

An Environmental Based Education: A Review

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ABSTRACT: *This paper focuses on the role of education in the protection of environment along with the development in prevention system by the modern education system in field of engineering, science, technology and others. It provides an overview about with main emphasis on safety aspect during teaching in different courses of various streams with practical impact. Under these kind of education system, the motto is to make students aware with the issues mainly concern to various environmental challenges with particular emphasis on soil, air and water pollution into their curriculum which if happens in reality, may exert much worse effect on the environment. Thus this education pattern creates a special force to tackle with real life situations as natural or human made disasters, and these courses also advocate the green technology. The environmental engineers create solutions to environmental challenges by applying biology, engineering, architecture, soil science along with the chemistry concepts. Many renowned world universities has initiated different courses to educate about these constantly rising pollution generated alarming situation. And this paper also discuss about the teaching pattern which should be corporate in various academic courses to create such specialized task force.*

KEYWORDS: Air, Engineers, Environmental, Management, Oil, Pollution, Technology, Waste, Water.

1. INTRODUCTION

In the today's world where the development of technology has eased up the human life on one hand, the human made pollution or overexploitation of natural resources have severely impacted the whole ecosystem. But in this era of economic development, neither the growth rate nor the natural resources can be totally compromised at the expense of other, which demands a balanced growth along with the harmony with nature. If we focus on the dark side of developments, it is apparent that the economic growth we are achieving is based on severe exploitation of natural resources and many of them are on the verge of exhaustion. Other deadly effects are the production of many harmful gases, toxic chemicals, hazardous materials and deadly things around us. In the near past, there has been debate about the origin of Covid-19 induced pandemic which is a mystery where no one is yet confirmed whether it's a natural mutant or a fatal outcome of any invention [1]. This balance could be achieved with help of green technology oriented education system. Green technology refers to any technology which aims to reduce the human effect over environment. It provides solution which by using less resources with integration of renewable resources [2].

It is essential that knowledge should grow in the direction which can tackle these problems. It is also required that the young generation should pay attention to these problems and come up with the solutions on the basis of their studies. To achieve these objects, many world universities have incorporated Green technology in their curriculum and now ready to make students as environmental engineers who have special knowledge to recognize the types of problems and probable solutions. They are able to recognize the causes of water, air and land related emissions and also understand how pollution harms the atmosphere. They also work "on the work field" along with their classroom knowledge and collaborate with health and safety facilitators to monitor the changes and design the programs as solution. Thus, Environmental Engineer's work in proactive manner rather than reactive, which means that they attempt to predict, forecast the future challenges with help of technology and also struggle in the direction of development of the existing technology.

They also mount the protection equipment at the site for repairing and maintenance [3]. This job requires them to work in precognitive manner to manage the societal issues like waste water treatment, elimination of industrial emission, recycling and waste management, to construct self-sufficient building, generation of energy from waves, solar energy harnessing, waste to energy conversion, designing of new equipment's/vehicle with least gas emission in proactive manner. Because of the scope of their work, environmental engineers work in a number of environments. Environmental engineer's works is collaborated in many fields who design and develop regional, urban or countryside planning. They are required to be at the construction sites to examine that the work is going on, in energy efficient manner. A bachelor degree in chemical, mechanical, civil or general is required to work as environmental engineer. Industrialists and employers also seek for these practical skills to reduce their carbon footprint which may impose a huge

compensation to them as their corporate social responsibility (CSR) [4]. As a result, these cooperative engineering programs that give college credit with organized work experience are very useful and advantageous.

2. LITERATURE REVIEW

The majority of environmental injuries or significant manufacturing mistakes occurs because of the absence of requisite information or absence of the competence measure at the right time and in the right place. Now, the industries are required to work as green technology unit with absolute liability to ensure the safety measures which is critical to achieve. It's very critical to manage the societal issue, secure economic growth, along with the sustainable development with minimum exhaustion of the environment along with improvement in this competency.

