.5 represents that in experimental group mostly people opt (RGH) Rourkela Government Hospital for their treatment and control group they opt private medical treatment In experimental group maximum people go for medical treatment to (RGH) Rourkela Government Hospital. In control group maximum people go for medical treatment to the private clinic and hospitals. In experimental group- 1% people go to IGH, 11% to private, 1% to ESIC and 87% to RGH. In control group- 14% people go to IGH, 83% people go to private, and 3% people go to ESIC.

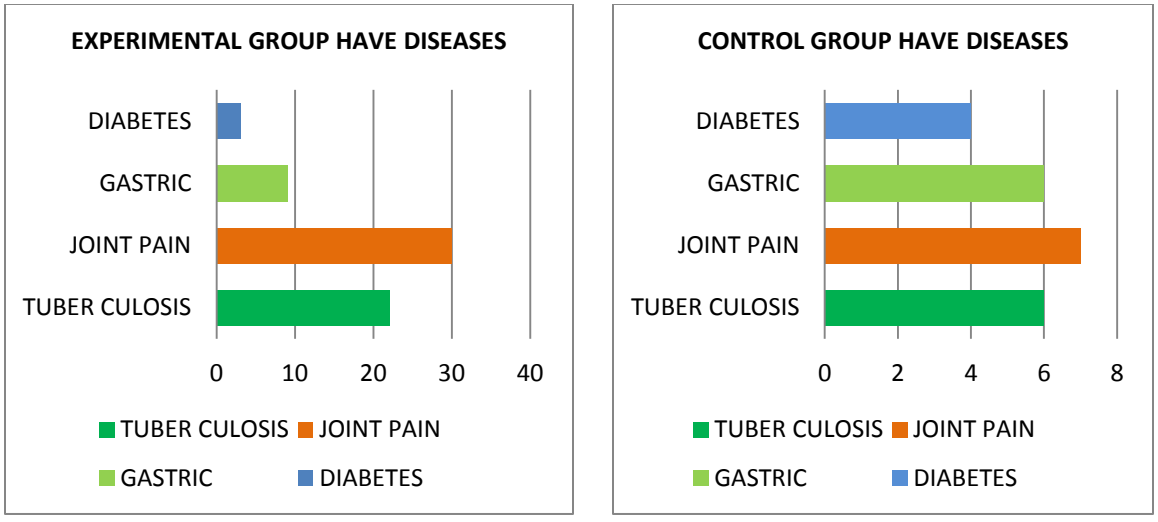

Figure 3.6, showing the people having different diseases.

Bar graph 3.6 represents that in experimental group number of Tuber culosis patient are more as compare to the control group. In experiment group 34% people have tuberculosis, 5% people have diabetes, 14% people have gastric and 47% people have joint pain. In control group-26% people have tuberculosis, 17% people have diabetes, 26% people have gastric and 31% people have gastric.

The health status of people is one of the objective in present study, I also went to the Rourkela Government Hospital, because in experiment group which is an industrial area 87% people go for treatment in RGH. I went to (RNTCP) Revised National TB Control Programme in RGH, where when I make conversation to the lab technician who are doing diagnosis, they told me that here if 5 persons comes for Diagnosis for TB out that 5 persons one will be from Sheetal pada, as because the reasons are it has observed during a research that if a person have TB can give TB to more 15 people due to spreading infection. Here in case of Sheetal pada experimental group they are living in congested type of houses, having addiction towards tobacco, smoking and alcohol, not eating hygienic food, polluted and dusty area, and if one is having TB the person is not using the mask so due to which other family member also get infected and the rate of TB increases.

CHAPTER-IV

CONCLUSION

4.1 In experimental group and control group the maximum people are of young age, and in both the groups male female population is near about the same. In both the groups, maximum population is Hindu, and they come under scheduled tribe. In both the groups maximum people are daily wage laborers', and their maximum household income is under Rs 5000. In experimental group most of the people have come from different districts of Odisha in search of livelihood but in control group the whole population is the real native of the area. In experimental and control group maximum people don't have toilet in their houses, and they use hand pump for water source. In both the groups maximum people strain the water to make it suitable for drinking. In experimental group maximum people use coal for cooking food whereas in control group maximum people use wood for cooking food. In experimental group most of the people go for medical treatment to (RGH) Rourkela Government Hospital but in control group maximum people go for medical treatment to private clinics and hospitals.

