

Chapter VI

Impact of pollution on health and the environment

1. Introduction

Many human activities (industrial, chemical, agricultural, and even domestic) are responsible for environmental degradation:

- Global warming.
- Climate change and ecosystem disruption.
- Depletion of the ozone layer.
- Pollution of soil and water, but also of the air.

These environmental threats constitute a major risk to human health (appearance and/or resurgence of various pathologies: cancerous diseases, infectious diseases, congenital malformations, cardiovascular and respiratory pathologies, reduction in quality of life and well-being, etc.).

2. Effects of pollution

The effects of pollution depend on the personal sensitivity of the exposed individual: age, state of health, smoking, predispositions.

According to experts, they also depend on the following factors:

- Individual exposure to different sources of pollution.
- Duration of exposure to these levels.
- Respiratory flow at the time of exposure.
- Interaction with other compounds present in the atmosphere such as pollen, fungal spores, etc.

It is therefore difficult to predict the effect of a given level of pollution on the health of a given person. However, there are people who are a priori more sensitive than others to the effects of air pollution. For example, children, the elderly, people with respiratory or cardiovascular diseases, and pregnant women generally constitute so-called sensitive populations.

In terms of air pollution, there is no threshold below which pollutants have no effect on health. Some people are affected by very low levels.

There is a short-term statistical link between daily pollution levels, commonly observed in large cities, and certain public health indicators (hospitalizations, work stoppages, anticipated mortality, etc.).

Faced with these health issues, public authorities define pollution levels beyond which temporary or permanent actions to reduce emissions are implemented. These are alert thresholds and limit values.

3. Impact on health

3.1. Depletion of biodiversity

This transformation of the environment generally results in a depletion of biodiversity (Biodiversity, in the etymological sense of the term, refers to the diversity of living things, i.e. all the processes, lifestyles or functions that lead to maintaining an organism in a state of life. This term is much too broad to have a real scientific connotation) then by the disruption of the functioning of ecosystems (characterizing an environment in which the physicochemical conditions are relatively homogeneous and allow the development of a set of living organisms. In an environment, climatic conditions (such as temperature, solar radiation, humidity), geological conditions, etc.). The weakening and disappearance of the ecological services provided by these ecosystems (purification mechanisms, soil stabilization, etc.) generate a generalized

degradation of the living environment for both organisms and for humans and their activities.

3.2. Cardiovascular diseases

Hypertension (high blood pressure), hypercholesterolemia and smoking are the main risk factors identified in cardiovascular diseases. Other factors such as obesity, physical inactivity, a diet too rich in fat also interact. However, it seems that environmental factors do not play a major role in the onset of cardiovascular diseases, with the exception of exposure to carbon monoxide which could promote cardiac arrhythmias and the aggravation of angina symptoms. Excessive and prolonged exposure to noise in sensitive people can cause hypertension and cardiac ischemia (WHO-1999).

3.3. Cancers

The appearance of cancerous diseases is particularly accentuated by different factors, namely:

- Lifestyle (alcohol, tobacco, diet).
- Genetic functions
- Hormonal functions.

However, other factors whose role is less preponderant should not be neglected, such as those related to the environment, especially in certain populations and/or certain regions.

Three major sources of contamination should be cited and are detailed below (via food consumption, via air or via radiation):

- Source 1: Food (pesticides, polychlorinated biphenyls, chlorinated derivatives, etc.)
- □ Source 2: Air (pesticides, polycyclic aromatic hydrocarbons, smoking, benzene, asbestos, etc.)
- Source 3: Radiation (ionizing, non-ionizing, etc.)

