Environment Pollution and Human Exposure

Definitions

Environment

The definition of environment is the surrounding or conditions a person, animal or plant lives in. It includes the outdoor, indoor and occupational settings in which we live. In each of these environments, what we breathe, what food and water we eat, and exposure from toxic agents are major determinants of the population's health. There is another type of environment- 'personal' environment which is more particular to each individual and it is influenced by tobacco use, alcohol consumption, drug use- both therapeutic and recreational, diet etc. The factors in personal environment have more of an effect on a human health than surrounding environment.

Pollution

Pollution is defined as the introduction of a substance that has harmful effects in to the environment. Pollution can take the form of chemical substances, biological substance or physical factors. Examples of each form are carbon dioxide, bacteria and fungi, noise. Pollutants can be natural or man-made substances.

Human Exposure

Total extent of environmental pollution is difficult to assess. Analyses of *non-systemically* collected air and surface water samples yield virtually worthless data because the actual degree of environmental contamination may vary across a relatively wide range. This is because concentrations of air pollutants are influenced by weather conditions, local air movement and by inversions. All of these may be the cause of accumulation of pollutants in a given area and lead to increased concentrations of air pollutants. In addition, the quality of surface water is dependent on flow rate and the discharge of industrial effluents.

Ideally, a continuous measurement of environmental pollution can be achieved through the use of a network of automated monitoring systems e.g. hexagonal scheme of air pollution monitoring networks. It is preferable if the monitoring systems were capable of automatic sampling, analysis, registration and evaluation of data. However, automated monitoring systems are not easily accessible due to technical and economical issues.

Therefore, an *alternative* to this problem is the use of biological indicators to monitor environmental pollution. This method seems to demonstrate pollution by potentially toxic xenobiotics and trace elements well.

The use of animals to monitor noxious substances in the working environment is a long tradition, for example, the use of canaries in coal mines as an indicator of carbon monoxide and carbon dioxide. Examples of more recent forms of biological indicators are the absence of lichen on rocks and trees can indicate levels of sulphur dioxide.

Human Exposure Assessment

The assessment of human exposure can be performed by examination of suitable human tissue. This seems to be more appropriate than analysis of plant or animal materials currently used.

The human materials that are accessible for sampling are *blood, urine, hair, nails, saliva* and even *teeth*. The method of hair analysis is ideally suited as the first examination method. If an excessive exposure is detected, it is recommended that the examination should be completed by analyses of other biological materials- blood and urine, in order to obtain a more accurate result of the degree of exposure.

Advantages and limitations of hair analysis as a bio-marker of trace elements:

Advantages

- Simple to collect, transport and store (compared to blood and urine)
- Easy to preserve for later control analyses
- Reflects past exposure (blood and urine reflects recent exposure)

- Serves as a basis for identifying the population groups at risk of contamination

Limitations

- Extent of exposure varies from person to person, leading to great intra-group differences. Therefore, the best approach to overcome this is to use the method of group approach. At least 20 individuals per population group to be sampled.
- No generally applicable limits for normal content of individual trace elements in human hair. Element content of hair tends to vary from one geographical region to another, depending on the natural background conditions including composition of soil, element concentration in water and food and eating habits.
- No biological limit values have been established as yet for exposures to toxic trace elements, with the exceptions of mercury and selenium.