In view of above, the role of engineers are critical for environmental protection. As they are the technologist who can define methods to protect our environment by, keeping our water clean, explore new ways for reusing the waste water bottles, freshwater management, surface and groundwater flow, soil fertility enhancement and maintenance, control air pollution, proper waste disposal, sewage treatment, e-waste management and others. Engineers clearly make a significant contribution to our health and safety. Environmental engineering students specifically learn about factors which influence the water quality and study about different conditions which impact the animals, plants of that habitat or the thrive of other species. There specialized knowledge help them to determine the groundwater situation and enable the environmental engineers for using groundwater to predict the surface emission distribution, natural habitat of aquifers, direction of groundwater flows, examination of drinking water from different sources as groundwater versus surface water. They look at future situations of drinking water pollution and how pollutants can damage species that come into contact with them.

Electronic waste (E-waste) assessment and proper recycling or disposal has gained much attention in the present time. It requires a strategic planning to achieve a sustainable growth as electronic pollution has emerged as serious environmental issue because of dynamics of electronic consumption. E waste management is required for everyone, from the governments to the end users. Its crucial challenge to let the universe free from electronic waste by taking into account the three pillars of sustainability as environment, fiscal growth along with social sustainability.

In order to achieve a positive effect over the environment, academic institutions have come into play by encouraging the education system oriented towards the implementation of sustainable growth policies. Solid waste is most noticeable, concrete sign of human made waste by consumption. Universities in Canada, have make a good start with campus sustainability projects. These universities project work outlines a campus waste characterization based research projects especially designed to identify prospective for improving the waste disposal, its recycling, producing compost out of the waste while improving viability of a waste management program at a remote locations, geographically isolated areas in western Canada [5].

Many higher education institutions have recognized their special role and commitment in fostering an environmentally friendly world. This realization has resulted in several administrative commitments to reduce the environmental effects of campus organizational, teaching, and research practices. In the Prince George campus under the University of Northern British Columbia, a full flagged course has been incorporated in the higher education for the sustainability and solid waste management which inquiries into the composition and management of solid waste. In year 2008, a technique was developed for waste characterization to determine the generation of solid waste and its composition in different sites throughout the campus for two times each five day observation project. These findings include the observations, benchmarking the evidence to focus on particular materials, areas with highest potential in reducing the waste and diversion. This study suggested to university administration for improving the effectiveness, quality of waste management processes in the campus and also come forward as more sustainable academic institution [6].

Likewise, Cranfield University runs M.Sc program in Water and Wastewater engineering to make real impact for delivering reliable water sources by enhancing and maintaining ground and river water quality. This MSc program provides skillful solution for the practical problems by appointing technologists, treatment scientists and engineers to communicate effectively for successful work which makes experts highly sought by the relevant industries and government organizations[7].

Respiration signifies the life and air pollution damages the quality of life by affecting plant growth, human health, wildlife and whole ecosystem. Every year, air pollution costs 1.6 trillion Dollar to European Union economy and causes 7 million premature death worldwide. To address these issues, the Birmingham University offers Master of Science in Air Pollution Management and Control which is designed to provide a comprehensive understanding for the effects and causes of air pollution. It also teaches about existing technologies and management resources for controlling air pollution. The Birmingham Institute of Forest Research has also initiated an investigation about the effects of high carbon dioxide (CO₂) environment on the forest ecosystems [8].

University of Southampton is also working on the same page and provides a Master's degree in Environmental Pollution Control to provide excellent training in water, air and waste pollution management to educate about the importance of environmental concepts, technology for pollution redressal, other socio economic/legal obligations [9]. In the same line, University of Manchester has also started to educate about the Pollution and Environmental Control.

Through these innovative teaching methods which blends the theory with practical application, Institutions are developing advanced understanding about the causes and remedies for the pollution controlling system which enable to work for treatment and management in all the areas and provide a valuable contribution to the country with global footprint.

