Defining the Environment by environmental health professionals

To accomplish their goals effectively, environmental health professionals must keep in mind that there are many ways to define the environment. Some of the more prominent of these are:

1. The inner versus outer environment:

From the standpoint of the human body, there are two environments: the one within the body and the one outside it. Separating them are three principal protective barriers:

a. The skin, which protects the body from contaminants outside the body;
b. The gastrointestinal (GI) tract, which protects the inner body from contaminants that have been ingested;
c. The membranes within the lungs, which protect the inner body from contaminants that have been inhaled (Figure 1.2).

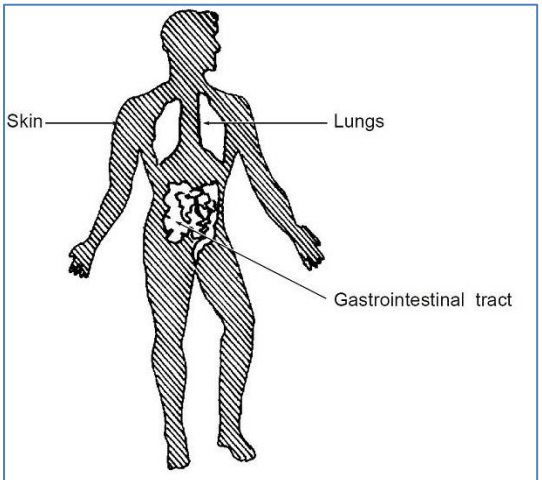

Figure 1.2 Barriers between the inner and outer environments

Although they may provide protection, each of these barriers is weak under certain conditions.

- Contaminants can penetrate to the inner body through the skin by dissolving the layer of wax generated by the sebaceous glands.
- The GI tract, which has the largest surface area of any of the three barriers, is particularly weak to compounds that are soluble and can be readily absorbed and taken into the body cells.

Fortunately, the body has mechanisms that can protect the GI tract:

- Unwanted material can be vomited via the mouth or rapidly excreted (diarrhea).
- Airborne materials may be deposited in the lungs and, if they are soluble, may be absorbed. Mechanisms for protecting the lungs range from simple coughing to cleansing by macrophages that engulf and promote the removal of foreign materials.
- Unless an environmental contaminant penetrates one of the three barriers, it will not gain access to the inner body, and even if a contaminant is successful in gaining access, the body still has mechanisms for controlling and/or removing it. For example, materials that enter the circulatory system can be detoxified in the liver or excreted through the kidneys.

Although an average adult ingests about 1.5 kilograms of food and 2 kilograms of water every day, he or she breathes about 20 cubic meters of air per day. This amount of air weighs more than 24 kilograms. Because people usually cannot be selective about what air is available, the lungs are the most important pathway for the intake of environmental contaminants into the body. The lungs are also by far the most fragile and susceptible of the three principal barriers.

2. The personal versus ambient (outdoor)environment:

In another definition, people's "personal" environment, the one over which they have control, is contrasted with the working or ambient (outdoor) environment, over which they may have essentially no control.

3. The gaseous, liquid, and solid environments:

The environment can also be considered as existing in one of three forms—gaseous, liquid, or solid. Each of these is subject to pollution, and people interact with all of them (Figure 1.3). Particulates and gases are often released into the atmosphere, sewage and liquid wastes are discharged into water, and solid wastes, particularly plastics and toxic chemicals, are disposed of on land.

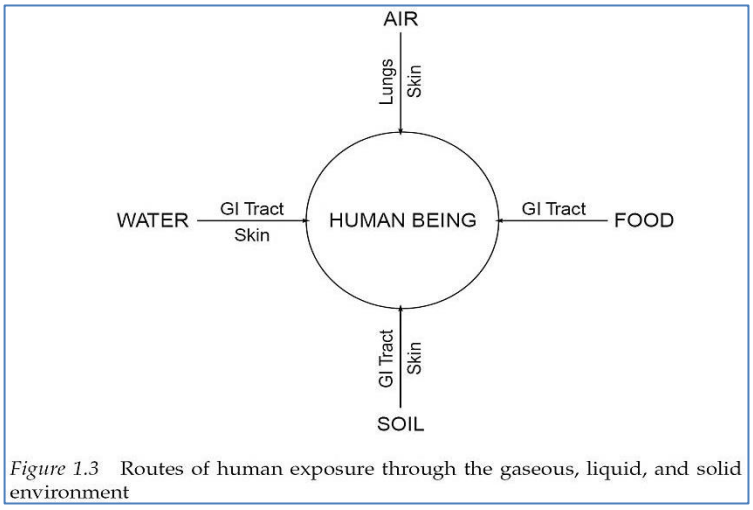

Figure 1.3 Routes of human exposure through the gaseous, liquid, and solid environment

