COMMISSION OF THE EUROPEAN COMMUNITIES

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Report on the Radiation Protection Programme

This report has been established in application of Article 4 of the Council Decision of 15 March 1976 adopting a research and training programme (1976 to 1980) for the European Atomic Energy Community in the field of biology - health protection (radiation protection programme).

REPORT ON THE RADIATION PROTECTION PROGRAMME

1. Introduction

On March 15, 1976, the Council adopted a research and training programme for the European Atomic Energy Community in the field of biology - health protection (Radiation protection programme 1976-80).

Article 4 of the decision reads as follows : "The Commission shall be responsible for the continuous supervision of the implementation of the programme in order to ensure that real coordination has been achieved and to decide whether developments in the situation or unforeseen research results necessitate changes to the programme. To this end it will report to the Council and to the European Parliament at the end of the second year of the programme and will propose, where appropriate, any amendments necessary".

The present report is intended to comply with this article.

2. The Radiation Protection programme of Euratom

2.1. Objectives

The preparation of basic safety standards for protection against ionizing radiations is one of the tasks incumbent on the Commission pursuant to the Euratom Treaty. The foreseeable increase in the use of energy of nuclear origin, including the probable use of thermo-nuclear fusion in a more distant future, the handling of waste, effluent and fuels throughout their cycles and the various uses of ionizing radiation and radioisotopes, are all factors calling for adequate prevention and control measures.

The role of this scientific research programme is to supply sufficient information to contribute to the shaping of appropriate decisions on issues about which public opinion has become very sensitive. Therefore, the radiation protection programme of the Community is designed to gain adequate understanding and control of the possible radiation hazards encountered, with two main objectives :

- improvement of scientific and technical knowledge with a view to

laying down radiation protection standards and guaranteeing adequate protection for workers and the general public;

- evaluation of the biological and ecological consequences of nuclear activities and of the use of nuclear energy and ionizing radiation, in order to ensure an adequate protection of man and the various components of the environment.

2.2. Problems and results

2.2.1. Historically radiation protection research has started to occupy the attention of experts when three-quarters of a century ago, the pioneers of ionizing radiations, medical doctors and scientists without a sufficient knowledge of radiation hazards, encountered serious and unforeseen consequences. It was then owing to a steady build-up of radiobiological research results that the first procedures for radiation protection were adopted half a century ago. Among those who benefitted from this newly acquired knowledge were the patients who had to undergo medical radiation diagnosis and treatment. During the last twenty five years, legislation on radiation protection has been continuously amended according to the improved knowledge of the effects of ionizing radiations and radioisotopes.

The Radiation Protection programme of the Community endeavours, through a co-operative European effort, to increase our knowledge while taking into account particular problems and competences existing in Europe, as well as research carried out elsewhere in the world.

The programme is divided into six sectors which arbitrarily - but conveniently - serve to indicate its overall structure. They are :

- the radioactive contamination of the environment,
- the hereditary effects of ionizing radiation,
- the short-term somatic effects of ionizing radiation,
- the long-term somatic effects of ionizing radiation,
- radiation measurement and its interpretation, personnel dosimetry,
- assessment of radiation hazards.

2.2.2. It is impossible to give in the present report a comprehensive review of the results obtained in the programme. Nevertheless, a few recent achievements with an evident practical importance can be outlined as examples :

- The importance of plutonium behaviour and radiotoxicity is well known and has been given much attention. The "resuspension" and "inhalation" pathways still require further study. If released into the environment, plutonium does not seem to pass up easily through the various stages of food chains, and is not readily taken up from them by humans. Americium, curium and other transuranic elements could well behave differently in this respect however and be important as far as ingestion is concerned.

- The importance of tritium is emphasised by its increased use in industries, its considerable production in some fission reactors, and by the possible future operation of fusion machines, which will contain a very large inventory of this isotope.

