Newsletter no 34
November 1999

International Union of Radioecology

NEWSLETTER

Editor: Gilbert Desmet, Hertevoetweg 12,1982 Zemst, Belgium
Tel: +32 15 621 193 Fax: +32 15 621 830
E-mail: Gilbert.Desmet@skynet.be
Co-Editor: Dr. Barbara Rafferty, Radioecological Protection Institute Ireland
3 Clonskeagh Square, Clonskeagh Road, Dublin 14, Ireland
Tel: 353 1 604 1353 Fax: 353 1668 0187
E-mail: barbara@rpii.ie

Contents

MORAL REPORT BY THE PRESIDENT OF THE IUR

General Assembly,
Edinburgh 19 September 1999

Radioecology has now arrived in a phase where interest may be waning from the side of scientific and political authorities, as no "critical" obvious events are attracting their attention.

The IUR should not neglect now to take this opportunity of "silence" to assess the achievements of the past and to make them comprehensive and understandable for several user groups, including the general public. The products of research need to be "**sold**". In this light,I would like to emphasise again the role of the IUR as one of these organisations which should be pivotal:

- to make evaluations of the results and achievements in radioecology in the past years,
- to extract the generic elements from the research in an intelligible synopsis to make them fit for a more general use,
- to create "fora" for debate,
- to make promotion for the "achievements", and to find ways to communicate these achievements to a broader audience than only radioecologists,
- to seek for new directions in the radioecological research and to expand its field beyond the "old" grounds and break new ones.
- to intensify the multidisciplinarity of the field

Many assessments have been published to extract the generic elements from former research e.g. in connection to the Chernobyl accident and many other accidental situations. However, criticism still remains from those who have been less actively involved, and who have looked at the research endeavours from an interested but authoritative distance, as to to need to more clearly identify the useable output from this research. In particular, for possible application in the case of other nuclear detrimental events, but occurring within a completely different ecological, geographic and economic situation! This comparison has still to be made, urgently! The IUR is ideally suited to make this evaluation, comparison and synopsis, having a Membership from over the whole world!

The IUR is also now calling more and more on the advice from senior scientists and authorities. A number of personalities have been asked to sit in the Advisory Panel and we greatly acknowledge their favourable reaction. It is an excellent way to strengthen the visibility and authority of our Union, giving it the best chance of penetration in the for a where decisions are made . Another aspect that badly needs some attention is the place and role of the Task Forces of the IUR. The question is of particular importance. In the last 4 years, the focus was very much on the Action Groups that were created in the context of the contract between the IUR and the European Commission, DGXII, Radiation Protection. The results of these works will be summarised at the Workshop jointly organised with the scientific societies, EULEP (Radiobiology) and EURADOS (Dosimetry). Thus 1999 has been the period of finalisation of the work of the Action Groups and to a rather comprehensive extent the IUR Task Forces coincided with these Action Groups. This appeared to be an acceptable situation for the other two scientific societies, which are restricted in their international context to the European Union, at least from a viewpoint of internal organisation. This is not at all the situation with the IUR, as we have a worldwide Membership. Every Member of the IUR therefore should have a

chance to participate in its major actions, independent of any citizenship.
Bearing this in mind we would like to spend more time to the stimulation of the IUR Task Forces, to profoundly consider or reconsider their responsibilities, and to solicit for new input from the Members to adapt their objectives or create new ones. Obviously any Task Force accepted by the IUR Management should obtain all the necessary support to launch or to maintain its activities.
Another point that however has to be borne in mind when any Task Force sets out for an activity, is the continuous precarious financial situation of the Union. I therefore call for "creativity" in this respect, i.e. it seems quite reasonable that any current or proposed Task Force produces:

- a scientifically based Workplan with clear objectives
- a schedule (foreseeable beginning and ending of the Task Force)
- appropriate budgeting and reasonable indication of probable sponsorship from resources beyond the IUR itself
- an rational estimate of the production of eventual publications or other technical documents and IT-documents
- an identification of the need, the position and users of the outcomes of the Task Force

for submission to the IUR Management! This IUR Management will certainly then in its turn seeks for the best ways to give all indispensable support to the Task Force.

I call then to the creativity of the IUR Members to submit their wishes and suggestions to the IUR Management as this an organisation that wants to work principally to the best of its Members. In the light of the above, I therefore would like to end with a strong call for "INTERACTIVITY" between Members and the IUR Management team. Guidance for further research directions can only arise from such an interaction!

Editorial

JER/IUR:
A New Co-operation for the New Millennium

Murdoch S Baxter, Chief Editor JER
Per Strand, General Secretary IUR

At the close of this their first century of study, we think it is fair to say that progress in the fields of environmental radioactivity in general and of radioecology in particular have been considerable; whether we recall the measurements and definition of the environmental occurrence, inventories and applications of radionuclides of natural and artificial origins or the development of new approaches towards improving our understanding of their behaviours - including their fundamental controlling processes, their transport mechanisms and their uptake properties and kinetics, not only into humans but also into fauna and flora. The effects of environmental radionuclides and radiation on health have long been under the scientific and public microscopes. Indeed, the passage of time has revealed a chain of new challenges towards understanding and estimating the radiological consequences for man and the environment and on defining the appropriate inputs for the best protection of the ecosystem. At least as importantly, the unique timing and tracing properties of radioactivity have underpinned a revolution in the earth and environmental sciences as radionuclides used as tracers have for the first time revealed the time-scales and mechanisms of past and present environmental processes.

As we enter the second century of study of environmental radioactivity and welcome the new millennium, we are pleased to announce here the beginnings of a new scientific collaboration between the *Journal of Environmental Radioactivity* (JER) and the *International Union of Radioecology* (IUR), a co-operation which we hope will contribute significantly to the continuing health of our subject. This new strategic partnership, already approved by the Editorial Board and the publishers of JER, Elsevier Science Ltd, and by the Executive Committee of IUR, will work at a variety of levels. It is of course hoped that in time more of IUR's peer-reviewed science will be published in JER and accordingly IUR members are encouraged to submit their work to JER for peer-review and hopefully eventual publication. Conversely, JER will publish occasional news items on IUR's behalf and JER readers are also asked to consider supporting IUR in order to strengthen its international power-base as the primary professional body for scientists in our general work area. Then, and perhaps most importantly, we envisage a dynamic two-way flow and cross-fertilisation of ideas and initiatives

between the two complementary bodies. JER, through the varied scientific inputs by its readers, contributors and Editorial Board, is in essence a generator and communicator of current research ideas and priorities. IUR also, again through its members and its Board, promotes and supports new science and scientists and catalyses communications through its various fora. By sharing ideas on priorities and trends and by combining rather than competing in their respective efforts, we hope that JER and IUR may provide a wider and more effective joint service to the radioecological/ environmental radioactivity community. We also hope to stimulate the subject in a way which will encourage the recruitment of young scientists to our field. The two organisations, though still evolving, are clearly different and generally complementary. JER, a scientific journal publishing peer-reviewed and hopefully high quality scientific papers, has recently also begun a period of expansion of its overall communications package in co-operation with Elsevier Science Ltd by initiating plans firstly for a comprehensive Book Series (on Radioactivity in the Environment) and secondly for involvement in, organisation of and selective publication from relevant workshops and conferences (including 3 meetings in 1999 and plans under consideration for a major JER-focused conference in Monaco in 2002 on all aspects of environmental radioactivity). The Editorial Board of JER regularly indicates its assessment of scientific priorities either by producing Special Issues on certain perceived key topics or by authoring Editorial articles. In the latter context, for example, it is planned that, during the year 2000, individual issues of JER will begin with Editorial perspective comments from different members of JER's Board.

IUR, on the other hand, is a scientific society in the field of radioecology with an aim of supporting its science through joint meetings, seminars and congresses and publishing recommendations in the field of radioecology and training young scientists. We believe that the differences between JER and IUR represent a strength, providing a good foundation for complementary approaches and actions. This is neither a merger nor a take-over. It has no commercial aspect to it. It is simply a scientific linkage which we believe will enhance the international viability and visibility of radioecology.

An obvious first step in initiating this new collaboration has been the arrangement of some mutual appointments, ie Murdoch Baxter as an Honorary Member of IUR and as a member of the Advisory Panel of IUR and Per Strand and Yoichiro Ohmomo as new members of JER's Editorial Board. The second consequence has been the beginning of an active dialogue on scientific priorities, some of which are contained in the following paragraphs and may well ultimately be covered by JER Special Issues or IUR-sponsored projects or both. The third outcome is an agreement already for specific practical areas of collaboration, including cross-linking of web-pages, provision to IUR members of certain Elsevier services (eg ContentsDirect), co-operation on selected publication of aspects of certain projects and conferences (eg the 1999 conference on Radioactivity in the Arctic) and IUR co-sponsorship of JER conferences.