4. The chemical, biological, physical, and socioeconomic environments:

Another perspective considers the environment in terms of the four types or mechanisms by which various factors affect people's health:

a. *Chemical* constituents and contaminants include toxic wastes and pesticides in the general environment, chemicals used in the home and in industrial operations, and preservatives used in foods.

b. *Biological* contaminants include various disease organisms that may be present in food and water, those that can be transmitted by insects and animals, and those that can be transmitted by person-to-person contact.

c. *Physical* factors that influence health and well-being range from injuries and deaths caused by accidents to excessive noise, heat, and cold and to the harmful effects of ionizing and nonionizing radiation.

d. *Socioeconomic* factors, although it is more difficult to measure and evaluate, but significantly affect people's lives and health. Statistics demonstrate relationships between morbidity and mortality and socioeconomic status. People who live in economically depressed neighborhoods are less healthy than those who live in more rich areas.

5. The urban environment:

Another environment that is assuming increasing importance is that of large cities, the so-called urban environment. One of the primary reasons is that today about half of the world's population lives in urban centers (Figure 1.4). This is projected to increase to 60 percent within the next 20 years, with a major share of the change occurring within the less developed countries.

Unfortunately, the quality of life in cities throughout the world has been declining. As a result, many urban environments today are noisy, congested, frustrating, and unhealthy. Furthermore, the heat islands created by urban centers increase both the costs for cooling and the concentrations of air pollutants.

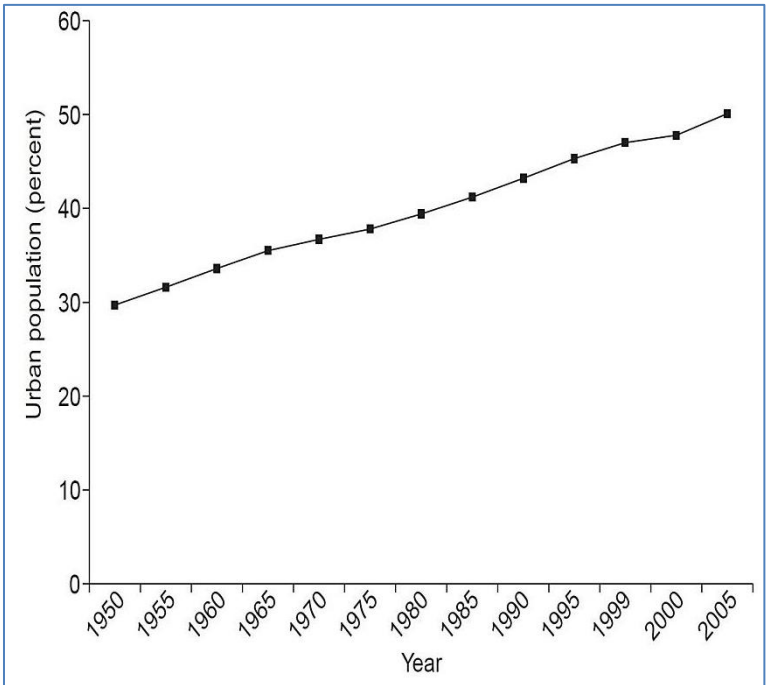

Figure 1.4 Increase in percentage of world population living in urban areas

Assessing Problems in the Ambient Environment

Environmental health professionals must understand the various ways in which humans interact with the ambient (indoor or outdoor) environment.

A primary step is to study the process that leads to the generation of a problem and to determine how to achieve control. Components of such an analysis include:

(1) Determining the source and nature of each environmental contaminant or stress.

(2) Assessing how and in what form that contaminant or stress comes into contact with people.

