AQUATIC AND ENVIRONMENTAL ENGINEERING

Aquatic and environmental engineering; an engineering topic, used sometimes as a synonym for Civil engineering by some universities in Sweden, since the word 'civil engineer' often refers to an engineering degree.

It is the application of science and engineering principles to improving the environment (air, water, and/or land resources), to provide healthful water, air and land for human habitation and for other organisms, and to investigate the possibilities for remediation of polluted sites. Negative environmental effects can be decreased and controlled through public education, conservation, regulations, and the application of good engineering practices.

Development of environmental engineering

As long as people recognized that their health and well-being were related to the quality of their environment, they have applied thoughtful principles to attempt to improve the quality of their environment. The Romans constructed aqueducts to prevent drought and create a clean healthful water supply for the metropolis ofRome. Bavaria in the 15th century created laws restricting development and degradation of alpine country that constituted the region's water supply.

Modern environmental engineering began in London in the mid-19th century when it was realized that propersewerage could reduce the incidence of water-borne diseases such as cholera. The introduction of drinking water treatment and sewage treatment in industrialized countries reduced water borne disease from leading causes of death to rarities.

In many cases as societies grew, actions were taken to achieve benefits for those societies, but longer-term impacts reduced other environmental qualities. One example is the widespread application of DDT to control agricultural pests in the years following World War II. While the agricultural benefits were outstanding and crop yields increased dramatically, thus reducing world hunger substantially, and malaria was controlled better than it ever had been, numerous species were brought to the verge of extinction due to the impact of the DDT on their reproductive cycles. The story of DDT as vividly told in Rachel Carson's "Silent Spring" is considered to be the birth of the modern environmental movement and the development of the modern field of "environmental engineering."

Conservation movements and laws restricting public actions that would harm the environment had been developed by various societies for millennia. Laws decreeing the construction of sewers in London and Paris in the 19th century, and the early 20th century creation of the U.S. national park system are notable examples.

Scope of environmental engineering

"Pollutants" may be chemical, biological, thermal, radioactive, or even mechanical. Environmental engineering emphasizes several areas: process engineering, environmental chemistry, water and wastewater treatment(sanitary engineering), waste reduction, and pollution prevention. It is a synthesis, incorporating elements fromcivil engineering, chemical engineering, public health, mechanical engineering, chemistry, biology, andgeology.

Environmental engineering is the application of science and engineering principles to the environment. There are several divisions of the field of environmental engineering.

Environmental impact assessment and mitigation

In this division, engineers and scientists assess the impacts of a proposed project on environmental conditions. They apply scientific and engineering principles to evaluate if there are likely to be any adverse impacts to water quality, air quality, habitat quality, flora and fauna, agricultural capacity, traffic impacts, noise impacts, visual impacts, etc. If impacts are expected, they then develop mitigation measures to limit or prevent such impacts. An example of a mitigation measure would be the creation of wetlands in a nearby location to mitigate the filling in of wetlands necessary for a road development if it is not possible to reroute the road.

Water supply and treatment

Engineers and scientists work to secure water supplies for potable and agricultural use. They evaluate the water balance within a watershed and determine the available water supply, the water needed for various needs in that watershed, the seasonal cycles of water movement through the watershed and they develop systems to store, treat, and convey water for various uses. Water is treated to achieve water quality objectives for the end uses. In the case of potable water supply, water is treated to minimize risk of infectious diseasetransmittal, risk of non-infectious illness, and create a palatable water flavor. Water conveyance systems are designed and built to provide adequate water pressure and flow rates to meet various end-user needs such as fire suppression, showering, and irrigation.

See: hydrology, and water resources.

Wastewater conveyance and treatment

Most urban and many rural areas no longer discharge human waste directly to the land through outhouse, septic, and/or honey-bucket systems, but rather deposit such waste into water and convey it from households via sewer systems. Engineers and scientists develop conveyance and treatment systems to carry this waste material away from where people live and produce the waste and discharge it into the environment. Indeveloped countries, substantial resources are applied to the treatment and detoxification of this waste before it is discharged into a river, lake, or ocean system. Developing nations are striving to obtain the resources to develop such systems so that they can improve water quality in their surface waters and reduce the risk of water-borne infectious disease. There are numerous wastewater treatment technologies. A standard wastewater treatment train would typically consist of a primary clarifier system to remove solid and floating materials, a secondary treatment system consisting of an aeration basin followed by flocculation andsedimentation or an activated sludge system and a secondary clarifyer, a tertiary biological nitrogen removal system, and a final tertiary disinfection unit. The aeration basin/activated sludge system removes organic material by growing bacteria (activated sludge). The secondary clarifyer removes the activated sludge from the water. The tertiary system is becoming more prevalent to remove nitrogen and phosphorus and do a final disinfection of the water prior to its discharge to a surface water stream or ocean outfall.

Air quality management

Engineers apply scientific and engineering principles to the design of manufacturing and combustion processes to reduce air emissions to acceptable levels. Scrubbers, precipitators, after-burners, and other devices are utilized to remove particulates, nitrogen oxides, sulfur oxides, and reactive organic gases from vapors prior to allowing their emission to the atmosphere. This field is beginning to overlap with energy efficiency and the desire to reduce carbon dioxide and other greenhouse gas emissions from combustion processes. Scientists develop dispersion models to evaluate the concentration of a pollutant at a receptor source or the impact on overall air quality and smog production from vehicle and stack emissions.

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