As mentioned above, initial contacts between IUR and JER have already identified a number of potentially interesting and important topics to be addressed jointly in the future. First and foremost of these is the following:

The scientific challenges in radiological aspects of our field are many, a major objective being to address the scientific bases for assessing and estimating exposures and consequences for man and the environment and how to apply countermeasures to reduce these consequences. For man, this leads to a need to address the interactions between man and the environment, the different exposure pathways pertaining thereto, the spatial and temporal dependencies of these exposures and the long-term management of contaminated areas. It is essential to be able to understand and describe the effects on individuals, groups of individuals and populations. The framework for the protection of man needs scientific input from radioecology so that it can in the best possible way describe the consequences for the individual and for society as a whole. It is essential to make a total assessment of the eco-dosimetry, ie the negative effect on the whole ecosystem. The framework for such an assessment is currently missing and IUR is initiating international joint work on this issue and is trying to encourage relevant research in this field. JER is planning a Special Issue on the topic. Thus the partnership between IUR and JER can provide a good forum for promoting and describing developments in this scientific area and can hopefully have more effect together than they can have individually.

Of course, in this topic of environmental dosimetry or eco-dosimetry, regulatory bodies and the nuclear industry traditionally have relied heavily on the International Commission on Radiological Protection (ICRP) which in essence states that if man is adequately protected from ionising radiation then flora and fauna will also be protected. This statement is not based on any available scientific justification or conclusive demonstration of validity. On the contrary, it contradicts the fundamental philosophies resulting from the UNCED process and from the Precautionary and Biodiversity Principles, which are now applied in environmental protection against all other pollutant types. In addition, it has been demonstrated that the ICRP's view is not valid for all, indeed for many, radiological situations. For example, it has been shown that deep sea nuclear waste disposal could result in a harmful dose to

biota whilst still maintaining doses to man well below the recommended dose limits. One therefore may not forget those environments which host considerable inventories of nuclear material but are remote from people or have limited public access to them. Recently, statements relating to environmental protection have also been introduced into the texts of international conventions (e.g. OSPAR) and into the legislation of individual countries. At present, however, there is no explicit way of assessing the consequences for the environment or of demonstrating whether it is in fact being protected. This is clearly not good practice and leads to the undermining of public confidence. Furthermore, as mentioned already, there is a fundamental inconsistency with the environmental standards set for other hazardous materials such as heavy metals and organic chemicals. This area may well need considerable scientific development in the future. From all perspectives, a strong holistic view is needed and closer contacts with other scientific disciplines should be encouraged. Radioecologists must rise to the new research challenges - for example, to produce reference or critical flora and fauna types, with reference data sets to relate by new models the calculated dose rates to observed or modelled environmental concentrations which could be measured to demonstrate compliance with the requirements of continued ecological functioning of each community. There are also many gaps in knowledge of the effects of radiation on organisms of all types, particularly for alpha and beta particle contamination. By highlighting such issues in a combined way now, IUR and JER hope to work together to catalyse new science and to provide open and fast-track communications, whether in terms of science or opinion. In future, other joint topics for high priority common emphasis will presumably be identified by the joint memberships.

Ultimately it is the scientists themselves who should direct the discipline and mould the future, guided by the needs of the various users and the concerns of the public. JER and IUR can only help in this process. This assistance, we believe, will be more efficient and complete in the context of a strategic alliance for the benefit of radioecology.

Radioecological input is also important for those who communicate radiation issues to the public. Nuclear issues, indeed environmental radioactivity issues, are generally misunderstood by decision-makers and by the public at large, often resulting in expensive decisions, on energy-use or remediation of contaminated sites etc, which are difficult to justify on a scientific basis. We need an increasingly open and scientific regime of communications which substitute calm, facts and understanding where fear, myths and misunderstanding have been dominant until now.

Finally, in support of this new linkage, we note that a typical feature of the science of radioecology is that resources for, and public interest in, it vary considerably with time. Of course, the interest and demand become acute in the event of an accident. However, there is a need to maintain radioecological expertise and to ensure appropriate long-term development – an extreme cycle of fluctuating interest and resources puts such requirements at risk. Both IUR and JER believe that a healthy scientific capacity in this area is essential to any country with an interest in how nature and the environment operate (using the tracer/dating aspects) and in how to deal not only with any future nuclear accidents or discharges but also with existing contaminated sites. We currently have shared concerns in particular that the USA has perhaps recently dismantled too many of its research facilities and too much of its expertise, probably in association with the running down there of the nuclear weapons and nuclear energy programs, and in fact is now in danger of being unable to respond effectively to its current and future environmental challenges. We call on the appropriate funding bodies and employers to reverse this trend. By contrast, we perceive and welcome Asia as a major growth area for our subject and both IUR and JER are giving programmatic priority to scientific issues of special relevance to that region, eg JER is providing special coverage on radionuclide transfers in tropical environments/fruits and on research priorities in SE Asia, while IUR has appointed a regional co-ordinator and plans to expand in that region.

In conclusion, we hope for your support in promoting this new scientific linkage and we will welcome your comments on how IUR and JER can best work together to ensure an effective and healthy future for our subject.

The XXII GENERAL ASSEMBLY OF UIR

was held at the Caledonian Hotel in Edinburgh, Scotland
Sunday 19. September 1999 at 14.00 hrs.
About 40 IUR members attended the General Assembly where the following Agenda was discussed:

1. Moral report
2. Report of the elections of the Board and Executive Committee
3. Approach with respect to Regional Offices, Advisory Committee, Steering Committees and Task Forces
4. Outline of Programme of Work for 1999 -2002
5. Financial report and Budget planning
6. Fixation of fee for year 2000
7. The General Assembly year 2000
8. Any Other Business

New members

From June 1999, the Executive Committee has accepted 21 new members to IUR:

José Antonio Corcho Alvarado	Cuba
Rajmund Gwozdz	Denmark
Siobhán Staunton	France
Christian G. Tamponnet	France
Jérôme Joly	France
Kurt Bunzl	Germany
Maira Mukusheva	Kazahkstan
Konstantin Koupri	Russia
Natalia Slobodyanyuk	Russia
Stanislav Lavkovsky	Russia
Vladimir Kiselev	Russia
Vladimir Kobzev	Russia
Almudena Real	Spain
Carl Magnus Larsson	Sweden
Synnøve Sundell-Bergman	Sweden
Chih-Yu Chiu	Taiwan
Zitouni Ould-Dada	UK
Alexandz Nazazov	Ukraine
Douglas Dasher	USA
David Layton	USA
Stephen Domotor	USA

Membership fees for 2000

At the recent general assembly, the fees for 2000 were discussed. It was agreed that fees for the CIS, China, Cuba, Colombia and Central Europe are to remain unchanged. Those for "Other countries" will be increased as shown in the table below (some fees have been slightly rounded up or down after currency conversion).

Membership grade	**CIS, China Cuba, Colombia**	**Central Europe**	**Other countries**			
	$	**$**	**EURO**	**$**	**BEF**	**£**
Student	7	10	20	21	800	13
Regular	14	20	50	53	2000	32
Senior	21	30	70	74	2800	45
Fellow	21	30	70	74	2800	45
Emeritus	7	10	20	21	800	13
Honorary	0	0	0	0	0	0.0
Supporting	>140	>200	>400	>420	>16000	>260

Currently, collection of fees is a very time consuming and somewhat ineffective process. Therefore, as agreed at the General Assembly, the method of payment is going to change, to be consistent with that of most other equivalent scientific societies, by collecting the fees automatically from bank accounts or credit cards for the "Other countries" and for elsewhere where possible. We are currently exploring the method of carrying this out. If this method of payment is not possible then collection of fees by the methods used before, notably with the assistance of regional officers, will continue (particularly for the CIS countries). Members will be able to continue to have their fees paid by their organisation if requested. Receipts will be sent as before.

I hope that the new arrangements, if possible, will ensure that the fee payment is efficient and effective, and will ensure that the maximum funds are available for the potential benefit of all the members of the IUR.