(3) Measuring the resulting physical and economic impacts.

(4) Applying controls when and where appropriate.

Tracing the source and pathways of each contaminant is important; an essential part of the process is to determine the effects on human health and the environment. When a pollutant is being evaluated for the first time, and exposure limits have not been established, such efforts may determining relationships between the exposure, the resulting dose, and the associated effects.

To assess the effects of exposures correctly, care must be taken to account not only for the fact that they can derive from multiple sources and enter the body by several routes, but

also that elements in the environment are constantly interacting. Those responsible for protecting people's health must be wary of demands for "zero" pollution: it is neither realistic nor achievable as a goal in today's world. Rather, given the host of factors that are an integral part of our daily lives, the goal should be an optimal level of human and environmental well-being.

The Systems Approach

Attempts to control pollution in one segment of the environment can often result in the transfer of pollution to a different segments or the creation of a different form of pollution.

- On a short-term basis, the incineration of solid wastes can cause atmospheric pollution; the application of scrubbers and other types of air-cleaning systems to airborne effluents can produce large amounts of solid wastes; and the chemical treatment of liquid wastes can produce large quantities of sludge.
- On a longer-term basis, the discharge of sulfur and nitrogen oxides into the atmosphere can result in acidic deposition at some distance from the point of release; the discharge of chlorofluorocarbons CFCs can lead to the destruction of the ozone layer in the upper atmosphere; and the discharge of carbon dioxide can lead to global warming.

Intervention and Control

Because the complexity of the problems in environmental health requires multidisciplinary approaches to their evaluation and control, the techniques for addressing them often differ from those applied in medical practice. Physicians traditionally deal with one patient at a time, whereas environmental health specialists must consider entire populations, they must also try to expect problems to prevent them from developing.

As drawn in the Clinical Intervention Model CIM (Figure 1.5a), the goal of the physician is to prevent a specific disease from leading to death. The Public Health Intervention Model PHIM(Figure 1.5b), in contrast, calls for preventing the development of disease.

The Environmental Stewardship Model ESM(Figure 1.5c), in which the goal is to protect humans by preventing environmental degradation and its resulting impacts on health.

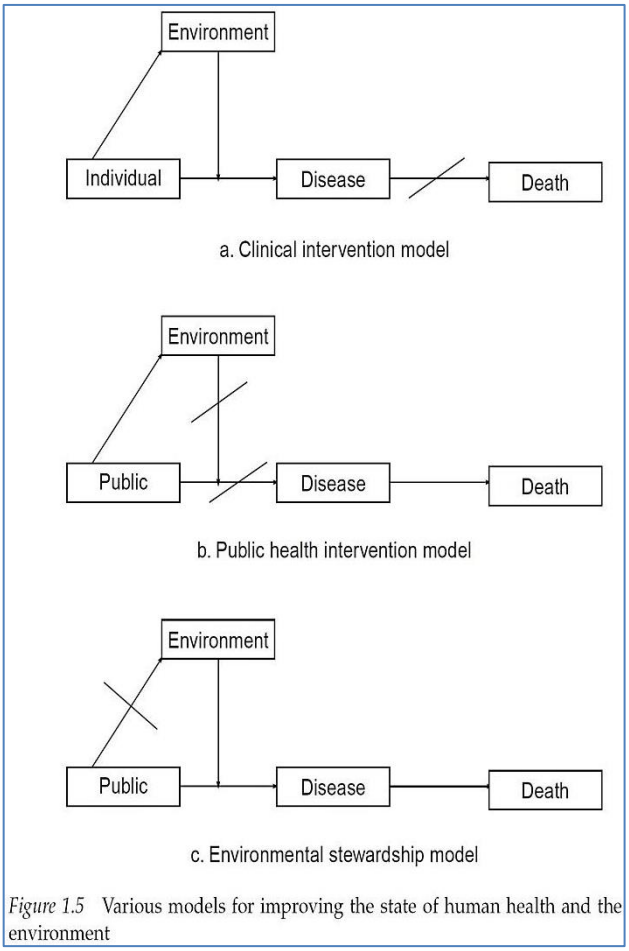

Figure 1.5 Various models for improving the state of human health and the environment