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The way tritium distributes in the environment and its biological effects have been studied in order to keep dose commitments and effects under control. Nevertheless, there are still certain problems of dose commitment related to particular pathways and of long-term effects of tritium as well as other radionuclides incorporated in living matter which deserve to be studied.

- There are some experimental clues about a possible synergism between radiation and chemicals which are not usually carcinogenic. These combined effects seem to be higher than those of radiation alone, dependent on the dose level of radiation and the concentration of the chemicals. This finding is important enough to stimulate further research.

- A fast neutron dose as low as 0,1 rad induces a statistically significant increase in the development of mammary tumours in rats. This was shown by a refined statistical analysis of experimental data. The relative biological effectiveness (RBE) of these neutrons seems to be much higher at low doses than assumed hitherto. At higher doses, the RBE decreases to the values already known as is consistant with a theory of dual radiation action.

- The molecular basis of sensitivity and repair of the genetic material has been determined on lower forms of life. Through the isolation and characterization of several human cell mutants, a fuller understanding of the ways in which the human cell deals with radio-induced heritable damage has been achieved.

- Techniques have been developed which allow the localization of DNA repair genes in man through the transfer of human chromosomes in Chinese hamster cells and in human - Chinese hamster hybrid cells.

- The damage induced in human ovaries have been evaluated in individuals who received therapeutical irradiation for abdominal tumours.

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- The role of several factors, including type of radiation and environmental circumstances during irradiation, on the rate of induction of genetic damage has been studied. The occurence of an additional chromosome in humans leads to disorders specific to the identity of the additional chromosome present, which may be the origin of considerable social hardship. The manner through which irradiation induces such a phenomenon is being explored in experimental animals and the dose-response relationship after X-irradiation has been established for anomalies in the distribution of the sex-chromosome in mammalian germ cells.

- Co-operative research in radiation protection depends largely on the success of standardization of experimental methods and materials. Therefore dosimetric intercomparisons have been carried out in various ways e.g. on personnel dosimeters as well as on X-ray dosimeters and recently with neutrons. All of these intercomparisons have revealed quite a number of imperfections in experimental arrangements and their execution has induced a considerable improvement in research procedures, and increased the reliability of the measurements.

- A similar effort but adapted specially to late effects research has been promoted within EULEP (European Late Effects Project Group) first for dosimetry, then for the handling of laboratory animals, and finally for the interpretation of pathological observations. For different observers, the microscopic examination of the same tissue may, in certain cases, yield different conclusions. However, when the question is raised to know, for example, if a given dose of radiation produces in animals a certain percentage of mammary tumours, it is essential that in Munich, in London, in Paris or in Brussels, one is dealing with the same dose of radiation, given to similar animals, treated in the same way and observed according to the same criteria.

- After total body irradiation at relatively high dose, the stem cells of the hemapoïetic system are the first to show severe damage. These cells are the precursors of the red blood cells, the platelets and the white blood cells which are responsible respectively for the transport of oxygen, the coagulation of the blood and the

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defence against infection. In man, the stem cells are present in the bone marow. In principle, the transplantation of a certain amount of marrow from a healthy donor should cure the heavily irradiated individual. In practice however, this procedure presents many difficulties which are progressively being overcome by a continuous research effort. For example, the donor and the acceptor need to be genetically as close as possible; otherwise, the transplanted marrow reacts against the recipient and might even kill him. Noticeable progress has now been achieved in selecting the donor and in mitigating the "graft versus host" reaction.

The Community research programme is sufficiently flexible to be adapted continuously to new developments and results such as those listed above. Whenever necessary, they can be taken up through reorientation of ongoing research or inclusion in the programme.

3. Implementation

Radiation protection research presents a great number of different scientific aspects. Throughout the member states there are research groups which have particular and specific competences in that area. On the other hand, as resources are indeed limited, co-operative action and an organized distribution of tasks are imperative. Therefore, since the very beginning of the programme, the Commission has endeavoured to initiate co-operation with the appropriate national institutes on work concerning the various focal points of the programme. The results of these efforts are evidenced by the fact that about all (18) national research institutions active in this field and 50 university institutes are to be found among the Commission's contract partners.