3.4. Respiratory diseases

Respiratory diseases are particularly accentuated by different factors and several causes, namely:

- ✓ Suspended particles
- ✓ Nitrogen oxide
- ✓ Sulfur dioxide
- ✓ Tropospheric ozone
- ✓ Pollution inside buildings

3.5. Allergies

- Pollens (see figure 10)
- Molds
- Dust mites (see figure 11)
- Pets, pests and crawling insects

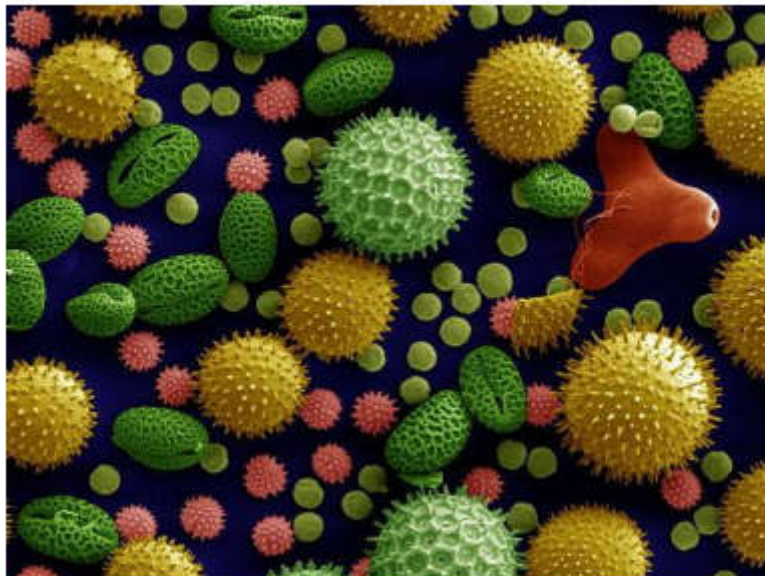


Fig 1. Pollen from several plants: sunflower (*Helianthus annuus*), morning glory (*Ipomoea purpurea*), *Sidalcea malviflora*, *Lilium auratum*, evening primrose (*Oenothera fruticosa*) and common castor bean (*Ricinus communis*).



Fig 2. Photo of a mite.

4. Quantification

In terms of figures, the number of premature deaths (or excess mortality) are:

- 3.7 million premature deaths in 2012 worldwide due to ambient outdoor air pollution in urban and rural areas (Source: WHO);
- 420,000 premature deaths caused in 2010 by air pollution in the EU (Source: European Commission).
- 21,400 premature deaths in EU-25 in 2000 caused by tropospheric ozone.
- 13,000 premature deaths per year, including 24 children, caused by PM_{2.5} in Belgium in 2000.
- 350,000 premature deaths (including 680 children) caused by PM_{2.5} in the EU-25 population. Added to this are hundreds of thousands of cases of bronchitis, thousands of hospitalizations and millions of days of medication (Source: CAFE Programme).
- A long-term increase of 10 μg/m³ in PM_{2.5} concentrations in ambient air would cause an increase (Source: WHO):

- 6% in mortality risks

- 12% in cardiovascular disease risks
- and 14% in lung cancer risks
- 7.3% of total mortality would be attributable to chronic exposure to PM10 concentrations above 20 µg/m³ in Liège in 2004 (Source: APHEIS)

5. Impact on the environment

There are many effects of pollution on the environment, we can mention:

- Oil spill which is dangerous for marine animals.
 - Air pollution which is caused by exhaust pipes and factory fumes.
 - CFCs (chlorofluorocarbons) which make holes in the ozone layer.
- Whether chemical, physical or biological, pollution causes changes in the environment. Depending on its nature, pollution affects the physiology and behavior of exposed organisms or the characteristics of biotopes (geographically delimited living environment in which the ecological conditions (temperature, humidity, etc.) are homogeneous, well defined, and sufficient for the development of living beings that reside there (called biocenosis), with which they form an ecosystem...) and therefore the composition and structure of populations.
- Consequences of the hole in the ozone layer Substances that deplete the ozone layer (CFCs, HCFCs, HBFCs, halons, CCl₄, CH₃CCl, CH₃Br, etc.) have indirect repercussions on human health. Indeed, the destruction of this layer induces an increase in harmful UV-B radiation at ground level and its hole could contribute in one way or another to global warming.
 - The increase in UV-B at ground level leads to:
 - An increase in skin cancers.
 - An increased risk of developing cataracts.