Brenda Howard
IUR treasurer

Forthcoming Conferences

ECORAD 2001: Radioactivity in the Environment, Continental Radioactivity and Ecotoxicology

Jointly organised with IUR

2-7 September 2001
Aix-en-Provence – FRANCE
Organised by the Institute of Nuclear Protection and Safety (IPSN), Department of Environmental Protection (DEP)

Topics:
- Transfer in Soil
- Soil-Plant transfer, food chains, irradiation
- Transfer in continental waters
- Transfer in deltas and estuaries
- Environmental metrology
- Post-accidental management
- Nuclear power and society

For information, please contact:
J.Cl. Barescut, Tel: + 33 1 46 54 79 06;
Email: jean-claude.barescut@ipsn.fr
L. Foulquier, Tel: + 33 4 42 25 38 69;
Email: luc.foulquier@ipsn.fr

Soil Geochemical Processes of Radionuclides

A Symposium for Soil Science Society of America 1999 Annual Meeting,

Salt Lake City, UT,
October 31 to November 4, 1999.

Questions regarding the symposium should be directed to Dr. Pengchu Zhang, MS 0750, Sandia National Laboratories, Albuquerque, NM 87105; 505/844-2669, pzhang@sandia.gov.
A symposium entitled Soil Geochemical Processes of Radionuclides is scheduled on November 1, 1999 for Salt Lake City. Recurring concerns about the fate of radionuclides, such as ^{137}Cs and ^{90}Sr, in the environment continue to focus interest on understanding the mechanisms controlling radionuclide transport in soils. The difficulty and complexity of cleaning up radionuclide-contaminated soils highlights the many gaps in our ability to predict radionuclide transport in near surface environments. Nevertheless, new theories and techniques are increasingly able to give us a picture of radioactive contaminants in situ in soils at the molecular level. There is the potential that an atomic level view of contaminant binding with soils can provide a knowledge-based framework for choosing remedial targets, achieving cleanup, and protecting public health. This planned multidisciplinary symposium is intended to: 1) outline research opportunities for the soil science community; 2) demonstrate the relevant expertise in the soil science community; 3) enhance communication between the soil science community, radionuclide research groups, site owners and regulatory organizations; and 4) highlight advanced new analytical techniques and theories of interfacial processes. Twelve invited speakers will present talks directed to various aspects of this complex problem. Panel discussions will then follow to provide the opportunity for discussions with DOE and NRC representatives regarding policy and future research needs.

Speakers and presentations:
Dr. Heino Nitsche, Livermore Berkeley National Laboratory. Actinide interactions in environmental systems
Dr. Raymond E Wildung, Pacific Northwest National Laboratory. The Department of Energy program in natural and accelerated bioremediation research: Challenges in understanding the biogeochemistry of metals and radionuclides
Dr. Paul Bertsch, Savannah River Ecology Lab and University of Georgia. Probing the chemical speciation of radionuclides in environmental samples and waste-forms by advanced

analytical and spectroscopic methods
Dr. James Davis, United States Geology Survey. Component additivity and generalized composite approaches to surface complexation modeling of complex mineral assemblages
Dr. John M. Zachara, Pacific Northwest National Laboratory. New perspectives on Cs adsorption by micaceous minerals in soils and sediments and their control on the subsurface migration of 137Cs from high level wastes
Dr. John F. McCarthy, Oak Ridge National Laboratory. Enhanced transport of radionuclides by natural organic matter
Dr. Bruce D. Honeyman, Colorado School of Mines. Colloid properties and their effects on radionuclide transport through soils and groundwaters
Dr. Pat Brady, Sandia National Laboratories. Regulatory targets for radionuclides clean up
Dr. Dave R. Turner, Southwest Research Institute. The role of radionuclide sorption in high-level waste performance assessment: Approaches for the abstraction of detailed models
Drs. Jim Krumhansl and Peng-Chu Zhang, Sandia National Laboratories. Recent advances in radionuclide-retarding reactive barriers: Role of earth materials

5th International Conference

on High levels of Natural Radiation and Radon areas:

Radiation Protection and Health Effects

4-7 September 2000, Munich, Germany

The German Federal Office for Radiation protection (BfS) is pleased to announce this 5th International Conference, which is organised by BfS, GSF, in co-operation with IAEA, UNSCEAR, WHO, European Commission-DGXII and the Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit at the Technical University Munich.

The Conference will include sessions devoted to the investigation of global natural radiation areas, radon in the environment, biological effects, combined effects, natural radiation environment and related issues in radiation protection.

Contact Prof. Dr. A. Bayer, BfS, Institute for Radiation Hygiene
P.O. Box 1108
D-85758 Oberschleissheim
Germany
mailto:abayer@bfs.de

OBITUARY

R. Scott Russell: Death of a Legend
February 14, 1913 - July 28, 1999

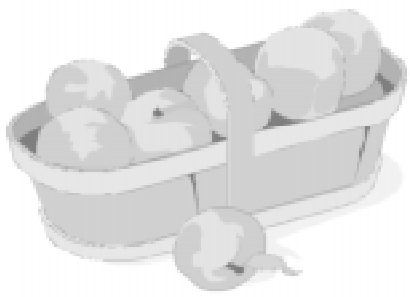
John Sandalls

R. Scott Russell, once described as the world's leading authority on the effects of radioactivity and a name synonymous with radioecology for more than 30 years, has died at the age of 86. Raised in New Zealand, he was a keen mountaineer and while a Japanese prisoner of war in Singapore wrote 'Mountain Prospect', describing his life and expeditions before the Second World War. In 1946, he became a lecturer at the school of Rural Economy in Oxford. In 1957 he founded the ARC Radiobiological Laboratory (later called the Letcombe Laboratory) near Wantage in Oxfordshire. The laboratory became a world leader on radioactive fallout. In 1966 he edited 'Radioactivity and Human Diet'; the book is probably the most authoritative collection of papers ever written on the subject of radioecology and remains a standard reference work. In 1977 he published the book 'Plant Root Systems: Their Function and Interaction with the Soil'. At the time of the Chernobyl accident, Scott Russell was one of the few scientists who correctly predicted both the short and long term consequences of land contamination. It is unlikely that anyone has contributed as much as Scott Russell to the subject of radioecology.

He was made a CBE in the 1976 New Year's honours list and was a Commander of the Order of the Polar Star in Sweden. He retired as director of the Letcombe Laboratory in 1978 but retained a remarkable knowledge of the early days of radioecology as can be testified by Rudolf Alexakhin and myself who, two years ago, spent a most interesting afternoon with him. He leaves a widow Anne, a daughter and a son.

The IAEA BIOMASS Theme 3 Fruits Working Group

Author: Franca Carini
Working Group Leader



The fifth meeting of the Fruits Working Group was held in Vienna, 4-6 October 1999, within the framework of the IAEA BIOMASS annual plenary meeting. The following progress was made at the meeting:

Model intercomparison studies *(acute scenario, continuous scenario*)

Both the acute and the continuous scenario consider apple, strawberry and blackcurrant, ^{137}Cs, ^{90}Sr and ^{129}I and, only for continuous scenario, ^{35}S. Both the continuous and the acute scenario had been revised to include the area covered by a plant, the time of leaf emergence as well as plant and fruit yield. New results with modified scenarios were presented by the Technical Secretariat (A. Venter) and discussed during the meeting.

Predictions have improved: differences have changed from 5-6 to 2 orders of magnitude. Different assumptions of modellers and the way they affect predictions were discussed. Some models are considering deposition to plants only, whereas others also consider deposition to soil. Direct deposition on fruit is considered in few models, pruning is disregarded, and different fruit growth curves are taken into account. Mispredictions can also arise from different interpretation of data, for instance, some modellers considered the 1st year as the year of deposition, whereas others interpreted it as the 1st year after deposition.
The possibility of providing uncertainty estimates with the model predictions was discussed, as this would help to separate uncertainty from variability. The importance of speciation to transfer was also discussed.

A further revision of both the acute and continuous scenarios was proposed: (i) to specify the total deposition/area (soil plus plant) instead of the concentration; (ii) to be more specific about the harvest dates; (iii) to specify the biomass of blackcurrant. The latter may be difficult due to lack of data.

Model validation studies

Scenarios for model validation are based on strawberries, grown in pots under an open tunnel and contaminated with ^{134}Cs and ^{85}Sr. Two scenarios are being considered: wet deposition on the above-ground part of the plant at anthesis and beginning of ripening, and soil surface contamination at the anthesis stage.
The first round of calculations was discussed during the meeting. As there were still some uncertainties about interpretation of the scenario, the modelled results were not yet compared with the measured data, to give modellers the chance to improve their results based on an improved understanding of the scenario. The scenario will be revised to specify a more exact evaluation time. Calculation of measured activity concentrations will also be revised to be more exact. Revised model predictions will be compared with the measured data during the next meeting.

