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Radiobiological Network for Radiological Protection (NET-EULEP)

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Final report (summary)

Work performed as part of the European Atomic Energy Community's research and training programme in the field of nuclear energy 1998-2002 (Fifth Framework Programme)
Generic research in radiological sciences

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Project coordinator

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Project partners

National Radiological Protection Board (UK)

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Objectives

WP1

Research into non-deterministic health effects of ionising radiation are conducted in a very fragmented manner at the national level. Reduction in funding, ageing of the scientific community as well as political considerations have all contributed to a decline in European competence and competitiveness. The Euratom-funded research on radiation biology has alleviated this situation, but it is recognised that the maximum impact of this work can only be realised by the optimal integration with other research efforts from the scientific community. The NET-EULEP contract was established to serve as a transnational coordinator of Euratom work within the European Research Area. Through a series of seminars, workshops and EULEP publications the goal of WP1 is to provide a forum for discussion, dissemination and cooperation in the field of radiation carcinogenesis and DNA repair.

WP2

The objective of this work package was to provide a platform to bring together researchers, working in the various EU consortia and non-EU supported research relating to mechanisms and models of radiation-induced cancer at low dose, to foster interactions to improve understanding of mechanisms of radiation-induced cancer, to disseminate the achievements of the research to the larger international audience, and to promote the use of the results to practical applications for radiation protection.

WP3

For radiobiological studies within the framework of radiation protection and health in the EU a standardisation of experimental techniques such as dosimetry is a prerequisite as recognised by the members of Work Package 3. In the past, dosimetry inter-comparisons for whole-body irradiation of mice by members of WP3 revealed unexpected discrepancies. These could often be resolved, resulting in revised dosimetry. The ninth dosimetry inter-comparison for whole-body irradiation of mice has been planned. The EULEP-EURADOS protocol for X-ray dosimetry in radiobiology, prepared within the Fourth Framework Programme (FP4) of Euratom, includes a detailed uncertainty analysis for dosimetry for whole-body irradiation. The uncertainty analysis will be extended to dosimetry for partial-body irradiation. It was intended to organise a dosimetry inter-comparison for partial-body irradiation of rats. For this purpose an inventory of partial-body irradiations was made.

WP4

The objective of WP4 was to foster cooperation between research groups and project consortia that focus on investigation of any effects of accidental whole- or partial-body exposure to ionising radiation.

WP 5

The aim of WP5 was to cluster EU- and non-EU-supported projects in the general field of the normal and perturbed biokinetics in the human or other mammalian body and to prepare guidelines for the treatment of persons accidentally contaminated with radionuclides, especially plutonium and americium. The WP meetings provided a valuable opportunity for the scientists involved in the various projects to exchange data and expertise. This resulted in greater collaboration between projects and improved the interpretation of the data produced. Comprehensive notes for the guidance of medical practitioners who may be called upon to treat persons contaminated with plutonium or americium were completed and will be published.

General

A forum for discussion of many of the issues investigated within the Fifth Framework Programme (FP5) of Euratom in the neighbouring project areas, 'clustered' by EULEP and EURADOS and expected to contain important matters for further research programmes, was provided for in the symposium Biological and Physical Dosimetry for Radiation Protection arranged towards the end of the contract.

Brief description of the research performed and methods/approach adopted

WP1

The goals of WP1 were achieved through three scientific workshops and a symposium. Workshops were open-invitation meetings aimed at highly focussed groups of Euratom-funded scientists, their collaborators, potential partners, and workers in the specific field. Topics covered were "Mechanisms and genetics of radiation tumorigenesis", "What have we learnt from FP5-funded research", and "Mechanisms of damage induced by ionising radiation: health implications". The latter two workshops were held in conjunction with WP2, providing a synergy with other fields covering low-dose effects.

A major task of the WP1 was the organisation of an open-invitation scientific symposium addressing the specific topic of telomeres and radiation. This was held during the European conference on radiation research (ERR 2002).

WP2

Two research workshops, a joint workshop with WP1, and a symposium were held and the findings disseminated through the WEB to the wider audience. Several non-EU-funded researchers attended the workshops and several researchers in training were supported as future potential scientists in the field. The symposium integrated the recently funded EU consortia into dissemination of the research.

WP3

A questionnaire was drafted on partial-body irradiations, including a completed one as example. The questionnaires were distributed among various participants. Completed questionnaires were analysed during WP3 meetings. The ninth dosimetry intercomparison for whole-body irradiation of mice is planned to be performed using mouse phantoms loaded with thermoluminescence dosimeters (TLDs). The TLDs were readout at a central laboratory and absorbed dose and dose distributions were derived. The uncertainty analysis in absorbed dose for partial-body irradiation was made for an arrangement for the *in situ* heart irradiation of the intact rat. It was shown that the estimated combined standard uncertainty in the dose is considerably larger than for whole-body irradiation.