About 500 scientists (*) are currently participating in the work on over 230 projects, obtaining a coherent picture of problems in radiation protection. The appropriate means for its execution are the cost-shared contracts, which the Commission has concluded with universities (49 contracts), national research institutions and radiobiological institutes of nuclear centers (57 contracts) and

(*) 500 full-time and part-time scientists, corresponding to 270 scientists/year.

with other scientific organisations, including also group contracts with several institutes (16 contracts). Furthermore the Commission's Biology group at Ispra is directly involved in the programme. (Appendix 1).

The overall cost of this work in 1977 is 16 million u.a. in which the Commission participates with a share of about 35 %. When compared with the total expenditures of the member states in radiation protection research estimated for 1977 at 60 to 70 million u.a., these 16 million u.a. spent on research covered by the Commission's programme represent a significant and important part.

4. Coordination

During the preceding programmes scientific co-operation between the contractual partners has been established, which has substantially improved the potential of each of them. Coherence and coordination of their activities have been pursued through several means : - the Advisory Committee on Programme Management "Radiation Protection" (ACPM), - regular meetings of study groups and experts on all major subjects, - the organization of seminars and the activity of the Commission's services.

The ACPM, with its 4 meetings in 1976/77 has advised on the conduct of the programme, and ensured a close liaison with the corresponding research and development work carried out in the member states. The best possible implementation is a main concern of the ACPM when it evaluates research proposals and advises about their integration into the programme and the selection of laboratories to which the work is to be entrusted. Results achieved are examined annually when the Commission presents the Annual Progress Report on "Radiation Protection" summarising the results of all contracts and of the Biology group at Ispra. Future guidelines or reorientations of contracts are proposed when discussing the work programme of each coming year. Evidently, owing to the national status of its members, the ACPM exercises directly its influence on the execution of the Commission's Radiation Protection programme and indirectly on those of the member states.

The basis for the preparation of decisions are the results of study groups and experts opinion. About 40 study groups, steering committees and other meetings, with more than 1000 participants, take place every year.

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The relations and contacts with scientists and institutes involved in radiation protection research have also achieved a de facto coordination of much of the research in which the Community does not participate financially.

5. Utilisation and dissemination of results

The scientific research results of the European Communities' Radiation Protection programme are available to all participants, member states and scientists. They are used by the Commission in establishing "basic safety standards for the health protection of the general public and workers against dangers of ionising radiation" for the Community*), on which are based the corresponding laws of the member states. On the international level, they play their role in the formulation of recommendations by ICRP**), or they are used in the compilation and evaluation of the latest data which provide a world-wide information basis for radiation protection (UNSCEAR***).

The results themselves are presented in articles published in scientific journals, in Euratom reports, in monographs issued by the Commission, and in the proceedings of symposia and seminars. More than 400 such publications have been produced in 1976. Such a high number of publications in itself stimulates a continuous coordinative effect.

6. Budgetary situation

Two factors could strongly influence the budgetary situation of the programme : the future introduction of the European unit of account and the application of estimates of gross staff expenditure.

Both are procedures which could not be taken into account when the programme was presented in 1975. They change the calculation basis of several budgetary items of the programme without being linked to the programme itself or without being open to influence by appropriate actions of contractors and Commission's services. The Commission will therefore evaluate their influence on the budget of the programme and propose, if necessary, adaptations of the estimated expenditures with the presentation of the 1979 budget.

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*) OJ n° L 187, 12/7/1976, p. 1-44
**) International Commission on Radiological Protection
***) United Nations Scientific Committee on the Effects of Atomic Radiation

7. Conclusions

The scientific content of the programme is well balanced as between its different components (listed under 2.2.1.). Contractual relations have been established with more or less all institutes actively working in radiation protection research. Thus a considerable direct and indirect coordinative influence on the overall activities in radiation protection in the Community is ensured.