Presentation of models

A new model, RUVFRU, designed especially for fruits and used in the intercomparison exercises has been presented by K. Eged (Hungary). Data that can be used for model validation on Cs and Sr in strawberry and blackcurrant systems will be available next year.
Linkov (USA) gave a presentation on the use of Bayesian Updating as a tool to improve model predictions.

Fruit conceptual model

The approach is the same as in BIOMOVS II, i.e. an Interaction Matrix containing the main features, events and processes relating to the transfer of radionuclides to fruit is being developed. During the meeting the participants ranked the importance of various processes and components by allocating a score to each component and process.

Deliverables

The first Working Document of the Group has been produced by the IAEA: "A critical review of experimental, field and modelling information on the transfer of radionuclides to fruit". The chapters of the review have been sent to the Journal of

Environmental Radioactivity for publication. The content of the final IAEA TECDOC, that will include the main results of all the activities of the Fruits Working Group, has been extensively discussed and agreed and topics have been allocated.

Next meeting

The next meeting will be held in Madrid (26-28 April 2000). It will be hosted by CIEMAT.
Purpose of the meeting:
Discussion of model intercomparison results
Discussion of model validation results
Discussion of matrix results for the Fruit Conceptual Model.

Discussion of the deliverables:

- Model descriptions
- Model intercomparisons
- Model validation
- Fruit conceptual model
- Database
- Experimental studies
- Priorities and recommendation
- Work programme and future meeting plans

Request for contribution

Those who wish to contribute to the fruit database can request the proforma and associated helpfile for submitting data from the dedicated database address: radflux@mouchel.com or directly to the Radflux Database chairman N. Mitchell.
Persons interested in participating in the model intercomparison and model validation studies can request detailed scenarios from the Technical Secretariat (QuantiSci) at:

biomass@quantisci.co.uk

Those who have or will have in a near future datasets on fruits useful for validation can get in touch with the Technical Secretariat (QuantiSci) at:
biomass@quantisci.co.uk

Enquiries about the BIOMASS Theme 3 Fruits Working Group can be addressed to either the Scientific Secretariat (IAEA) or the Technical Secretariat (QuantiSci) at the following addresses:

Mr. Yoshikazu Inoue
B0776
Division of Radiation and and Waste Safety
Department of Nuclear Safety
International Atomic Energy Agency
Wagramerstrasse 5
PO Box 100
A-1400 Vienna, Austria
Tel: +43 1 2600 22730
Fax: +43 1 26007-22730
Y.Inoue@iaea.org

Dr Ansie Venter
QuantiSci
Chiltern House
45 Station Road
Henley-on-Thames
Oxfordshire , RG9 1AT
UNITED KINGDOM
Tel: +44 1491 410 474
Fax: +44 1491 576 916
BIOMASS@quantisci.co.uk

Report of the IUR symposium "Fate of Radionuclides"

F. Carini/Piacenza
M.H. Gerzabek/Seibersdorf

Within the framework of the 5th International Conference on Biogeochemistry of Trace Elements, which was held in Vienna from 11th to 15th of July 1999 the International Union of Radioecologists organised a symposium on „Fate of Radionuclides". Within one and a half days (12th and 13th of July) 18 oral and 10 poster contributions were presented. The symposium started with an introductory talk by the president of IUR, Dr. Gilbert Desmet highlighting research needs for radioecology within the field of soil science and an overview of the UIR action on environmental models and data (F. Carini). The individual contributions covered a wide range of topics including: the impact of micro-organisms on the mobility of radionuclides in different ecosystems (J. Remacle, O. Kostyuk); rhizosphere processes influencing RN adsorption in soil (S. Staunton); speciation studies and studies on soil inventories (N. Gri, I. Yousfi, D. Claval, P. Bossew) methods to predict plant uptake of radionuclides (N. Waegeneers, S. Denys, T. Herren, A. Zichner, H. Tsukada, F. Pinel, A. Mikheev); radionuclide dynamics in the soil – plant system (M. Gerzabek, A. Gommers) and the food-chain (C. Feidt); possible remedial measures (H. Vandenhove, S. Dushenkov), the fate of radionuclides in forest ecosystems (B. Delvaux, F. Strebl, G. Zibold, C.-Y. Chiu) and catchments (P.Bossew); the influence of climate on the behaviour of radionuclides (F. Carini).

The main conclusions, which can be drawn from the presentations are:

(i) the role of micro-organisms is well identified, but needs more quantification,
(ii) the idea of investigating inventories and fluxes is already widely applied in radioecological studies leading to a better understanding and quantification of certain processes, as e.g. phytoextraction,
(iii) discussions between modellers should be intensified to make clear e.g. the advantages and disadvantages of compartment versus convection-dispersion models for estimating radionuclide migration.

XXIXth annual meeting of ESNA

(European Society for New Methods in Agricultural Research) and of the working group soil to plant transfer of UIR in Wye / UK, 8-12 September 1999

Report of the Chairman of working group 3 (soil-plant relationships)
Martin H.
Gerzabek(martin.gerzabek@arcs.ac.at)
Chairman working group 3
Soil-plant relationships
Liaison officer of IUSS to UIR

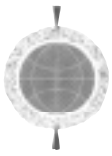
The annual meeting was well attended and in total 42 papers were presented orally (25) or as posters (17) by scientists originating from 15 countries. The first part of the sessions dealt with recent developments in terrestrial radioecology, addressing both agricultural and semi-natural environments (12 oral presentations, 2 posters). Mitchell (U.K.) reported on the present status of the flux database of UIR, which, due to its 17000 entries provides an excellent basis for applying or testing new model approaches. One paper was presented on the upward movement of mobile (Na, Cl) and less mobile (Cs) radionuclides in soil columns (Wadey/UK). Skarlou/Greece and Goncharova/Byelorussia highlighted important impact factors on soil-plant transfer of Cs and Sr as soil pH and ageing of contaminants/hot particles. Two presentations (Kirchner/Germany, Konopleva/Russia) focussed on successful soil scientific approaches to describe plant uptake of Cs and Sr taking into account ion competition in soil. Klemt/Germany presented an interesting model to estimate Cs-transfer to roe deer and highlighted the importance of mushroom in this respect. The important role of fungi for Cs-dynamics in forest soil was confirmed by the data of Nikolova/Bulgaria. Spiridonov/Russia presented a radioecological model describing Cs-dynamics in forest ecosystems. The FORESTLAND/FORTREE model is parameterized for both deciduous and coniferous forests. A set of three papers (Tkachenko/Ukraine, Goncharova/Byelorussia, Oncsik/Hungary) focussed on countermeasures. It became quite evident that the effect of applications of macro- and micronutrients, clay minerals and zeolithes on radionuclide soil-plant transfer is highly site specific and needs consideration of soil properties. Two papers described the long-term impact of radionuclide contamination on the collective dose of the population (Kravets/Ukraine, Goncharova/Byelorussia).

The contribution in the field of soil and plant sciences covered a broad range of topics. Influencing soil physical properties by applying soil conditioners (Sheta/Libya) was addressed as well as the impact of scots pine originating from different countries on soil microbial activity (Kieliszewska-Rokicka/Poland) and the consequences of slash and burn agriculture on soil fertility in Indonesia (Ketterings/USA). The impact of heavy metal contaminations of soil was addressed by various papers (Kovácz/Hungary, Shumik/Ukraine, Roxana/Romania, Bujtas/Hungary). The last mentioned author presented an interesting approach using

mobile heavy metal fractions to predict heavy metal plant uptake. The impact of P fertilizers on trace element uptake through alternation of soil pH was demonstrated by the paper of Osztoics/ Hungary. Stanica/Romania presented interesting results on heavy metal contamination of apple trees with varying distances to a highway. N dynamics in the soil/plant system again was one of the main topics of this meeting. Gerzabek (Austria) evaluated the possibilities to use natural abundance of ^{15}N to quantify N-turnover from organic manures. Hejnak (Czech Republic) used ^{15}N applications to quantify the impact of soil pH on N-utilisation. Another ten papers focussed on the efficient use of N-fertilizers or other macronutrients (Nankova/Bulgaria, Gökman/Turkey, Budoi/ Romania) including the impact of cereal varieties and the description of interesting models to optimize fertilizer applications.

One session focussed on economical aspects of fertilizer application in Turkey. The series of four oral presentations and 3 posters elaborated both on specific questions related to crops grown in Tokat province (Akca/Turkey) and general topics of global input-output analysis in the fertilizer sector or the suitability of organic farming for less developed countries (Karkacier/Turkey, Esengün/Turkey, Kizilaslan/Turkey, Akcay/Turkey).