- A possible weakening of the immune system in both light- and dark-skinned individuals, resulting in greater vulnerability to attacks by infectious diseases.

- Alteration of the environment In other words, chemical substances (heavy metals, endocrine disruptors, etc.) and physical effects (heat, light, radioactivity) on the one hand weaken organisms and their ability to reproduce and on the other hand alter environmental conditions (pH, oxygen, ultraviolet, etc.).

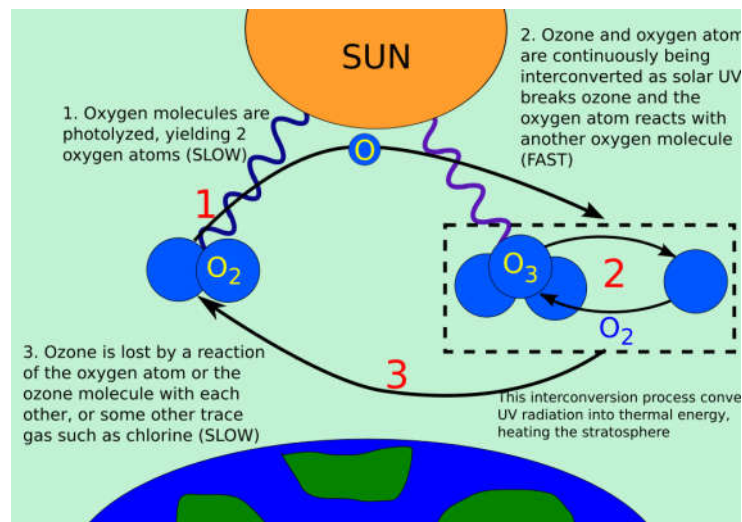
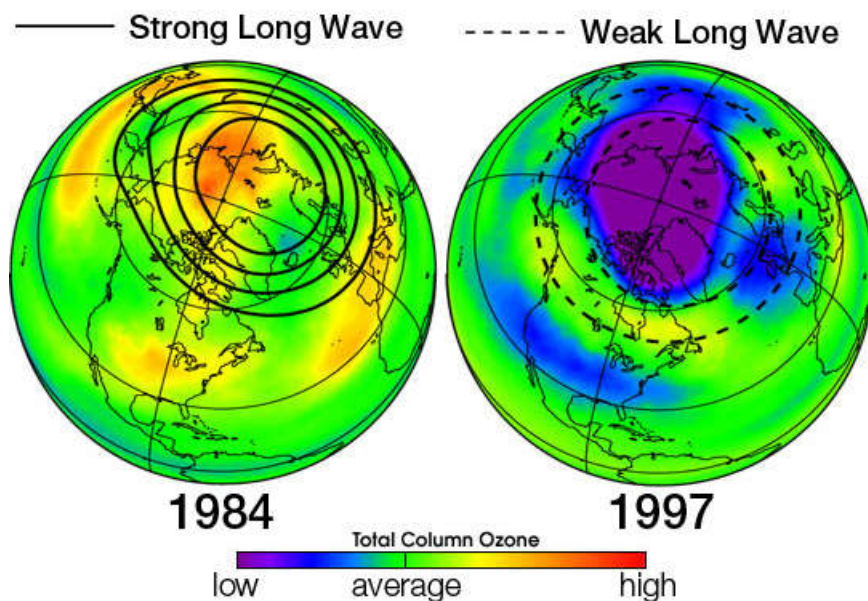


Fig.3 The ozone cycle



Ozone hole in North America during 1984 (abnormally warm, reducing ozone depletion) and 1997 (abnormally cold, resulting in increased seasonal depletion). Source: NASA