3. DISCUSSION

3.1 Calamity caused by oil spillage and effective cleanup technologies:

Balancing all the environmental factors with help of technology is the main task of environmental engineers, they work to maintain the sanitation of ecosystem through proper investigation. Oil spillage is a kind of man made calamity which affects eater ecosystem severely. One such extensively documented incident which always make its place in the curriculum of environmental engineers is about Exxon Valdez oil spillage, a historical environmental disaster caused by human. In March 1989, an oil tanker dumped 10.8 million gallons of crude oil in South coast of U.S. state of Alaska into the Prince William Sound. This calamity had severe ecological impacts and the oil spillage killed around 250000 seabirds, 2800 sea otters, 300 harbor seals, 250 bald eagles, 22 killer whales and billions of salmon and herring eggs. Even after the pass of decades, only two of the 23 species injured by the spill have been recovered.

3.1.1 What engineers can do:

When there is an oil spill, environmental engineers work to cover it up. Environmental engineers are in charge of determining the form of cleanup system is suitable for each case. They investigate the area's environmental conditions, the form of oil spilled, and what living things are or would be harmed by the spill. They take into account the local community as well as the population of plants and animals. Dispersants (chemicals used to break down the oil); booms and skimmers (used to trap the oil to keep it from spreading); absorbents and vacuum cleaners; burning the oil; and biodegradation are some of the techniques used by engineers (the use of microorganisms that digest oil).

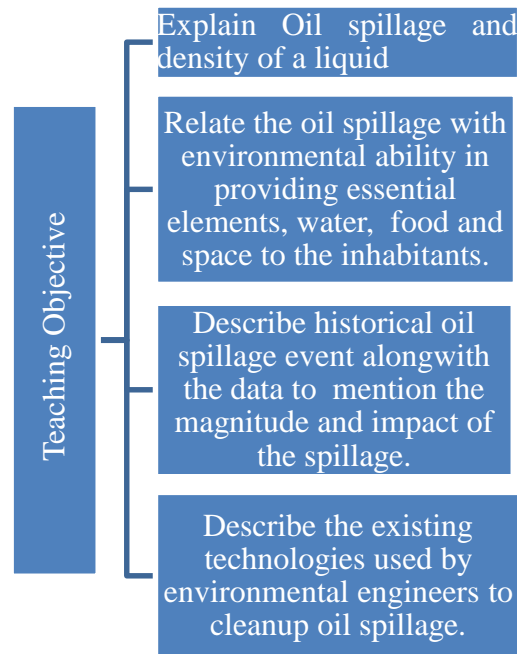


Figure 1: Illustrates a schematic diagram about the Teaching objective of Oil spillage generated pollution.

Apart from these basic teaching objectives for oil spillage treatment as mentioned in Figure 1, teachers should always include the recent events and development in national/international laws as a part of study material.

3.2 Groundwater toxicity and effective cleanup technologies:

Groundwater pollution may occur as a result of leakage in tanks, any chemical spillage, by application of pesticides/fertilizer at the surface. Such contaminants moves into groundwater over time, either through the gravity or by the influence of precipitation.

3.2.1 What engineers can do:

Environmental engineers are hired by government agencies, local communities, and private players, to locate pollution and come with clean up solutions. They conduct experiments to find out the concentration of pollutant/contaminant and analyse the probable travel mode of the contaminant. Engineers perform this job by drilling a well and determine the flow direction of the groundwater and the pollutant in that region by the help of mathematical models. They search for the remedy which includes phytoremediation, excavation, disposal, chemical and biological treatment, pumping based removal and other treatment methods. Engineers may also monitor for pollutant or contaminant concentration and use the knowledge to assess if the contaminant has migrated throughout the past.