Summing up we can conclude that we had a highly interesting meeting with lively discussions in all sessions and we enjoyed the environment provided by our host institution. The proceedings of the meeting will be published later this year.
The XXXth annual meeting of ESNA will be held in Keszthely/Hungary between 26th and 30th August 1999 (information: Prof. A. Szabo, H9623MED@ELLA.HU)



The 4th International Conference on Environmental Radioactivity in the Arctic

Line D. Blytt, NRPA
Justin Brown, NRPA

The conference organised by the Norwegian Radiation Protection Authority (NRPA), the Scottish Environment Protection Agency (SEPA) in co-operation with Arctic Monitoring and Assessment Programme (AMAP) and International Union of Radioecology (IUR), was successfully held at the Caledonian Hotel in Edinburgh from 20th - 23rd September, 1999, with a total of 180 delegates from 17 different countries participating.

The conference covered a wide variety of topics concerning radioactivity in the Arctic. A diverse grouping of scientists from sectors including nuclear authorities, the nuclear industry, universities and private consultancies ensured a spectrum of views and led to healthy and constructive debating sessions. The conference was divided into four sessions: Arctic Radioecology, Dose assessments and Effects on Human Health, Exposure and Protection of Flora and Fauna and Nuclear Safety and Risk Assessment. In addition, two parallel sessions concerning the EU fifth framework project on marine radioecology, ARMARA, and the Arctic Military Co-orporation Project, AMEC, were arranged. The Conference was initiated with opening remarks from the State Secretary Mr. Jesper W. Simonsen from the Ministry of the Environment in Norway, First Deputy Head Yuri Tsaturov, from Roshydromet, Russia. Introductory presentations were given by Per Strand, General Sectretary of IUR, George Hunter, European Commission and Vincent McClelland from the U.S. Department of Energy. The opening remarks and introductory lectures related to strategies for maintaining a pristine Arctic environment, recommendations for dealing with nuclear safety and a plea to include environmental risk assessment before remedial actions are planned. An overview of our present knowledge with respect to radioactive contamination in the Arctic was also presented.

In the radioecological session, informative and useful scientific material was presented including details of studies conducted at RTP Atomflot in the Kola Bay, Novaya Zemlya, the Kara Sea, the Bering Sea and Alaska. Newly-acquired data pertaining to radioactivity levels in Arctic environmental media formed the main part of these presentations but a number of articles dealt with associated subjects, such as "state of the art" analyses methodologies and the environmental transfer processes dictating the transfer and fate of radionuclides in the environment. On a more negative note, only a low number of the presentations were related to terrestrial ecosystems, the rest being concerned with aquatic radioecology. This imbalance is of concern especially in view of the fact that the most significant dose contributions to Arctic people are from terrestrial pathways.

A diverse range of topics were presented in the "Dose Assessment and Effects" session. Talks covered subjects such as the estimation of critical loads, the quantification of vulnerability in the Norwegian Arctic, the impact on man from fallout sources in Norway, impacts from radioactive discharges in the Kola and Motovsky Bay and temporal trends of ^{99}Tc in Norwegian coastal environments following the increased discharges from BNFL Sellafield. An interesting plea was made by Dr. Yablokov of the Centre for Russian Environmental Policy who called for a complete inventory of radioactive sources in the Arctic to be

made on an international level following the lead made by Russia in its "White Book".

The subject of the protection of the environment from ionising radiation was covered in a session compiled of 3 articles. As IUR members will know, this has been a subject of some interest for the union in recent months following the view, of a number of distinguished scientists, that there is a pressing need for a radiological framework which will explicitly include the environment. The presentations provided an overview of current developments in this field such as the recommendations being forwarded in the UK concerning the selection of dosimetric units, dosimetric models and dose-effects relationships for flora and fauna, the criteria being introduced in the Russian Arctic for environmental protection and the preliminary methodology that the Norwegian Authorities are adopting for assessing the impact of radioactive discharges on the environment.

The final plenary session dealt with the subject of "Nuclear Safety and Risk Management". A number of interesting presentations were given covering various subjects including potential accidents in the vessels of the Russian Navy, the potential migration of radionuclides following peaceful underground nuclear explosions (PUNES), the potential for transboundary transport of radionuclides following potential decomissioning accidents and predictions of radionuclide migration around Mayak PA in the Southern Urals.

The parallel session "ARMARA" provided a succinct and interesting insight into this recently- and successfully-finalised EC-funded project. A number of presentations were made relating directly to the subject of marine radioecology, including a new approach for modelling radioactive contaminants in Arctic waters, the inventories and distribution of plutonium isotopes around the site of Thule airbase and work concerning the transport of plutonium in high Arctic waters. In the other parallel session, recent developments from the Arctic Military Environment Co-operation (AMEC) were addressed including issues relating to waste storage, facilities control and safety.

Former advisor to President Jeltsin (left) Dr. Alexey Yablokov, gave new information about plans of floating nuclear power plants in the Russian Arctic.

A suitable counterpoise to the oral presentations was provided by the poster exhibition which ran during the scheduled refreshment breaks. The structure of these illustrated presentations followed the themes dictated in the plenary sessions, providing the viewer with a large array of new and complementary information.

The conference left the participants with a number of points for reflection, many of which pertained to the need for future studies. For a start there seems to be little co-operation between environmental scientists and authorities on how to incorporate environmental impact assessments in the handling of radioactive waste in Arctic. It is important that action programs for nuclear safety and waste handling are based on risk and impact assessment and that the environmental impact of such actions are also addressed. Currently, interactions between Risk and Impact assessment Programs and Action Programs in nuclear safety are poor. It is vital to bridge the gap and foster and interdependence between programs to improve monitoring, response strategies and the implementation of action plans. Secondly, the AMEC project concerning decommissioning of submarines should be developed to include a more comprehensive study on radiological consequences and releases to the environment which will enhance the work already conducted on engineering technologies. Thirdly, although modelling on the transport of radioactivity in the marine environment has been significantly improved, gaps concerning the long-range transport of Pu and transfer of radionuclides from sediments to benthic organisms need to be addressed. Finally, the protection of the environment from ionising radiation is a subject which requires more attention not least in its application to the Arctic.

Further to the intention of the Executive Committee of the IUR to strengthen the international character of the Union, the editor made a plea to the Members to give input on the State of the Art of Radioecology in their countries. As a first result we can now present contributions from members of Argentina, Brazil and Chile.

Radioecology in Argentina

Author: Dr R. Hugo Velasco
Instituto de Matematice Aplicada
San Luis
Ejercito de los Andes, 950

ARG-5700 SAN LUIS
Argentina

This report presents a brief description concerning the situation in Argentina from a radioecological point of view. The first part describes the real and potential sources of artificial radioactivity in the country. Subsequently the principal conclusions of the environmental surveillance carried out by Nuclear Regulatory Authority (ARN) of Argentina are presented. These results have been obtained from the annual report 1998[1] published by this government agency. Finally, the radioecological research programs achieved by scientists from the National University of San Luis, Argentina, in the framework of a scientific collaboration with the Italian Environmental Protection Agency, are briefly addressed.

In Argentina, artificial radioactivity in the environment is attributable to atomic weapons testing and the routine operation of the nuclear facilities located all around the country. No traces of deposit of contaminants originated from the Chernobyl accident were detected in soils.

About 25% of the total global fallout from atmospheric nuclear explosions have been deposited in the Southern Hemisphere. According to the National Commission of Atomic Energy of Argentina, in the centre of the country, the mean accumulated deposit of ^{137}Cs from 1964 to 1980, was approximately 750 Bq/m^2.

Since 1997, the Nuclear Regulatory Authority of Argentina (ARN), carried out the control of the different nuclear facilities and monitoring in its surrounding environment. In Argentina there are two nuclear power plants in operation, one under construction, six research and radioisotope production reactors, 24 major radioactive facilities and more than 1500 installations (for medical, industrial, research and teaching purpose) which employ radioactive materials.

The main technical characteristics of the Argentinean nuclear power plant are the following: *Atucha I* is located approximately one hundred kilometres to the Northwest of the city of Buenos Aires. Its pressure vessel reactor is fuelled with natural uranium and uses heavy water as moderator and coolant. The electrical output is 335 MW and commercially operating since 1972. The *Embalse* nuclear power plant, which was commissioned in 1984, is located near the city of Embalse, 100 km from the city of Cordoba in the centre of the country, with a net electrical output of 600 MW,. This pressure tube reactor is fuelled with natural uranium and uses heavy water as moderator and coolant. A third nuclear power plant, Atucha II, with a net electrical output of 693 MW, is in the last construction stages.