- The ACPM advises the Commission effectively in the implementation of the programme, supervises the progress being made, supports coordination efforts and proposes - where appropriate - adaptations to scientific progress and changing situations.

- The continued execution of the programme according to the Council decision will provide scientific knowledge enabling the "Safety Standards" to be adapted to progress and experience, and providing authorities empowered to take decisions with up-to-date scientific information on radiation protection problems, which are ones on which public opinion is particularly sensitive.

- No amendment of the general scientific scope of the programme is therefore necessary.

- The possible influence of administrative and other procedures on the budget will be evaluated. It might necessitate adaptations to be proposed in the 1979 budget to eliminate their influence on the execution of the contractual programme.

APPENDIX 1

List of research contracts classified as regards

- the sectors of the programme
- and the detailed research subjects.

1. Dosimetrie
   Dosimetry
   Dosimétrie

	Microdosimetry, RBE radiation quality	Neutron dosimetry	Measurement devices	Basic dosimetry data	Standardization, intercomparisons	Personnel dosimetry and monitoring
TNO, Rijswijk (Barendsen/Broerse)	x	x	-	-	-	-
Univ. Toulouse (Blanc)	x	-	-	x	-	-
GSF, Neuherberg (Jacobi/Burger)	x	x	-	x	-	-
Univ. Strasbourg (Rechenmann)	-	-	-	x	-	-
Univ. Homburg (Muth/Grillmaier)	x	x	-	-	-	-
NRPB, Harwell (Dolphin)	-	x	x	x	-	-
CEGB, Berkeley (Wheatley)	-	x	-	-	-	-
NPL, Teddington (Lewis)	-	x	x	-	-	-
CEA, CEN Fontenay-aux-Roses (Parmentier)	x	-	-	x	-	-
KFA, Jülich (Feinendegen)	x	x	-	x	-	-
CNEN, CSN Casaccia (Silini)	x	-	-	-	-	-
Univ. Würzburg (Kellerer)	x	-	-	-	-	-
PTB, Braunschweig (Reich)	-	-	-	x	-	-
Univ. Dundee (Watt)	-	-	-	x	-	-
CEA, CEN Grenoble (De Choudens)	x	x	-	-	-	-
Univ. Aberdeen (Mallard)	-	-	x	-	-	-
CENDOS (Broerse et al.)	x	x	x	x	x	-
ICRU (Wyckoff)	x	x	x	x	x	x
ITAL, Wageningen (Sybenga)	-	-	x	-	x	-
AERE, Harwell (Peirson)	x	x	-	x	-	-
EULEP (Duplan et al.)	-	-	-	-	x	-
CNEN, Bologna (Busuoli)	-	-	-	-	-	x
GSF, Neuherberg (Jacobi/Burger)	-	-	-	-	-	x
Univ. Toulouse (Blanc)	-	-	-	-	-	x
AERE, Harwell (Peirson)	-	-	-	-	-	x
CEGB, Berkeley (Wheatley)	-	-	-	-	-	x
CEA, CEN Fontenay-aux-Roses (Portal)	-	-	-	-	-	x
PTB, Braunschweig (Wagner)	-	-	-	-	-	x
KFA, Jülich (Heinzelmann)	-	-	-	-	-	x