In the real life situation, engineers have to determine not only how the pollution has been migrated through the ground but also about its way and the speed of movement. Once the engineers finds out that where pollution is going, there job mandates to design a strategy for the removal of contaminants. There are several ways for doing this which includes: put an obstacle over the ground to stop the groundwater flow, any biological treatment, Chemical treatment by adding chlorine/ozone or other chemicals to make contaminant less toxic, soil vapour extraction method which moves air and vapour through the groundwater for the removal of contaminant, Construction of wetlands, pump & treat method where contaminated water is taken out of the ground for the treatment then again put it back into the ground.

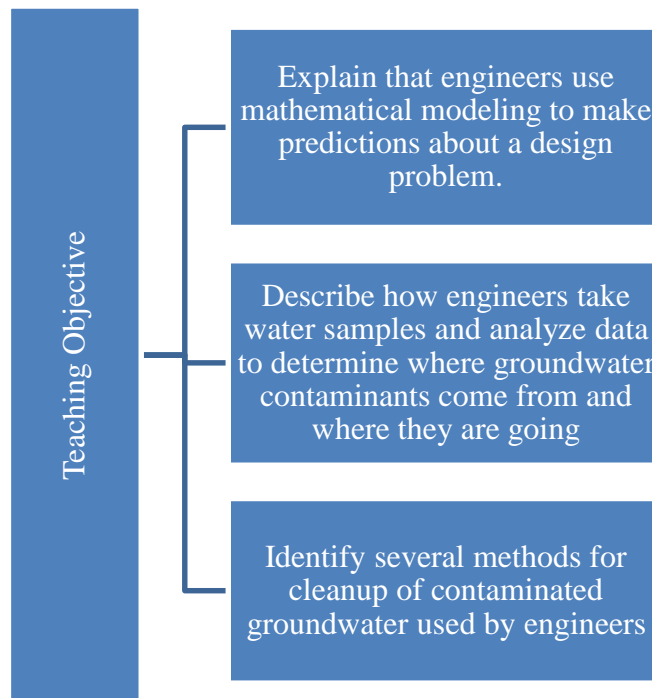


Figure 2: Illustrates a schematic diagram about the Teaching objective of ground water pollution.

Teachers can motivate students to locate a hypothetical site for contaminant spill and measure the soil pH. Figure 2 provides a schematic view about the learning objectives for ground water related pollution and its treatment plans which should also cover the recent events and developments in national/international laws.

3.3 Air pollution and effective cleanup technologies:

Air pollution is generated by the combustion, adulteration of toxic chemicals in air or any other method. Air pollution has emerged as a serious concern since the start of industrialization era by the excess use of coal. Initially the situation was under control but the exponential growth in population, the exaggerated demand of goods and services led towards excessive utilization and manufacturing capacity enhancement. As a result, the burning of coal resulted into the generation of micro/nano particle causing pollution and smoke up the clouds, thus disturbed the whole weather cycle of every country which causes rain storms, tsunami, shifting of wind, extreme winter or cold.

Air pollution attracted the public's concern since 1950, when numerous pollution generated accidents caused illness and death of the residents at many places. The worst incident occurred in London in 1952, when the whole city covered with toxic air for 4 continuous days and appeared static due to no changes in the atmosphere. The combination of humid air and a high level of waste discharged by an industrial area proved devastating. Which resulted in the death of more than 4,000 people and many fall ill due to this toxic breathing. As a result, a bill for air quality was passed, in London.

3.3.1 What engineers can do:

Environmental engineers work to reduce and eliminate air pollution. They devised several methods to reduce air pollution emissions, such as a catalytic converter for the vehicles to prevent the emission of harmful gases. Engineers have created air filters to reduce indoor air pollution and also modified the industrial processes to eliminate and trap the contaminants before their emission to outside atmosphere. Gravity settlers, cyclones, electrostatic precipitators, scrubbers are typical yet few lead inventions in this line which are commonly used to remove the particulate matter. Settling chambers works on the principle of gravity to settle the coarse particle before entering into the air stream. Engineers know a combined knowledge of physics, chemistry, environmental biology and many other subject. They can interlink these skills for the development of a new technology. For example, the development of Cyclones, which uses centripetal force to separate particles as

the air stream spins round and round in a cyclone. By passing contaminated air over electrically charged plates, electrostatic precipitators can remove smaller particles from the air. Because particulate matter always has a mild positive or negative charge, pollutant particles can adhere to and gather on the electrically charged plates.