In the vicinity of Atucha I and Embalse nuclear power plants, representative samples are periodically taken by experts of ARN in order to assess the environmental impact of the liquid discharge. Samples of river and lake water, sediments and fish have been collected and analysed. Aquatic ecosystem would be the most affected by the routine operation of the nuclear plants.

To assess the environmental impact of the gaseous effluents released into the atmosphere, samples of locally produced food, such as milk and vegetables are frequently taken and analysed. According with their importance from the radiological point of view, radionuclides analysed are mainly the radioactive fission products (^{137}Cs, ^{90}Sr, ^{131}I) and neutron activation products. According ARN reports[1] no environmental contamination was

detected attributable to nuclear power plant operation, except for very low activity levels in some sediment samples.
In 1998 the radioactive effluent release during operation of *Atucha I* and *Embalse* nuclear power plants accounted respectively for 10% and 8% of the annual constraints. The resulting doses to individual of the critical group for both nuclear operating power plants reached respectively 0.004 and 0.005 mSv. These doses accounted for 3% of the annual dose constraint for a particular facility as established by the ARN at 0.3 mSv.

As conclusion, according to the regular environmental monitoring performed by ARN, no environmental contamination exists attributable to the monitored facilities.

Environmental monitoring was also carried out for CNEA's Ezeiza Atomic Centre (CNEA is the National Commission of Atomic Energy of Argentina). Representative samples of the different compartments of the environmental matrix were collected from around the centre and then analysed. No radionuclides were detected attributable to the operation of this atomic centre, except from some sediment samples.

There is no information concerning alternative environmental monitoring performed by non-governmental institutions.

Researches on Radioecology are independently carried out at IMASL (San Luis Institute on Applied Mathematics[2]). The IMASL belongs to the National University of San Luis (Argentina) and Conicet (National Council of Science and Technology of Argentina). This Institute is composed by an interdisciplinary team of experts, including physicist, mathematician and biologist.

Radioecological research at the IMASL has been permanently supported by grants from the National University of San Luis, the National Agency for Science and Technology and Conicet.

Since 1989, scientists of the IMASL and the radiecological research group lead by Drs. Maria Belli and Umberto Sansone of the Italian Environmental Protection Agency (ANPA) have participated of a multiyear radioecological research programme, sponsored by both institutions and the International Centre for Theoretical Physics (ICTP, Trieste, Italy).

The studies have focused on investigation of the radionuclide transfer processes in natural and semi-natural environments, to predict the pathway of radioactive material and to estimate possible doses to the population. In this context, a new mathematical model (RABES model), descriptive of the radionuclide behaviour in undisturbed soil has been formulated. This model has been calibrated and validated from experimental data obtained from the radioecological research programme carried out by ANPA in the Friuli Venezia Giulia Region (northeastern Italy).

In the framework of this collaboration, the influence of the chemico-physical properties of the soil on the soil-to-plant transfer process has been intensely studied in the last years. With this goal, in the current year, experimental studies are scheduled, in Tarvisio, a region specially selected in the North of Italy.

The future activities include developing a new Monte Carlo code to evaluate the gamma irradiation in air from radionuclides located in soil. The photon soil/air transport will be simulated, taking into account the vertical distribution of the radionuclides, possible changes in the soil density with the soil depth, the shielding of rough surfaces and other characteristics of the considered regions.

Finally it is important to remark the great deal of experience has been gained from the ANPA-IMASL scientific collaboration. Radioecology in Argentina in particular and in South America in general is poorly developed. Experience, knowledge and training of the European or North America leader groups are propitious to stimulating the progress of the Radioecology in the South Hemisphere.

Annual Report. Nuclear Regulatory Authority. Argentina. 1998
http://www.arn.gov.ar
IMASL. National University of San Luis. Conicet. Argentina
http://www.unsl.edu.ar/imasl/

Radioecological Studies in Brazil

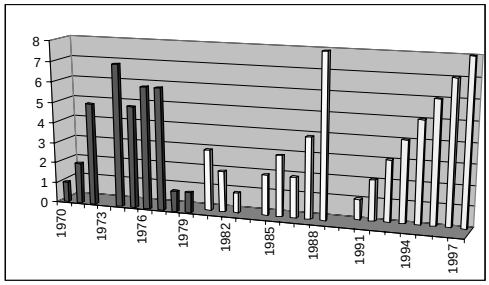
Author: Jose Marcus de O. Godoy
Instituto de Radioproteçào e Dosimetria
Av. Salvador Allende S/NO, Via 9
BR-22780 RIO DE JANEIRO 160
Brazil

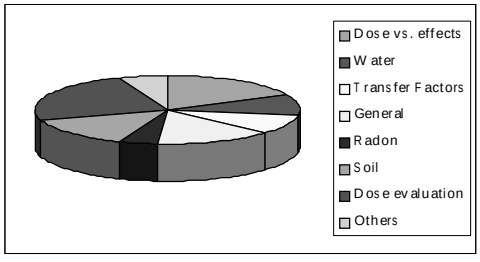
Radioecological studies in Brazil, starting in the late 50's, focused on high natural radioactivity areas such as Guarapari (ES) and Poços de Caldas (MG). As a consequence, today there remains a "clear correlation" between studies on high natural radioactivity areas in Brazil and famous names of researchers such as Merrill Eisenbud, Eduardo Penna-Franca and Pe. Thomas Cullen. The First International Symposium on Areas of High Natural Radioactivity has recently occurred in Poços de Caldas (1975) and the cover page of its proceedings (below) presents an auto-radiograph of a leaf found at Morro do Ferro (Iron Hill), Poços de Caldas.

A large effort on uranium resources research resulted from the Nuclear Agreement between Brazil and Germany. As a result, today, more high natural radioactivity areas in Brazil are known. Due to mining activities at some of them, new radioecological studies sites have being developed at for example Pitinga (AM), Caetité (BA) and Buena (RJ). Buena is an old monazite sand mining area, but until recently little research was carried out there due to greater emphasis being placed on the Guarapari (ES) site nearby.

In comparison to natural radioactivity, little has been done in relation to artificial radionuclides in Brazil. Mainly, work has been associated with the radiological accident with ^{137}Cs in Goiania, Goiás, in 1988, or with the Angra dos Reis nuclear reactor site, Angra dos Reis, Rio de Janeiro. During the sixties, some work was carried out in order to evaluate the impact of the fall-out from French nuclear tests, on foodstuffs and plants.

One of the features of radioecological studies in Brazil is its cyclical character. This is clearly observed in figure 1 below which presents annual publication numbers. Figure 2 shows the breakdown of research emphasis between various topics illustrating what has been done and what needs to be done





Project funding and partnership have also changed with time. At the beginning, radioecological studies in Brazil were performed together with the New York University and funded by the US Department of Energy or the IAEA. A second Poços de Caldas project was organized during the 80's in order to study the environmental behavior of thorium, uranium and the lanthanides, found at Iron Hill and the Poços de Caldas uranium mine, as natural

homologues of the transuranic elements. It was a large project involving several European countries, the USA and Brazil. From the 80's up to now, radioecological studies are supported mainly by the Brazilian federal government agency (CNPq) and, on a lower scale, by local agencies (FAPESP, FAPERJ and others similar to them). From the beginning of the 90's following the signing of the German-Brazilian nuclear agreement, an intensive cooperation program with German scientists was established, in particular with Karlsruhe Nuclear Research Center and to the Forschungszentrum für Umwelt und Gesundheit (GSF Munich). After the Goiania accident a special research program was supported by the IAEA with the objective of studying the environmental behavior of ^{137}Cs on a tropical region.

Research groups are mainly located at São Paulo and Rio de Janeiro, the two largest Brazilian cities. Radioecological studies are also carried out at Piracicaba (SP, CENA/USP), Recife (PE, DEN/UFPe) and Belo Horizonte (MG, CDTN/CNEN). Below, are listed Brazilian radioecology research groups, contact person and actual field of interest:

1. Centro de Energia Nuclear na Agriculture
   Universidade de São Paulo (CENA/USP)
   Contact person: Prof. Dr. Epaminondas S. B. Ferraz [epferraz@cena.usp.br]
   Address: Avenida Centenário, 303 - Bairro São Dimas – Caixa Postal. 96 - CEP 13400-970, Piracicaba - São Paulo – Brasil
   Phone: (019) 429 4600 - Fax: (019) 429 4610

Support agencies: Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), Conselho Nacional de Pesquisa (CNPq) and International Atomic Energy Agency (IAEA).
Actual projects: ^{137}Cs transfer to animals; Natural radionuclide transfer to plants; Environmental impact associated with waste rock deposits from the Poços de Caldas uranium mining and milling.

