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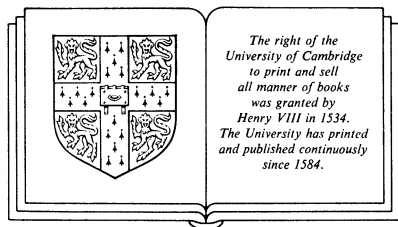
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RADIOACTIVE AEROSOLS



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PREFACE



Public interest in radioactive aerosols began in the mid-1950s, when world-wide fallout of fission products from bomb tests was first observed. The H-bomb test at Bikini Atoll in 1954 had tragic consequences for the Japanese fisherman, and the inhabitants of the Rongelap Atoll, who were in the path of the fallout. In 1957, radio-iodine and other fission products, released in the accident to the Windscale reactor, were tracked over much of Europe, and these events were repeated on a much larger scale after the Chernobyl accident.

Everyone learns from their mistakes, but, in the nuclear industry, it was also the policy from the start to anticipate trouble by calculating the probable consequences of exposure to radioactive materials. Various pathways of exposure had to be considered, including radiation from radioactive clouds and from fallout on the ground, activity inhaled and activity entering via food chains. Only very limited information was available from actual cases of exposure to radioactive aerosols, and this remains the position today. Almost the only epidemiological evidence is related to the exposure of workers in uranium and other mines to radon and its decay products, and much effort has been devoted to understanding the very difficult dosimetric problems which relate to this exposure. Within the last decade it has been realised that domestic exposure to radon, though lower by order of magnitude than that received by miners, is considerably the most important constituent of the population dose, the radiation dose multiplied by the number of persons receiving it.

Over the last 40 years, Harwell Laboratory has contributed in one way or another to the study of radioactive aerosols, both in its theoretical and practical aspects. Also, aerosols have been used experimentally, particularly in the study of the interaction between airborne gases or

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particles and the surfaces over which they travel. Transfer to surfaces across boundary layers, whether near the ground or in the human lung, is an essential part of the pathway of entry of aerosols into the human body, and the concepts are relevant to other problems.

The first five chapters of this book are about radioactive nuclides of potential concern to public health. In the sixth chapter, some applications to the study of boundary layer transport are discussed. In the last chapter examples are given of using radioactive aerosols to study deposition of particles in the lung and the subsequent uptake into the body. The widespread dissemination of lead aerosol from motor exhausts, its inhalation by the public, and fallout onto crops, present problems of analysis not dissimilar to those of radioactive emissions. Experiments in which volunteers inhaled motor exhaust labelled with ^{203}Pb provided one piece of evidence to fit into the picture.

Some subjects, for example the movement of radioactive particles in the earth's atmosphere and the resulting patterns of fallout are not discussed, being adequately covered in other texts.

No attempt is made to summarise the findings of the International Commission on Radiological Protection, or the reports of the National Radiological Protection Board, except in a few instances where they are directly relevant to the subject under discussion.

There is inevitably a bias towards work done at Harwell. One of the objects of this book is to relate the Harwell work to that done elsewhere and to indicate the recent developments. I am greatly indebted to my colleagues for their help in writing this account.

Many lessons were learnt during the period 1955–1965 by analysis of dispersion and fallout from bomb tests and also from the Windscale accident, but some of these had been forgotten by 1986 when the Chernobyl accident happened, so no apology is made for describing some work which is now 30 years old.

March 1990

A. C. Chamberlain