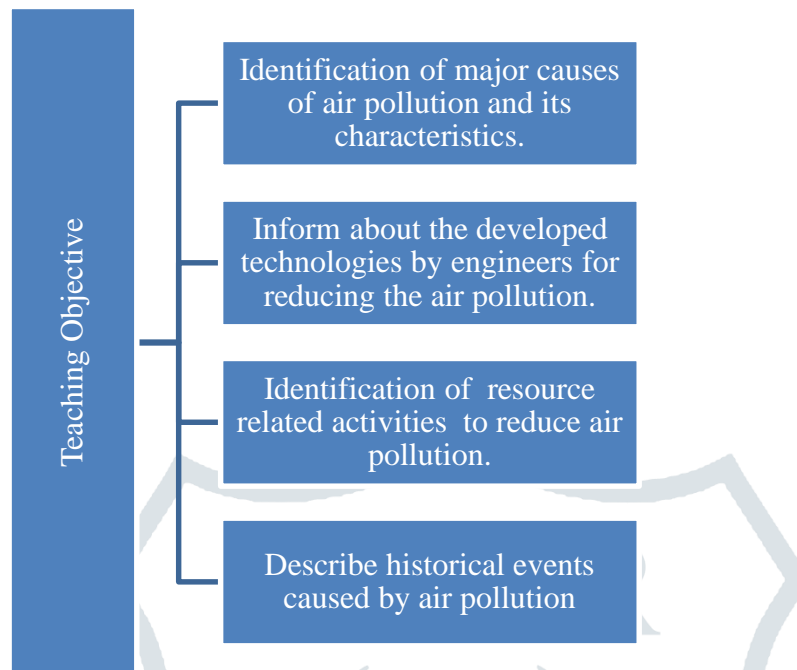


Figure 3: Illustrates a schematic diagram about the Teaching objective of Air Pollution.

Teachers can inform students about the overall impact of the air pollution. How severely it has impacted the environment as it destroyed our radiation shield, the Ozone layer too. Thus teachers can motivate the engineers to work in the direction of developing renewable energy based technologies. Teachers should also include the recent events and developments in national/international laws along with the main teaching objectives as mentioned in Figure 3 for air pollution.

3.4 Landfilling for a better future:

During the medieval period of human civilization, people just threw their garbage out the window. Even in today's date, it would not be a concern if the population remain under control as the space is limited. As a result of this continuously growing population, the available land is shrinking and generating the cities where the garbage overabundance has appeared as a huge problem. In the present time, waste disposal has been emerged as an acute problem. It is extremely required to design sanitary landfills to control the contaminants leakage into the landfills to control the ground water from the induced toxicity. Hence, there should be a developed leachate collection system to collect, treat and dispose the precipitant coming out of garbage which can also create a capping device for the landfill to be in such position which can control the release of harmful gases into the air.

During the period of 1948 to 2001, nearly 11,000 tons of garbage was generated only from New York City which created Fresh Kills Landfill on Staten Island. Fresh Kills Landfill, previously a wetland, began to be used as open dumping ground in 1948 and by 1955 it converted into World's largest landfill. As a result, the landfill continuously emitted hazardous substances into the surrounding water, noxious gases into the air for years. It also resulted in an environmental disaster popularly known as Syringe tide which washed up huge amount of medical waste including hypodermic syringes to the beaches of Jersey shore in New York City, also at long island.