2. Radioaktive Kontamination der Umwelt
Radioactive contamination of the environment
Contamination radioactive du milieu

	Marine Environment			Terrestrial Environment				
		Temperate Ecosystems			Terrestrial Ecosystems			
	Mediterranean Ecosystem	Irish sea	Elcagrain Bay	Freshwater Ecosystems	Tritium + Carbon	Plutonium	Iodine	Other Radio-nuclides
CNEN, Fiascherino (Brondi)	x	-	-	-	-	-	-	-
MAFF, Lowestoft (Mitchell)	-	x	-	-	-	-	-	-
Univ. Nantes/CEA La Hague (Pieri)	-	-	x	-	-	-	-	-
ITAL, Wageningen (Sybenga)	-	-	-	x	-	x	-	x
Inst. d'Hygiène et D'Epidémiologie Bruxelles (Cantillon)	-	-	-	x	-	-	-	-
CEA,CEN Fontenay-aux-Roses (Bovard)	-	-	-	-	x	-	-	-
CEN, Mol (Kirchmann)	-	-	-	-	x	-	-	-
Landbouw Hogeschool, Wageningen (van den Hoek)	-	-	-	-	x	-	-	-
AERE, Harwell (Chamberlain)	-	-	-	-	x	-	-	-
Bundesgesundheitsamt, Berlin (Stieve)	-	-	-	x	x	-	-	-
CEA, CEN Cadarache (Grauby)	-	-	-	-	-	x	-	-
GSF, Hannover (Kühn)	-	-	-	-	-	-	x	-
AERE, Harwell (Chamberlain)	-	-	-	-	-	x	-	-
Univ. Louvain (Myttenaere)	-	-	-	-	-	x	x	x

3. Genetische Wirkungen ionisierender Strahlen
Hereditary effects of ionizing radiations
Effets héréditaires des rayonnements ionisants

	Biochemistry and genetics of repair and sensitivity		Nature and origin of genetic damages in eukaryotes			Meiosis and damages to mammalian reproductive tissue and embryos	Parameters affecting dose-effects relations	Low doses
	Micro-organisms	Cultured cells, tissues	Mutations	Non-disjunction	Struct. chr. aberrations			
Univ. Aarhus (Marcker)	x	-	-	-	-	-	-	-
TNO/RU Leiden (Rörsch)	x	x	x	-	-	-	-	-
TNO/RU Leiden (Sobels)	-	-	x	x	x	-	x	-
TNO/RU Leiden (van der Eb)	x	x	x	-	-	-	-	-
TNO/RU Leiden (van der Eb)	x	x	x	-	-	-	-	-
Univ. Bruxelles (Brachet)	x	-	x	-	x	x	-	-
Univ. Dublin (Winder)	x	-	-	-	-	-	-	-
Univ. Galway (Houghton)	-	-	-	-	-	-	-	-
Univ. Galway (Houghton)	-	-	-	x	-	-	-	-
Univ. Rotterdam (Bootsma)	-	-	-	-	x	-	-	-
Univ. Leiden (Simons)	-	-	-	-	-	-	-	-
TNO, Rijswijk (Lohman)	-	-	-	-	-	-	-	-
MRC, Brighton (Bridges/Arlett)	x	x	x	-	-	-	-	-
Univ. Swansea (Parry)	x	-	-	x	-	-	-	-
Univ. Pisa (Loprieno)	x	-	-	-	-	-	-	-
Univ. Milano (Magni)	x	-	x	-	x	-	-	-
Fond. Curie, Paris (Latarjet)	x	-	x	-	-	-	-	-
NRPB, Harwell (Dolphin)	-	x	-	-	x	x	x	x
AERE, Harwell (Peirson)	-	-	-	-	-	-	-	-
Univ. Pavia (Fraccaro)	-	x	-	-	-	x	-	-
INRA, Dijon (Dalebroux)	-	-	-	-	-	-	-	-