In both the groups I found many types of diseases but some of the common diseases which I have compared are: in the experimental group more number of people suffers from joint pain as compared to people of the control group. In experimental group tuberculosis patient are more as than in the control group. In experimental group gastric patients are found more in number more as compare to the control group. Moreover in the control group people are more diabetic than the ones in the control group.

In this present study, I found that people living near the industrial dump yard area are highly affected with diseases like TB, Gastric, and Joint pain etc. It is not clear and proved that the air pollution and water pollution in the experimental area are the direct reasons for those diseases. But it is a fact that people who are living there are exposed to pollution that can cause the chronic diseases as referred to earlier that can make them ill severely. Environment means the surroundings, and in the experimental area the surroundings are very unhealthy for human existence. The ongoing ash dumping activity has blanketed the peripheral area with small dust particles that disturbs and makes people sick and to lead an unpleasant life. Both the dumping as well as the transport activity pollutes the atmospheric layer making the residents more vulnerable

to respiratory problems. The residents of the area come into direct contact of the waste water drainage system making them open to infectious diseases especially skin disease. They also give rise to environmental problems such as land degradation, water contamination etc. The Steel plant being very close to the experimental area emits carbon dioxide, sulphur dioxide and nitrogen oxides which are harmful for health and which are the direct reasons for respiratory problems and to environmental problems such as air pollution. Observing the distinctive features of the experimental and the control area like its type, distance from the industries, population, solid waste management system, drainage system, vehicular emission and availability of natural resources in both areas it can be clearly concluded that the experimental area is more prone to pollution as a result of which people living in Sheetal Pada suffer more from diseases like TB, gastric and joint pains than people from Lauwakera area.

Therefore effective environmental management programmes and activities must be implemented in those polluted areas if we desire to make valuable changes and improve the present situation. As for suggestions, we can go for changes in improvement in the capital intensive techniques, use of green technology, adaptation of proper waste management, emphasize on combination of labor intensive technique and capital intensive technique, aforestation, use of pollution control equipments such as (ESP) Electro-State Precipitators, bag houses and ventury scrubbers.

Limitations of the Present Study

The present study is an indicative of the findings discussed above. A more rigorous sampling as well as choice of control area could yield a much better result. An increased sample size with more demographic variables would do justice to future studies. A long term study in this area may provide some vital information regarding the long-term effects of environment and health. Health, being a broad concept could not be addressed adequately in the present study. Information gathered from the areas should happen at a regular interval in order to control biasness in data and overgeneralization of the findings.

Conclusions

Though the present study is having some limitations discussed above, this is an eye-opener for both public and the industries on the long term effects of industrialization on environment and health. Prior to setting up an industry, the welfare of the environment and people surrounding the industry should be carefully studied. Awareness camps regarding protection of environment and a healthy living should happen regularly in industrial belts, so as to prevent and detect something unusual ahead of time. Industrialization is essential for development, but should not happen at the cost of environment and health.

REFERENCES

Acevedo, K. (2009). Effects of Environmental Change on Wildlife Health, *Philosophical Transactions Biological Sciences.*,364, pp. 3429-3438

Bhopal R S. (1998). Does living near constellation of chemical, steel, and other industries impair health, *occupational and environmental medicine*., 55, pp. 812-822

Daly C. *(1959).* Air Pollution and Causes of Death, *British Journal of Preventive and Social Medicine., 13, pp. 14-27*

Downey L. ,(2005).Environmental Stressors: The Mental Health Impacts of Living near Industrial Activity, *Journal of Health and Social Behavior*., 46, pp. 289-305

Gutberlet, J. (1996). Encyclopedia of life support systems,The Impacts of Industrial Development in Brazil, Department of Geography, University of Victoria, Canada, PP.1-9