3.4.1 What engineers can do:

Engineers calculates the implications of storing vast volumes of waste in any area to build landfills and plan to design more environmentally safe landfilling. They design landfill liners with several layers which includes one from soil, after that a layer made up by synthetic permeable membrane known as geotextile layer which lets water pass through filters out of the trash, then a water storage also known as leachate collection system,

plastic lining layer for preventing the leaching to mix into the groundwater and the last one is impermeable clay layer made up of plastic to stop water.

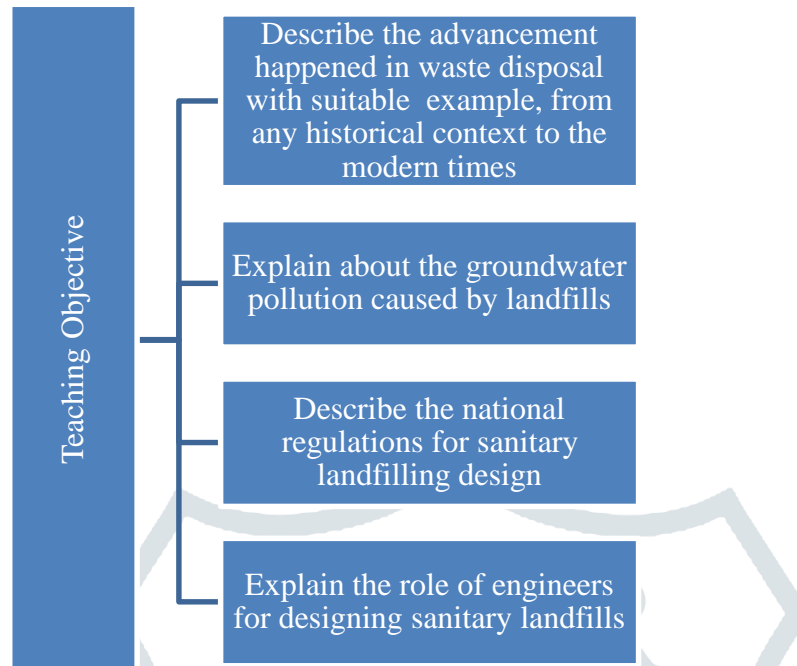


Figure 4: Illustrates a schematic diagram about the Teaching objective of Landfilling.

Teachers must discuss about the basic types of waste disposal through recycling the waste by composting method, burning the trash in incineration method or depositing in landfill under dumping method. Students should also be informed about the recent development in government regulations and laws in force along with the main course objective as mentioned in Figure 4. Every nation government has established rules for municipal solid waste landfills which includes preventive measures to avoid or reduce emissions from leachate, based on severity of issue. The location of landfill and construction, its operation, along with the groundwater monitoring, post construction care with corrective measures, and financing, all are covered under the government made rules and an environment engineer should be well versed with all these details.

4. CONCLUSION AND IMPLICATION

The main aim of these programs are to provide interdisciplinary training to the students with a real incident based practical experience which also combines with all the science streams to enable them to work in effective manner in the development of green technology. It develops high caliber students to prepare them for adverse situation by providing a practical life problem through the advanced laboratory experience, quantitative data analysis, develop potential and leadership skills which immensely needed for handling extreme situations related in these kind of work. It also instill students about importance of proper approach towards the environmental issues through multidisciplinary actions and develops rational attitude for advanced decision such as, when and how to use additional disciplines. It also informs the students about the importance of study in the industrial and regulatory sectors, as well as in society as a whole, including the importance of understanding and transmitting the results, as well as addressing ethical issues if any. It also provides the information to the students which they need to make an educated decision about their personal suitability and inspiration for a research career. It allows the student to do a thorough study of every aspect of environmental destruction from the literature to make an informed decision about alternative career choices as per their own interests. Environmental study also aimed to create successful solutions for the management and regulation of pollution in a significant way that society faces in today's date. These specialized engineers constantly work to prevent contamination for the safety of vital elements of life as air, water, soil. The study shows the importance of an environmental engineer, they work as a 'Shield' against the destruction of the universe and make earth a more livable place.

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