	Biochemistry and genetics of repair and sensitivity		Nature and origin of genetic damages in eukaryotes			Meiosis and damages to mammalian reproductive tissue and embryos	Parameters affecting dose-effects relations	Low doses
	Micro-organisms	Cultured cells, tissues	Mutations	Non-disjunction	Struct. chr. aberrations			
Univ. Toulouse (Delpoux)	-	-	-	-	-	-	-	x
CEN, Mol (Leonard)	-	-	-	-	-	-	-	x
CEN, Mol (Maisin)	-	-	-	-	x	x	x	-
Carlsberg Lab., Copenhagen (von Wettstein)	-	-	-	x	-	x	-	-
Finsen Institute, Copenhagen (Faber)	-	-	-	-	-	x	-	-
Univ. Roma (Fasella/Whitehead)	x	-	-	-	-	-	-	-
PCL, London (Holt)	-	-	x	x	x	-	x	-
Techno. Dublin (Taaffe/Malone)	-	x	-	-	-	-	x	x
Univ. Bruxelles (Radman)	x	x	-	-	-	-	-	-
Univ. Pavia (Falaschi)	-	x	-	-	-	-	-	-
CNRS, Gif-sur-Yvette (Devoret)	x	-	-	-	-	-	-	-
CNRS, Gif-sur-Yvette (Anagnostopoulos)	x	-	-	-	-	-	-	-
Univ. Roma (Olivieri)	-	-	-	-	x	-	x	-
Univ. Göttingen (Hansmann)	-	-	-	x	x	x	-	-
GSF, Frankfurt (Pohlit)	x	-	-	-	-	-	-	-
Univ. Louvain (Goffeau)	x	-	-	-	-	-	-	-
ITAL, Wageningen (Sybenga)	-	-	-	-	x	-	x	x
MRC, Harwell (Vennart)	x	-	-	-	-	-	x	-
CEA, Fontenay-aux-Roses (Lacourly)	-	-	-	-	-	-	x	-
ENEL, Roma (Farulla)	-	-	-	-	x	-	-	x
Biology Group Ispra (Devreux)	-	x	x	-	-	-	-	x

4. Kurzzeitwirkungen ionisierender Strahlen
Short-term effects of ionizing radiations
Effets à court terme des rayonnements ionisants

	Primary effects on DNA - constituents	Evaluation of early somatic effects	Treatment of radiation injury: Bone marrow transplantation	Treatment of radiation injury: Other	Immunological aspects
Cl. Bernard, Paris (Mathé)	-	x	x	-	x
M. Negri, Milano (Garattini/Spreafico)	-	x	-	x	x
Univ. Ulm (Fliedner)	-	x	-	x	-
TNO, Rijswijck (van Bekkum)	-	-	x	-	x
Univ. Bruxelles (Tagnon/Stryckmans)	-	x	x	x	-
GSF, München (Thierfelder)	-	x	x	-	x
Univ. Dublin (Mullins/Greally)	-	-	x	-	x
CNEN, CSN Casaccia (Doria)	-	-	-	-	x
Univ. Bruxelles (Dumont)	-	-	-	x	-
Univ. Louvain (Bazin)	-	-	-	x	x
Univ. Firenze (Becciolini)	-	x	-	-	-
Univ. Regensburg (Hüttermann)	x	-	-	-	-
Univ. Giessen (Lohmann)	x	-	-	-	-
MPI, Mülheim (Schulte-Frohlinde/von Sonntag)	x	-	-	-	-
Univ. Newcastle (Scholes/Garner)	x	-	-	-	-
CEA, CEN Grenoble (Téoule)	x	-	-	-	-
Primary effects (Cramp et al.)	x	-	-	-	-
Univ. Homburg (Muth/Grillmaier)	x	-	-	-	-
KFA, Jülich (Feinendegen)	x	-	-	-	-
Univ. Bruxelles (Brachet)	x	-	-	-	x
GSF, Neuherberg (Gössner/Hug)	-	x	-	-	-
Univ. London (Lindop)	-	x	-	-	-
MRC, Harwell (Vennart)	x	-	-	-	-
Univ. Copenhagen (Danø)	-	x	-	-	-

5. Langzeitwirkungen ionisierender Strahlen
Long-term effects of ionizing radiations
Effets à long terme des rayonnements ionisants

