Some Specifications of Multimedia Exposure Monitoring Assessment*

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The continued expansion of industrial production and the growing use of chemicals in agriculture have led to an increase in the number and quantities of chemicals discharged into the environment. These substances may come into contact with humans through various media: air (outdoor, indoor and the workplace), water, foodstuffs, and household chemicals. In recent years, each medium has been contaminated with relatively low levels of multiple contaminants. Under such conditions, monitoring is quite difficult, especially to assess the contribution of each medium to overall dose and to the adverse health effects of mixtures of chemicals.

The combined action of mixtures has been discussed extensively elsewhere (WHO, 1981, 1983; Vouk *et al.*, 1987), and is, therefore, not considered in this paper. One can only emphasise that the problem is far from resolved, and the combined action of all possible chemical combinations at all levels of exposure is impossible to know or predict. Assessing doses from complex mixtures of chemicals by all possible media and all routes of exposure is extremely difficult to accomplish.

Exposure to mixtures is encountered in real conditions, and information is necessary for the management of the environment to protect the population's health. Thus, investigations involving a systematic approach to monitoring the health of the population and the environment are acquiring great significance. While such investigations will not provide all answers to many theoretical questions related to these problems, they will lay the basis for management of the quality of the environment.

Following a government decision, the USSR has introduced an automated state information system—"AGIS Health System"—which at present is functioning in 102 cities of the USSR (Korneev and Zaiconko, 1983; Korneev, 1984).

The system which is still in the developmental stage uses a series of data sources analysed by computer models. The objective is to characterise the effect of local pollution on health and environment to aid in the development

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of better monitoring procedures and better characterisation of the effects of pollution.

Three groups of factors or "subsystems" are used in the analysis. These include
(1) environmental pollution; (2) health; and (3) the composition of the population.

Pollution levels are determined from analysis of ambient air, drinking water and noise. Analyses of ambient air include SO_2, NO_2, CO, and suspended particulate matter. Where appropriate, relevant industrial contaminants were measured near industrial sites. Metals were included by the analysis of snow cover.

Districts which were designated as polluting or clean were selected in each city. A population of 25,000 to 30,000 is normally observed in each district. The cities under study range from 100,000 to 500,000.

A number of meteorological factors are included such as temperature, humidity, wind direction, velocity, and atmospheric pressure. District analyses on water pollutants are included in the data inputs including some analyses not regulated by local or national standards. Monthly inputs of such data were found sufficient.

Population health status was based on international classification of diseases, and morbidity was emphasised. Standard census and population data were used for the analysis of population composition.

Statistical analyses were undertaken involving a series of correlation studies using various data inputs. Eight inferences were included for which different statistical analyses were undertaken. The inferences included such factors as single contaminants acting independently, the concentration of each contaminant, the effect of several contaminants acting jointly assuming either no synergistic effects or the presence of synergistic effects, the use of linear or non-linear effects in relation to concentration, and several other variations. Taken together, they led to eight assumptions as to the possible interaction of pollution with health and/or environmental effects.

The eight conditional inferences were analysed in groups of four for possible correlation with health or environmental effects. Those inferences showing the highest correlation could then be regarded as most suitable for use as health or environmental indices and could be recommended for control purposes. These could also be used to formulate thresholds and the likelihood of synergism. They could also form the basis for placement of monitoring equipment and for control purposes. They may also provide the basis for developing concepts of permissible exposure levels and could aid in developing standards for the general environment.

These studies are continuing, and the findings will be revised as additional analyses are incorporated.

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