2. Instituto de Pesquisas Nucleares e Energéticas
   Comissão Nacional de Energia Nuclear (IPEN/CNEN)
   Contact person: Dra. Barbara P. Mazzilli [mazzilli@net.ipen.br]
   Address: Caixa Postal 11049 - Pinheiros - CEP 05422-970, São Paulo, SP, Brasil - Phone: (011) 816 92 06, Fax: (011) 816 92 08

Support agencies: Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), Conselho Nacional de Pesquisa (CNPq), International Atomic Energy Agency (IAEA) and Comissão Nacional de Energia Nuclear (CNEN).
Actual projects: Natural radionuclides in drinking water and dose assessment; Technologically enhanced natural radioactivity in the phosphate industry; Environmental and radiological impact of coal industry; Evaluation of environmental and radiological impact; Indoor radon -internal dosimetry

3. Instituto de Radioproteção e Dosimetria/ Comissão Nacional de Energia Nuclear (IRD/CNEN)
   Contact person: Dra. Eliana Amaral [eliana@ird.gov.br] and Dra. Elaine Rochedo
   Address: Caixa Postal 37750, Barra da Tijuca, Rio de Janeiro, RJ, Brasil. CEP 22642-970.
   Phone: (021) 442 1927, Fax: (021) 442 1950

Support agencies: Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ), International Atomic Energy Agency (IAEA) and Comissão Nacional de Energia Nuclear (CNEN).
Actual projects: Characterization of Brazilian natural radioactivity and assessment of the exposure to natural radiation and risk evaluation; Dynamics of the outdoor and indoor radon in air; Enhanced natural exposure due to the use of industrial byproducts; In-situ gamma measurements and the use of Monte Carlo methods for kerma in the air determination and dose to organs; Environmental modelling for dose assessment; Environmental impact assessment of non-nuclear mining and milling facilities; Taillings remediation; Environmental Restoration; Soil to plant transfer.

4. Departamento de Energia Nuclear/ Universidade Federal de Pernambuco (DEN/ UFPe)Contact person: Prof. Dra. Helen Khoury [khoury@elogica.com.br]
   Address: Av. Prof. Luiz Freire 1000, Cidade Universitária, Recife, Pernambuco, Brasil, CEP 50740-540.
   Phone: (081) 271 8251, Fax: (081) 271 8252

Support agencies: Fundação de Amparo à Pesquisa do Estado de Pernambuco (FAPERJ) and Conselho Nacional de Pesquisa (CNPq)
Actual projects: Environmental radiological studies concerning a phosphate high natural radioactivity area.

5. Superintendência de Licenciamento e Controle/Comissão Nacional de Energia Nuclear (SLC/CNEN)
   Contact person: Dra. Yannick Noialhetas [yannick@cnen.gov.br]
   Address: Rua General Severiano 90, Botafogo, Rio de Janeiro, RJ, Brasil, CEP 22292-040.
   Phone: (021) 546 2394; Fax: (021) 295 1745

Support agencies: Comissão Nacional de Energia Nuclear (SLC/CNEN)
Actual projects: Dose-effect relationship at Poços de Caldas involving Tradescantia flowers.

Radioecology in Chile: State of the Art

Authors:

Roberto Hojman
Comisión Chilena de Energía Nuclear
Casilla 188 - D, Santiago, Chile

Paulina Schuller
Instituto de Física, Universidad Austral de Chile,
Casilla 567, Valdivia, Chile

I. Introduction

Chile is a long and narrow country that extends from Atacama Desert down to Antarctic territories and from the Pacific coast up to the Andes Mountain Range. In addition, Easter Island belongs to this territory.

Several climates, from polar to tropical, occur within this territory and soil properties also vary strongly depending on geological and climatic conditions.

Such wide geographical features in one country are convenient for studies of the behaviour of radionuclides in a variety of environments.

In this article we summarise 30 years of work and quote the main results of measurements of anthropogenic radioactivity in different environments of the Chilean territory. We will briefly describe the studies that are currently underway and enumerate many of the possibilities and needs to improve research activities on Radioecology.

II. Brief History

Monitoring network for environmental radioactivity in Chile exist since 1966.

The Chilean Nuclear Energy Commission (CCHEN) has responsibility for development of the National Program for Environmental Radioactivity Measurements, the function of which is monitoring the radioactivity in foods and the environment and the evaluation of the potential health risk for the population.

The operation of the monitoring stations is co-ordinated by CCHEN which analyses, processes and publishes the obtained data while other associated governmental institutions are responsible for sampling.

There are 24 monitoring stations rather homogeneously distributed all along the territory, from Arica (18,5°S) down to Punta Arenas (51°S). They are mainly devoted to measurement of radioactivity concentration in air, rainwater, dry deposition, seawater, tap water and natural milk.

The only Radioecological Research Laboratory in Chile was created in 1983 and is located in Valdivia (Lake Region) at the Universidad Austral de Chile. A multidisciplinary team composed of physicists and soil scientists works in Radioecology, granted aided by FONDECYT (the governmental agency for S&T) and the Research Department of the University.

Mainly the following issues have been addressed:

- Factors influencing ^{137}Cs accumulation and downward migration in different soil types.
- Time dependency of ^{137}Cs concentration in the soil-plant-milk pathway in the agricultural region of Chile.
- Modelling and quantification of soil redistribution (erosion/sedimentation) rates based on the spatial distribution of ^{137}Cs inventories.

All related results have been internationally reported (see References).
Due to the relatively high potential risk of radioactive fallout in the Lake Region compared to other Southern Hemisphere sites, Radioecology has developed at this regional University. Latitudinal position (40,5°S – 44°S) as well as high rainfall rates, have significantly enhanced anthropogenic

radionuclide deposit on this region [1].

III. International Collaboration

In addition to national financial aid, radioecological research at the Universidad Austral de Chile has been continuously supported by German research institutions: GTZ, BMFT, VW-Foundation, DAAD).

Relevant scientific contact has been established since the 80's with scientists from the Zentrum für Strahlenschutz und Radioekologie (ZSR) University Hanover.

From 1996 up to now the IAEA has provided funds in the form of Research Contracts linked with Co-ordinated Research Programs.

IV. Main Results and Current Research

1998 monitoring

Analysing the results delivered by the monitoring network during 1998 [2] and comparing them to registered historical radioactivity [3] it can be safely said that the anthropogenic radioactivity in environmental samples declined during the last two decades. The measured levels are now just above the detection limit and far below the maximum permissible values for the population.

Natural background radiation

Natural background radiation reveals normal and trace levels of remnant stratospheric fallout from nuclear atmospheric tests [2].

Chernobyl effect

No increase in ^{137}Cs or ^{134}Cs concentrations were detected in any samples analysed after April 1986, indicating that contamination released at Chernobyl did not directly affect the studied area. This reflects the influence of the equatorial boundary from the Northern Hemisphere in retarding movement of Chernobyl related debris when compared to the long range of the fallout from nuclear weapon tests. This may be due to the relatively low altitude at which the contaminants were emitted during the accident. This result point to the fact that possible future contaminants released at low altitude in the Northern Hemisphere will probably not affect the studied region [4].

Time-course of ^{137}Cs concentration in the soil-plant-milk pathway

The absence of detectable Chernobyl derived fallout in Chile provided the opportunity to study the rate of change of ^{137}Cs transfer in the soil-prairie plant-milk pathway during a 15 y period without the transfer being affected by new radioactive inputs. The effective half-life of the ^{137}Cs concentration in prairie plants increased from 5.6 y during 1982-1990 to 12 y during 1991-1997. As the animal feeding conditions did not change the feed-to-milk transfer factor remained constant at (0.011 ± 0.001) d kg^{-1} during the 15 y period [5].

Influencing factors on 137Cs inventory

The local annual precipitation rate was found to be a major factor influencing the ^{137}Cs inventory measures within the wide latitudinal band (27 – 63°S) studied in the Chilean territory [1].

^{137}Cs distribution in soil profiles

Long-term downward distribution of ^{137}Cs was studied in natural and semi-natural environments. The ^{137}Cs soil content showed an exponential decrease with depth. Relaxation depth ranged from 0.9 cm in the polar climate environment up to 20 cm in the temperate one. Leaching rates of ^{137}Cs in soil depends on climatic characteristics (temperature and precipitation rate) and on the soil properties that favour percolation [6,7].