Kaushik A, Kaushik C P.(2010).*Basics of environment and ecology*. New Age International Publishers

Kim J W. (2006).The environmental impact of industrialization in East Asia and strategies toward sustainable development, *Integrated Research System for Sustainability Science and Springer*.,1, pp.107-114

Kromm E D. (1973). Response to Air Pollution in Ljubljana, Yugoslavia, *Annals of the Association of American Geographers.*,63, pp. 208-217

Maurer C et al, 1999. Water Pollution and Human Health in China, *Environmental Health Perspectives.*, 107, pp. 251-256

Nagdeve, A N. (2004) Environmental Pollution and Control: A Case Study of Delhi Mega, *Springer Population and Environment*., 25, pp. 461-473

Pfennigstorf W. (1979). Environment, Damages, and Compensation, *American Bar Foundation Research Journal*, *4*, pp. 347,349-448

Pandey P R. (2008). Negative Impact of Industrialization along Lumbini Road, Nepal, *bulletin of the Department of Geology*., 11, pp. 71-78

Robb A G. (1994) Environmental Consequences of Coal Mine Closure, *The Geographical Journal*., 160,: pp. 33-40

Rahim J et al. (1996).Teplice Program: The Impact of Air Pollution on Human Health, *Environmental Health Perspectives.,* 104, pp.699-714

Singh R, Das A, Banerjee, P.K, Bhattacharyya, K.K. &. Goswami, N.G (2010) Proceedings of the XI International Seminar on Mineral Processing Technology (MPT-2010) NML Jamshedpur, pp. 1147–1156 dec-17

Woodley R A. (1967). Pollution Control in Mining and Processing of Indiana Coal. *Journal Water Pollution Control Federation., 39,* pp.41-49

APPENDIX

Photographic representation of industrial pollution, Photograph by author, 14th april 2013.

Photograph- 1

Photographic representation of industrial pollution, Photograph by author, 14th april 2013.

Photograph-2

Photographic representation of industrial pollution, Photograph by author, 14th april 2013.

Photograph-3

Water pollution by industries in Sheetal pada area, Photograph by author, 14th april 2013.

Photograph-4

QUESTIONNAIRE

IMPACT OF INDUSTRIAL POLLUTION ON HEALTH AND ENVIRONMENT: A Study of Urban Slums in Rourkela

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DEMOGRAPHIC PROFILE

1. Family no: _____

2. Name of the respondent: _____

3. Head of the family: _____

4. Sex:

Male		female	

5. Age: _____

6. Religion _____

7. Caste _____

8. Education _____

9. Occupation _____

10. Income p.m: _____

11. IRDP: Yes [ ] No [ ]

12. Basti name: _____

13. Landmark:

14. Village: _____

15. Whether migrants (If yes) then from where: Yes [ ] No [ ] _____

16. No of habitation year: _____

17. Source of drinking water: (specify here) _____

18. What do you usually do to the water to make it safer to drink?
    - *BOIL*
    - *ADD BLEACH/CHLORINE TABLETS*
    - *STRAIN THROUGH A CLOTH*
    - *USE WATER FILTER (CERAMIC/SAND/COMPOSITE/ETC.)*

19. What kind of toilet facility do members of your household usually use? (Specify here) _____

20. Do you share it with others: _____

21. How many no of household uses it: _____

22. When members of your household get sick, where do they generally go for treatment? (Specify here) _____

23. Source of cooking food: (specify here) _____

24. Health status profile of the members in a family

Sl no	Name	Relation	Sex	Age	Income p/m	Disease detected	From how many days/month /year
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

25. Any health check-up facility by Government: Yes [ ] No [ ]

(If yes then give a tick mark) Monthly [ ] Quarterly [ ] Half yearly [ ] Yearly [ ]

26.Any health check-up facility by RSP/NGOs: Yes [ ] No [ ]

(If yes then give a tick mark) Monthly [ ] Quarterly [ ] Half yearly [ ] Yearly

27. Any suggestion to improve the situation:_____