WP4

The topic of Work Package 4 was deterministic effects after accidental irradiation. At the time of the initiation of the contract, no projects on this topic were initially funded by the EU, and the work package hence integrated research groups funded by national sources or the industry. Projects newly funded by the European Commission, such as GENEPI-ENTB, NAIMORI and – more recently – FIRST, were included in the annual meetings as well as in the scientific workshops and symposia to further promote communication and cooperation between all research groups involved.

The scientific symposium on the involvement of growth factors in deterministic radiation effects facilitated an intense discussion between EULEP members and non-EULEP scientists, which clearly enhanced the network of and intensified discussions and contacts between research groups working on this topic. Moreover, a book summarising the current knowledge on the role of growth factors in pathogenesis and treatment of deterministic radiation effects was published. As a consequence of the first workshop organised by Work Package 4, a proposal for an integrated project on the use of adult stem cells for the amelioration of deterministic effects of radiation exposure in various critical organs, such as skin, oral mucosa, parotid gland, but also heart and CNS, was successfully submitted under FP6 (FIRST).

The second workshop, focussing on latent times of deterministic radiation effects and the validity of the latent time concept, clearly stimulated discussions on the time required for the follow-up of exposed individuals to achieve maximum information, but also on novel concepts and approaches for specific interventions into the pathogenesis of deterministic radiation effects.

WP 5

The clustering of EU- and non-EU-supported projects under WP5 facilitated a wide and valuable interaction of many of the scientists involved, with an added bonus that some scientists also made valuable contributions to projects with which they were not initially involved. This extensive sharing of information and ideas contributed to improved evaluations of the data produced. A consortium of scientists and physicians from six EU states, the TAIR group, was established and produced guidance notes on the treatment of persons who may become contaminated internally with plutonium or americium. This group noted the concerns of physicians that DTPA was not generally licensed for human use throughout the EU and that action is needed to remedy this situation. The group also noted that there appears to be little interest in the nuclear industry in developing new drugs for the treatment of actinide contamination, despite concerns about the absence of effective treatments for serious contamination with uranium or neptunium. Further, there appears to be no concern about how to treat large numbers of the general public who might be contaminated internally with radionuclides as a result of terrorist activity.

An additional objective was to identify potential new partners, especially from laboratories in the associated states of the EU. 22 laboratories in EU-associated states were identified which might be future partners in new projects.

Main achievements (absolute and relative to expectations)

WP1

The work of coordination activities can best be evaluated by the level of interest in the Sixth Framework Programme (FP6) of Euratom. Participants in the workshops run by WP1 have entered into an integrated project, RISC-RAD. Interestingly, a number of new partners were recruited through the efforts of NET-EULEP. A second achievement is the close cooperation now established between partners in current FP6 contracts with RISC-RAD as well as the expressed intent of these partners to form partnerships for future collaborative works. A third achievement was the number of participants at the workshops and symposium who were not currently partners in Euratom-funded contracts, as well as the number of participants from NIS and accession states.

WP2

The outcome of the workshops and symposia were widely disseminated and the joint workshops with WP1 broadened even further the thinking and scope of the researchers involved. The outcome of the workshops fed into the formulation of the next framework programme. The workshops provided added value to the FP5 programme through provision of a conduit through which the various consortia could be brought together to exchange views and ideas in an inter-disciplinary environment.

WP3

Inventory of exposure arrangements for partial-body irradiation was made as expected. The ninth dosimetry inter-comparison for whole-body irradiation of mice was performed. The results showed discrepancies for some participants. A dosimetry intercomparison for partial-body irradiation of rats was cancelled by the council due to lack of time and money. An uncertainty analysis for dosimetry for partial-body irradiation was made for an arrangement for the *in situ* heart irradiation of the intact rat. It was shown that the estimated combined standard uncertainty in the dose is considerably larger than for whole-body irradiation.

WP4

One main achievement of Work Package 4 was the clustering of newly EU-funded projects (under FP5), as was envisaged in the contract. Further achievements, according to the contract, were two scientific workshops and a scientific symposium. The latter, above expectations, resulted in a book summarising the current knowledge of the role of growth factors in the pathogenesis of deterministic radiation effects. This book was widely distributed among EULEP members and further research groups, and is available commercially. One major achievement of Work Package 4 – again above expectations – is the successful submission of a proposal for an integrated project under FP6 (FIRST) focussing on the potential of adult stem cells for modification of deterministic effects of radiation exposure. This was a consequence of the first scientific workshop, which was organised by Work Package 4.