	Carcinogenesis	Other effects	Combined effects	Distribution, metabolism and decorporation of radionuclides	Dose-effect relationship	Radiation exposure in medical diagnostic procedures	
						Radio-isotopes	X-rays
EULEP (Duplan et al.)	x	x	-	-	-	-	-
CEN, Mol (Maisin)	x	-	-	-	-	-	-
GSF, Neuherberg (Gössner/Hug)	x	-	-	-	-	-	-
DKFZ, Heidelberg (Scheer)	x	-	-	-	-	-	-
NRPB, Harwell (Dolphin)	x	-	-	-	-	-	-
NRPB, Harwell (Dolphin)	x	-	-	-	-	-	-
AERE, Harwell (Chamberlain)	x	-	-	-	-	-	-
CNEN, CSN Casaccia (Clemente)	x	-	-	-	-	-	-
AERE, Harwell (Morgan)	x	-	-	-	-	-	-
CNEN, Bologna (Prodi)	x	-	-	-	-	-	-
Univ. London (Lindop)	x	-	-	-	-	-	-
PCL, London (Simmons)	x	-	-	-	-	-	-
MRC, Harwell (Vennart)	x	-	-	-	-	-	-
ENEL, Roma (Farulla)	x	-	-	-	-	-	-
Fond. Bergonié, Bordeaux (Duplan)	x	-	-	-	-	-	-
CEN, Mol (Maisin)	x	-	-	-	-	-	-
Univ. Copenhagen (Danø)	x	-	-	-	-	-	-
Univ. Copenhagen (Ebbesen)	x	-	-	-	-	-	-
TNO, Rijswijk (Broerse/Barendsen)	x	-	-	-	-	-	-
GSF, Neuherberg (Kriegel)	x	-	-	-	-	-	-
CEN, Mol (Vanderborght)	x	-	-	-	-	-	-
MRC, London (Jones)	x	-	-	-	-	-	-
Univ. Pisa (Donato)	x	-	-	-	-	-	-
Univ. Erlangen (Pauly)	x	-	-	-	-	-	-
GSF, Neuherberg (Drexler)	x	-	-	-	-	-	-
AERE, Harwell (Peirson)	x	-	-	-	-	-	-
TNO, Rijswijk (Barendsen/Broerse)	x	-	-	-	-	-	-
KFA, Jülich (Feinendegen)	x	-	-	-	-	-	-
Univ. Würzburg (Kellerer)	x	-	-	-	-	-	-
Univ. Leiden (van der Eb)	x	-	-	-	-	-	-
Finsen Institute, Copenhagen (Faber)	x	-	-	-	-	-	-
Techno. Dublin (Taafe/Malone)	x	-	-	-	-	-	-
CEA-CEN Fontenay-aux-Roses (Lacourly)	x	-	-	-	-	-	-

6. Abschätzung des Strahlenrisikos
Evaluation of radiation risks
Evaluation des risques d'irradiation

CEA, CEN Fontenay-aux-Roses (Lacourly)
ICRP (Sowby)
GSF, Neuherberg (Gössner/Hug)
DKFZ, Heidelberg (Scheer)
ENEL, Roma (Farulla)

Evaluation of radiation risks			
Environmental irradiation	External irradiation	Internal irradiation	Epidemiological studies
x	x	x	x
-	x	x	-
-	x	x	x
x	x	-	x

APPENDIX 2

Opinion of the Advisory Committee on Programme Management - Radiation Protection

Having regard to the Council Decision of 15 March 1976 adopting a research and training programme on Radiation Protection (OJ No L 74 of 20 March 1976, p. 32), and in particular Article 4 concerning amendments to it, the Advisory Committee on Programme Management (ACPM) :

1. examined in detail at its meeting on 16-18 May and 14 November 1977 the progress and execution of the work,

2. considers that the programme has been carried out satisfactorily and in full agreement with the ACPM,

3. considers that the projects defined in Annex I of the programme approved by the Council should be continued and that, within the limits of the available resources, they adequately cover the field of research necessary for an objective evaluation of the effects and hazards of ionizing radiation with regard to man and his environment,

4. expresses its unanimous agreement with the conclusions of this report.

Done at Brussels, 14 November 1977

M. Faber
Chairman of the ACPM
Radiation Protection