COMMISSION OF THE EUROPEAN COMMUNITIES

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Biology, Radiation Protection
and Medical Research

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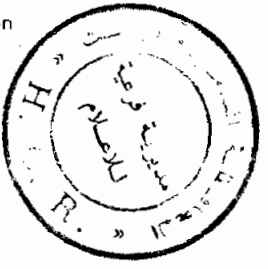

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RADIATION PROTECTION
PROGRAMME 1980 – 1984

Research priorities
and
Scientific Documentation

October 1979

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PREFACE

The Commission of the European Community has prepared a new multiannual research programme in the field of Biology - Health Protection concerning radiation protection and covering the period 1980-1984. This programme proposal has been elaborated in close collaboration with the Advisory Committee on Programme Management "Biology - Health Protection". It has been based on an evaluation of results from the current Radiation Protection Programme, on discussions in study group meetings, on numerous individual contacts with experts and on an analysis of recent publications. Evolution in radiation protection and its concepts has proved the validity of the work undertaken and emphasizes inter alia the importance of risk assessment and of investigations into quantification of effects.

The first part of this booklet contains the official proposal for the framework of the scientific programme as it was transmitted from the Commission to the Council of Ministers. It underlines the priorities derived from the present and foreseeable needs in radiation protection. In order to provide an overall view the research priorities have been grouped into six major sectors : radiation dosimetry and its interpretation, behaviour and control of radionuclides in the environment, short-term somatic, late somatic and genetic effects of ionizing radiation and evaluation of radiation risks.

The second part presents a documentation which is the outcome of the various ways in which the Commission has worked with the scientific community and assembled its views and opinions. As it is published here it should give a detailed insight into the aims of the new Community Radiation Protection Programme and help interested institutions and scientists to prepare research projects and to improve joint planning and coordination. The contributions from each of the scientific areas are presented differently but this in no way reflects priorities as between the various sectors.

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BIOLOGY AND HEALTH PROTECTION

Radiation Protection Programme

Proposed Research Activities 1980 - 1984

Excerpt from the proposal of the Commission
to the Council (doc. COM(79) 158 final)

(Original version written in English)

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The Radiation Protection Programme Proposal 1980-1984

Proposed research activities

The proposed Radiation Protection Programme of the Community endeavours, through a co-operative European effort, to increase knowledge in radiation protection while taking into account particular problems and skills available in Europe.

The programme will consist of six major activities or sectors which - arbitrarily but conveniently - serve to indicate its overall structure*:

- radiation dosimetry and its interpretation,
- behaviour and control of radionuclides in the environment,
- short-term somatic effects of ionizing radiation,
- late somatic effects of ionizing radiation,
- genetic effects of ionizing radiation,
- evaluation of radiation risks.

The information obtained from previous Commission research programmes and from research conducted elsewhere in the world in comparable fields has been examined, the present state of knowledge reviewed, especially as presented in the UNSCEAR report, future needs for practical protection measures and guidelines have been designed and the necessary research subjects identified.

The programme proposed by the Commission is based on foreseeable requirements of radiation protection in the Community and on the updating and adaptation of the activities already in progress, in the light of the expected development of nuclear facilities and other sources of ionizing radiation and of their possible effects on man and the environment. It is necessary to stimulate research on various subjects which are of crucial importance for the future and proposals to this effect are outlined in the following pages.

* No such subdivision can adequately define the complex scientific content of a balanced radiation protection programme. There is an apparent overlapping between sectors and there are subjects related to all or several of the sectors. Dosimetry, for example, is a basic requirement for all sectors, synergistic effects are observed under many different conditions and the problems of low doses or low dose rates, as well as of the fundamental mechanisms of the observed effects or the need for epidemiological studies manifest themselves in several sectors.

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1. Radiation dosimetry and its interpretation

Application of regulations for radiation protection and research on effects of ionizing radiation can only be carried out properly if it is possible to determine absorbed dose and/or other exposure parameters and interpret them in terms of biological effects and the risks to which they give rise. Furthermore the directives of Euratom on Basic Standards require the measurement and recording of certain exposure data which should be carried out in a comparable manner within the Community. Thus the following subjects require further investigation in support of the Radiation Protection Programme as a whole.

