Environmental considerations. The raw materials of cement are common enough. It takes about 3400 lb of raw material to produce 2000 lb of finished concrete. The most significant environmental impacts of cement manufacturing and concrete use are the amount of energy consumed, the energy-associated emissions of carbon dioxide and other greenhouse and acid-forming pollutants, the dust that results from the manufacturing process, and the pollution of surface waters from runoff and "washout water."

Manufacturing cement is an energy-intensive process involving burning fossil fuels to generate the high temperatures of the rotary kiln. Some cement plants have been converted to burn hazardous wastes or other solid waste to extract the energy value. The high temperature of the kiln can provide a fairly complete combustion with low levels of residual air pollution. According to the Portland Cement Association, a single cement kiln can consume more than a million tires each year. Other elements of concrete do not require the substantial energy inputs of cement manufacturing, and the use of fly ash in concrete reduces the energy load even more (EBN 1993).

In addition to the energy costs, there are environmental impacts associated with fugitive dusts. The EPA has estimated that for every ton of cement manufactured, there is about 360 lb of alkaline dust generated. Much of this occurs during the manufacturing process, but some is generated in handling and transporting the cement and in mixing it. At the cement manufacturing plant, much of the dust is captured in baghouses or other pollution control equipment. Ultimately some of the dust is used for agricultural soil amendments, but much is discarded in landfills. Dust generated at ready-mix facilities or construction sites is usually not controlled.

The alkaline character of cement may result in runoff or washout water with a pH as high as 12. High alkalinity is particularly harmful to aquatic life. Runoff from most concrete and ready-mix sites requires a surface water discharge permit. Washout on construction sites should be properly collected and managed on site.

Fly ash concrete. Fly ash is a residual by-product of burning coal that has become a more common substitute for portland cement in concrete. Fly ash is produced in the generation of electricity and industrial processes. In the past fly ash has been used for a variety of purposes but most commonly as landfill. The use of fly ash as a replacement for or in combination with portland cement reduces the need to produce portland cement and offsets the environmental costs to some degree. The advantages to using fly ash are well documented. Fly ash concrete results in stronger concrete, though it may take longer for strength to develop. Fly ash tends to increase the time it takes for concrete to set. While this may be an advantage in the summer because it allows longer working times, it may be a disadvantage in the winter. Concrete mixes can be adjusted for weather conditions. Local ready-mix plants are usually able to provide mixtures that are seasonally adjusted to a given area. The time for strength to develop can be reduced to be comparable to portland cement if a fly