WP5

The clustering of EU- and non-EU-supported projects under the WP5 facilitated a wide and valuable interaction of many of the scientists involved, with an added bonus that some scientists also made valuable contributions to projects with which they were not initially involved. This extensive sharing of information and ideas contributed to improved evaluations of the data produced. A consortium of scientists and physicians from six EU states, the TAIR group, was established and produced guidance notes on the treatment of persons who may become contaminated internally with plutonium or americium. This group noted the concerns of physicians that DTPA was not generally licensed for human use throughout the EU and that action is needed to remedy this situation. The group also noted that there appears to be little interest in the nuclear industry in developing new drugs for the treatment of actinide contamination, despite concerns about the absence of effective treatments for serious contamination with uranium or neptunium. Further, there appears to be no concern about how to treat large numbers of the general public who might be contaminated internally with radionuclides as a result of terrorist activity.

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General

The topics addressed in the symposium Biological and Physical Dosimetry for Radiation Protection covered three thematic areas:

- Quality Factors for Photons and Incorporated Radionuclides
- Lung Exposure to Radon
- Biological Effects in Individual Tissues.

In parallel to the symposium, different databases developed within EULEP and EURADOS frameworks were also presented. These included:

- The Radionuclide Biokinetics Database developed within the project RBDATA-EULEP;
- The European Mutant Mouse Pathology Database developed within the project PATHBASE;
- The European Radiobiology Archives (ERA) which, together with databases from Japan and North America, now includes information on about 480 000 animals and 190 000 humans involved in epidemiology studies;
- The *European Research in Radiological Sciences* (ERRS) newsletter, which covers topical issues in radiation protection. This newsletter is now published on the Internet (www.euradnews.org); and
- The Database of Facilities and Equipment for Dosimetry Research in Europe.

Exploitation and dissemination

WP1

The work of WP1 has already been used to establish research frameworks that have gone on to successfully compete for funding in FP6. The documentation of the workshops and symposium has been made available and can be consulted by interested parties through EULEP.

WP2

The dissemination of the outcome of the workshops contributed to formulation of future research areas within radiation protection. The WP provided a platform to foster interdisciplinary interactions between the consortia and provided a stimulating environment for researchers in training.

WP3

All deliverables are aimed to stimulate and increase the harmonisation, standardisation and quality assurance of methods in the dosimetry for radiobiology. This holds true for analysis of the questionnaire on partial-body irradiation, which led to the conclusion that dosimetric expertise is fading away from radiobiology institutes (groups). In first instance, the information from the questionnaires can be used as reference information, combined with examples given in the Leiden training course on partial-body irradiation. Similarly, dosimetry inter-comparisons provide the participants the possibility to check their dosimetry and, in the case of discrepancies, specific dosimetric assistance can be offered. The uncertainty analyses for partial-body irradiation can be used as example for other dosimetry arrangements.

WP4

All milestones and deliverables aimed at stimulation of communication and co-operation between research groups focussing on deterministic effects of radiation exposure. Novel approaches for the modification of these effects clearly require an interdisciplinary effort. The latter must be based on the distribution of specific information of the activities of individual research groups in the field to a broader community. The activities of Work Package 4 provided a platform for the dissemination of this information, e.g. via integration of the symposium and second workshop into large scientific conferences (European Radiation Research 2001 and 2004, respectively). Moreover, current knowledge – that may serve as a basis for further project proposals – on the role of growth factors in deterministic radiation effects has been made publicly available. All activities of Work Package 4 have been widely communicated through the ERRS newsletter and its website. Dissemination and exploitation of the activities of Work Package 4 have clearly stimulated and intensified networking of the research groups focussing on deterministic radiation effects, and has resulted in an integrated project (FIRST) funded under FP6.

WP 5

The information produced by the partners has been, or will be, disseminated through publications in the open scientific literature. New data were supplied to the International Commission on Radiological Protection (ICRP) for use in the development of new dose coefficients for workers following the intake of radionuclides. It is expected that these new ICRP dose coefficients will form the basis for future European and international basic safety standards for radiological protection of workers and the public. The RBDATA-EULEP database now provides a valuable medium for the long-term storage of critical publications and information relating to radionuclide biokinetics. Information has also been disseminated by responding to requests from individual scientists for information on radionuclide biokinetics or the treatment of radionuclide contamination.

General

The proceedings of the symposium Biological and Physical Dosimetry for Radiation Protection will be published following peer review in *Radiation Protection Dosimetry*.