- Physical aspects of radiation effectiveness (Microdosimetry)

Biological effects of ionizing radiation are dependent on different irradiation parameters, especially on the radiation quality, interpreted as the spatial and temporal distributions of radiation energy absorption and transfer to biological tissues, the distribution of energy deposition within sensitive sites, as well as the immediate biochemical effects. Despite the considerable progress made in the acquisition of the necessary physical data, more detailed investigations are required to establish convincing relationships between the form of radiation interaction and the dose-effect curves for external radiation and incorporated radio-nuclei. Microdosimetric research on tumour induction and defects of organ function should be able to contribute to the solution of such urgent problems in radiation protection as whether the relative risks from low doses and dose rates of both low and high-LET-radiations have been over or under-estimated, and any changes needed in Quality Factors, with all the impact that such changes might have on shielding design and personal dosimetry.

- Internal dosimetry

Research is needed to develop further quantitative methods to assess the effective radiation dose in the case of incorporation of radioactive isotopes such as tritium and the transuranic elements and the inhalation of radioactive aerosols. The

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improvement of dosimetric models used by ICRP for the lung, the gut and the bone, estimation of lung and body content of alpha-emitting radionuclides by whole body counter and excretion measurements respectively, and effects of labelled DNA precursors in the cell nucleus are of particular relevance for radiological protection.

- Dosimetry in case of external irradiation

External irradiation usually gives rise to quite inhomogeneous dose distributions or to partial body irradiation making it sometimes difficult to establish the dose in irradiated organs or tissues under risk. Therefore physical methods have to be improved in order to relate field characteristics of external radiation, such as exposure and quality and differences in tissue densities, more accurately to the organ dose.

- Personal dosimetry and area monitoring

Following the recommendations in recent ICRP publications the revision of radiation protection standards needs to be backed up by research into methods aimed at applying and evaluating these recommendations. The introduction of the effective dose equivalent and the dose equivalent index means that existing measuring methods have to be adapted and conversion factors and functions have to be theoretically and experimentally established for the different quantities, especially as regards instrument calibration.

There are various ways of carrying out personal dosimetry in the individual countries. An analysis will be made of parameters such as internal and external irradiation, contamination, incorporation and excretion which must be determined, in order to make decisions on risk estimates both for acute and chronic exposures and therapeutic measures. Measuring methods will be developed and coordinated. Research is required on protection standards for beta-particles and on the information needed for this purpose. Information from intercomparison programmes and field studies will complement the research results.

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- Dosimetry of high-LET-radiation and neutrons

  Concerted support is presently necessary to achieve data on high-LET-radiations including neutrons of selected energies of practical importance. Although many physical data and measuring methods for neutrons have been published or elaborated in recent years, completely satisfactory methods in personal neutron dosimetry as well as for neutron and high-LET-dosimetry for radiobiological experiments have yet to be devised. One problem will certainly be to collect and evaluate data that will enable a general consensus to be reached on neutron dosimetry itself. In this area also intercomparisons require a continuing effort, since those which have been carried out have revealed unexpected discrepancies in dosimetry procedures and accuracy.

A programme of continuing development and adaptation for all dosimetric methods - as has taken place in the past - is required to deal with changing needs of radiation protection. For this, some flexibility of approach is needed to tackle mission oriented problems or to carry out exploratory studies of actual needs, or to develop new instruments, thus guaranteeing flexibility and capability for innovation in the future.

- One such problem will be environmental dosimetry. A more realistic estimate should be made of the dose to the public resulting from natural radioactivity and enhanced natural exposure. This forms part of the proper assessment of the risk from man-made radiation sources.

- Another problem of increasing concern is exposure in medical diagnosis. This makes the greatest contribution of any man-made radiation source to the general population. Dosimetric research will aim at reducing the non-essential dose from this exposure while maintaining the quality of the diagnostic information. It will also examine the usefulness of such data for epidemiological studies of radiation effects.

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- Still another problem is the possibility of using biological dosimetry for accidents to provide important additional information on the effective dose received. Unfortunately these methods have not proved entirely sufficient in certain accidental situations. Research is needed on the improvement of reliable biological dosimetric methods and on the influence of a wide range of dose rates and non-uniform spatial dose distributions on the biological indicators.

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