

INTRODUCTION

This compilation of analytical methods was prepared by the Working Group set up by SCOPE on "The Methodology of Determination of Toxic Substances in the Environment".

SCOPE was formed as a committee of ICSU, following a recommendation of an ad hoc committee set up by the latter. In its report, the ad hoc committee listed substances of importance in environmental problems. Another listing was given by the SCOPE Commission on Monitoring in their report entitled "Global Environmental Monitoring". In selecting which pollutants to consider, the Working Group has given special consideration to these listings, and during its discussions decided on the addition of other substances. It is recognized by the Working Group that the list of substances to be considered is by no means complete, but it was felt advisable to publish these at this juncture; and to follow these with supplements as necessary.

The range of substances covered by the methods chosen should not itself be taken as indicative of a need for a monitoring program, nor should it be assumed that a substance for which a method has been included is necessarily a pollutant. The sensitivity or limit of detection of the analytical methods described are not necessarily indicative of the toxicity of the substance being measured.

It is well known that some elements play a beneficial role in living organisms, and this in some instances is a matter of essentiality. At higher levels, the same elements may exert toxic effects, and there is need in all cases to establish precise dose-effect relationships to evaluate these regions. In addition, the ratio of concentration of one element to another may be of importance. The work of the Ecotoxicology Commission of SCOPE will have a direct bearing on these matters.

It is apparent that many methods have been published and used in the past for these substances. The Group was aware of other compilations of methods which are of interest in the same field and of the work, in some cases still in progress, of other national and international bodies in this connection. A considerable amount of information is available on experience of the extent of validity and shortcomings of the various methods. There is in fact a growing need for a wider discussion of these activities on a common basis, especially against a background of an increasing understanding of the extent of occurrence of the various compounds in the environment and of their significance with respect to environmental quality. This is of particular importance in view of the increased sensitivity and specificity of analytical methods now available and of the prospect that even greater sensitivities may yet be achieved. The number of individual organic substances which theoretically could be present, for example, increases enormously as these aspects of analysis are improved.

The Working Group has devoted a great deal of consideration to the mass of information available. The choices of the methods presented in this compilation, based on the considered opinion of the Working Group, have necessarily been somewhat arbitrary. Unless designated as reference methods, the procedures described should be regarded as offering guidance in the choice of methods rather than as mandatory procedures. Other methods, or variations of the same method, may be available. Although specific advice relating to the choice has in some cases been given indicating why certain methods should not be used, this should not be regarded as excluding all other variations where they can be shown to give equivalent results or better results in individual circumstances. For example where a good neutron activation facility is available, this may be suitable for the estimation of trace metals.

The methods described assume the availability of laboratory facilities and qualified analytical chemists. Where possible, attempts have been made to avoid the use of very expensive equipment normally found only in the largest laboratories. Wherever feasible, general purpose (utility) methods have been described as alternatives. These methods have good reliability and precision, but accuracy and degree of sensitivity may be somewhat less than with a reference method. Where feasible, methods have been described for some substances in different substrates. When using the methods indicated, it is assumed that the analyst will establish the normal criteria of satisfaction with respect to control and recovery experiments.

Sampling is a most important consideration and this is thoroughly recognized by all analysts. The details and the precautionary measures to be taken have been widely discussed and described elsewhere. For air analysis, the methods may be based on high or low volume sampling techniques or on high or low flow rates, according to program requirements. This is discussed in more detail in the methods concerned. The methods based on the ring oven technique are relatively new in practice but have proved themselves over years of research. The technique has the advantage of being simple, cheap and rapid. It is well suited for field studies and for use in laboratories where sophisticated equipment and highly specialized personnel are unavailable. It appears likely that this technique will be adapted to a wider range of application in the future, including the analysis of various substances in water. The methods described for traces of lead and cadmium in water can also be simply adapted for use in the estimation of traces of other elements such as zinc, copper, nickel, manganese, cobalt and beryllium.

The format recommended by the International Organization for Standardization has been used for the presentation of methods.