

## Water pollution

### Facts

Water pollution is intended as water quality degradation caused by the introduction of substances that alter its physico-chemical characteristics and impede its normal use. These substances having either a solid, liquid or gaseous origin have different effects according to their amount and potential danger and fragility of the environments where they are released. These substances can have a human origin, when they are introduced by humans, or a natural origin. Pollution of water of natural origin can be caused by decomposition of organic debris, saltwater invading coastal aquifers, water blackening due to landslides, earthquakes, dust erupted from volcanoes.

Pollution can either be found at the level of superficial water or subterranean water. Pollution of superficial water can differ in its features or seriousness depending on whether it affects water in a river or in a lake and the consequences are: fish fauna depletion, death of aerobic bacteria and aquatic plants, formation of pestilential odors and deteriorating material, diffusion of pathogenic microorganisms, moreover, the more the water is polluted the greater are the costs of making it drinkable.

Pollution of aquifers is very dangerous from the point of view of preservation of water as a resource for humans. Once it's polluted, in fact, subterranean water has a low depurative power and shows to employ much more time to recover original quality of water.

### Substances polluting water

Water used in the agricultural, industrial and civil sectors often contains substances which will alter the ecosystem and hence must not be discharged directly into river flows.

The most common polluting agents are the following.

- **Fecal pollutants:** materials of fecal origin that reach water bodies through sewage discharges or introduction of zootechnical manure that hasn't been adequately treated. If there is a high fecal type pollution, can be observed the presence of pathogen microorganisms in water that can cause diseases as cholera, typhus fever, viral hepatitis, etc.
- **Toxic inorganic substances:** these are constituted by heavy metal ions that can poison or kill living organisms. Industries that employ these heavy metals during processing, must sanitize them to eliminate any heavy metal leftover before discharging water.
- **Inorganic harmful substances:** there are substances constituted by phosphates and polyphosphates existing in detergents, fertilizers, compounds of nitrogen and phosphorus and in some industrial discharges. These substances cause eutrophication (see paragraph on eutrophication).
- **Unnatural organic substances:** in this category are included weed killers, pesticides, insecticides, etc. These substances are convenient for agriculture but can pollute both water and soil. Among these substances are included also organic solvents used by industries, such as trichlorethylene, acetone, benzene, etc., which must be eliminated before water is discharged.
- **Free oils and emulsifiers:** these are insoluble, low density substances which for this reason form superficial oily film layers that prevent oxygen dissolution in water. It's not a rare phenomenon and it can cause real ecological disasters.
- **Suspended solids:** creating a mixture of various kinds of substances that make water murky and prevent solar light from passing through. When they deposit deep on the bottom of a water body they obstruct vegetation growth.
- **Heat, acids and strong bases:** originating especially from industrial discharges. They reduce the solubility of oxygen, modify the temperature and pH of the environment causing pathological alterations or the disappearance of living organisms or on the contrary the comparison of others.

## Alterations

The different types of pollution lead to chemical or physical alterations of the water, with mechanisms which are very complex at times. Contaminants that are dispersed in the water have harmful effects on animal populations and plants, that can be classified into the following categories:

- **deoxygenation or oxygen-depleting effects:** these effects are caused by the organic substances that are present in industrial waste. When industrial waste is dispersed in the water, it is degraded by microorganisms, with an excessive consumption of the oxygen dissolved in the water. The reduced availability of oxygen in the water is the cause of death of animal and plant species that are unable to tolerate this lack of oxygen and, on the other hand, an invasion of those species that are not influenced by the lack of oxygen;
- **eutrophication effects:** eutrophication is a phenomenon provoked by compounds (mineral nitrogen and phosphorus) that favour an abnormal growth of populations of phytoplankton and algae, at the expense of the survival of other plant and animal species. Lakes and sea-coasts are particularly affected by this;
- **physical effects:** are caused by very high temperature waste waters;
- **effects caused by radiations;**
- **pathogenic and toxic effects:** are caused by waste waters with a high content of suspended toxic or pathogenic materials (heavy metals, mineral oils, hydrocarbons, ammonia, solvents, detergents, pesticides, etc.)

## Water regenerates itself

When polluted, fresh water basins have the capacity to self-clean their water, i.e. to make the water return to its original quality and purity. This self-cleaning phenomenon is provoked by bacteria that, in the presence of oxygen, degrade and transform the polluting substances into inert inorganic compounds. Obviously this process is not effective on all types of pollutants and for any amount of polluting substances present in the water. In some cases, human intervention is necessary to clean the water reserves that have been polluted.

The type of treatment that must be used to clean the water depends essentially on the type of pollutant that must be eliminated. The greater the number of pollutants in the water, the more difficult it is to clean it. In some cases polluted water is extracted, purified and then returned to the water table, river or lake. In other cases water is purified on site (i.e. without removing the water from its natural site).

Also the sea has a great self-regenerating capacity, which can neutralize human polluting actions. However, if human activities continue to persevere in an uncontrolled and unsustainable exploitation of a resource that seems (but is not) inexhaustible, this regenerating capacity will cease and it will permanently jeopardize the sea's capacity to correctly carry out all the vital functions that it provides today.

Man is now aware of this and is increasingly aware of the mechanisms that regulate the water cycle, that allow rivers, lakes, seas and oceans to live. Therefore we know where and how to intervene: the problem is to succeed in improving and spreading good practices and sustainable use of the water resource all over the world, in our communities and in those countries where respect for natural resources seems to be applicable only to the richer countries.

## DDT

The history of DDT represents a significant example of the risks for humans every time they intervene on the environment without knowing inside out the balances of ecosystems. The insecticidal power of DDT was discovered in 1939 and, at the end of World War II, it was largely used in those regions where diseases transmitted by insects, such as malaria, typhus fever and yellow fever, were widespread. Moreover, once its usefulness was discovered in the fight against insects harmful for crops, it allowed to increase agricultural production in the immediate post-war period with a consequent rapid recovery of world economy. The problems related to DDT are given by its long decay times that

maintain unaltered for years its toxic characteristics. By the time when this insecticide was banned and substituted by other substances, 25% had been carried by rainfall and rivers into the oceans while a great quantity was circulating in food chains.