Studies Currently Underway

Modelling and calibration of the models for quantifying soil redistribution rates using the spatial distribution of ^{137}Cs inventories. Optimisation of methodologies [8].

Study of radiocesium and -strontium transfer from soil to broad-leafed crops on different allophanic soils characteristic for Central-South Chile.

V. Difficulties, Developments and Desiderata

International collaboration

Regional and intercontinental co-operative work should be strongly encouraged in order to improve efficiency of effort and to optimise use of human resources and infrastructure.

Training of human resources

At present national capabilities for training young scientists are poor. It is difficult to recruit postgraduate students in order to strengthen established research groups, with the result that there is little development on the existing expertise.

Infrastructure

Experimental facilities are insufficient and need to be renewed.

Widening of the research issues

The creation of research groups in theoretical (modelling) as well as other applied areas should be fostered.

VI. Acknowledgements

The authors thank Dr. Igor Tomicic for his kind collaboration during the preparation of this note.

VII. References

- **Schuller, P., Ellies, A., Handl, J. and Castillo, A.** 1998. ^{137}Cs accumulation and downward distribution in Chilean soils. In: Akber R.A. and Martin, P. (Ed.): Radioactivity in the environment. 4th Biennial Workshop of the South Pacific Environmental Radioactivity

Association, Darwin, Australia, 17-19 June, 1996: 17-21.

- **Comisión Chilena de Energía Nuclear, Departamento de Seguridad Nuclear y Radiología**. 1999. Radiactividad Ambiental en Chile. Informe anual 1998. CCHEN-RA/37, 17p.
- **Piñones, O. and Tomicic, I.** 1995. Estudio de los niveles radiológico-ambientales en Chile durante el período 1966-1994. Nucleotécnica 15(29): 67-82.
- **Schuller, P., Løvengreen, Ch. and Handl, J.** 1993. ^{137}Cs concentration in soil, prairie plants, and milk from sites in Southern Chile. Health Phys. 64: 157-161.
- **Schuller, P., Handl, J. and Ellies, A.** 1998. Long-term decrease of atmospheric test ^{137}Cs in the soil-prairie plant-milk pathway in Southern Chile. Health Phys. 75(1): 85-87.
- **Schuller, P. and Ellies A.** 1994. The influence of mean annual rainfall and soil texture on the ^{137}Cs vertical distribution in soils from Southern Chile. Z. Pflanzenernähr. Bodenk. 157: 429-432.
- **Schuller, P., Ellies, A. and Handl, J.** 1997. Influence of climatic conditions and soil properties on ^{137}Cs vertical distribution in selected Chilean soils. Z. Pflanzenernähr. Bodenk. 160: 423-426.
- **Schuller, P. Ellies, A., Ellies, A. and Castillo,A.**1999. Utilización de ^{137} Cs en cuantificación de erosión y sedimentación en un Palehumult de la IX Región. Agro Sur, 27:29-36.

Announcing the availability of a CD-rom, containing an Environmental Decision Support System

Authors: M. van der Perk1, J.R. Burema[1], A.G. Gillett[2], K. de Jong[1], M.B. van der Meer[1], C.G. Wesseling[3]
[1]Utrecht Centre for Environment and Landscape Dynamics, Utrecht University, the Netherlands
[2]Division of Environmental Science, University of Nottingham, United Kingdom
[3]PCRaster Environmental Software, Utrecht, the Netherlands

This system has been developed within the framework of the EC funded project "Restoration of Radioactively Contaminated Ecosystems - RESTORE" (EC-Contract No. FI4P CT95 0022c. Coordinator of the Project: Gabi Voigt, GSF, Germany

The RESTORE Environmental Decision Support System (EDSS) is a user-friendly GIS-embedded generic modelling tool to simulate the transfer of radionuclides from soil through food chains to humans and external exposure to radionuclides based on the understanding of the nature of contamination, the geochemical, hydrological, and biological processes involved, and the different pathways of radionuclides. The EDSS should be applicable to a variety of ecosystems and should account for spatial variation of the above mentioned factors and spatial relations between human behaviour and exposure. The principal aim of the EDSS is to identify vulnerable areas in terms of enhanced radionuclide transfer into food chains and/or presence of 'critical population groups' that suffer enhanced internal and/or external exposure to radionuclides based on basic maps of soil contamination, soil type, and land use, and consumption habits (Van der Perk et al. 1998).

All models have been implemented in the spatio-temporal modelling language of the PCRaster, a GIS-based modelling toolkit including cartographic, geostatistical and dynamic modelling. This raster GIS package was chosen because of the following reasons:

- The PCRaster spatial modelling language enables to implement generic, area independent models, so they can be applied to any available spatial data set;
- The PCRaster modelling language enables to implement dynamic models in a GIS environment;
- The raster GIS environment enables to handle continuous spatial data (e.g. soil contamination data or soil attribute data).
- To interpolate point samples to continuous data in PCRaster format, the Gstat geostatistical package is used.

The final deliverable has resulted in the implementation of a range of radioecological models into a dynamic GIS, which are integrated in one user-friendly system that can be applied for decision support of management of ecosystems contaminated by long-lived radionuclides.

Copies of the CD-ROM can be requested at:
Marcel van der Perk
Utrecht Centre for Environment and Landscape Dynamics
Faculty of Geographical Sciences, Utrecht University
P.O. Box 80115
3508 TC Utrecht
The Netherlands
e-mail : M.vanderPerk@geog.uu.nl

Announcing the availability of SAVE-IT on the Web

SAVE-IT : Spatial and Dynamic Prediction of Radiocaesium Transfer to Food Products

Jon Absalom
Neil Crout (Email: neil.crout@nottingham.ac.uk)
Anne Galer
Andy Gillett
Stewart Marshall (Email: stewart.marshall@nottingham.ac.uk)
Scott Young (Email: scott.young@nottingham.ac.uk)

SAVE-IT is a software output from an EC funded project (FI4PCT950015) whose objectives include the development of approaches to predict the dynamic transfer of radiocaesium to food products over large spatial areas (SAVE: Spatial Analysis of Vulnerable Ecosystems).
The software output has been developed by the radioecology team within the Institute of Environmental Sciences at the University of Nottingham, further details of other environmental modelling work can be found at the Environmental Modelling homepage.

Any problems with this site or use of the software please email
save-it@nottingham.ac.uk

Announcing the availability of the Arctic Environmental Atlas, 1999 and accompanying CD-ROM.

Authors: Kathleen Crane and Jennifer Lee Galasso, Office of Naval Research, Naval Research laboratory, Hunter College, Washington DC, US

This Atlas of environmental information is intended to display graphically and make available to a wide audience the data and references to data compiled as a result of the Arctic Nuclear Waste Programme (ANWAP). This was established by the United States Office of Naval Research (ONR) to determine the level, transport and fate of radioactivity in the Arctic from the practices of the Former Soviet Union and its potential to contaminate Alaska. A data repository was established at the Naval Research Laboratory (NRL) as a Geographic Information System. Early in the GIS program the authors linked the U.S. data-gathering work and Arctic Monitoring and Assessment Program (AMAP), headquartered in Oslo, Norway. The GIS organizes all data by latitude and longitude and enables the data to be analyzed and displayed accordingly.

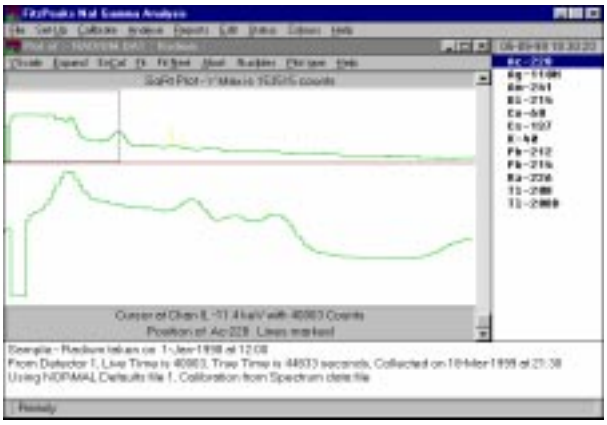
Letter to the Editor

BIC (British Instrument Consultants) is a new Company formed around the development of its own very affordable gamma/Xray spectroscopy system - the LCG_Spec. Possibly the lowest cost system in the world. This system uses proprietary hardware, robust code and can be supplied complete or as part of an existing system. Diagnostic software allows the user to check output from the probe without having to use a scope. The system also accommodates for the inherent drift problems associated with the likes of Sodium Iodide detectors.

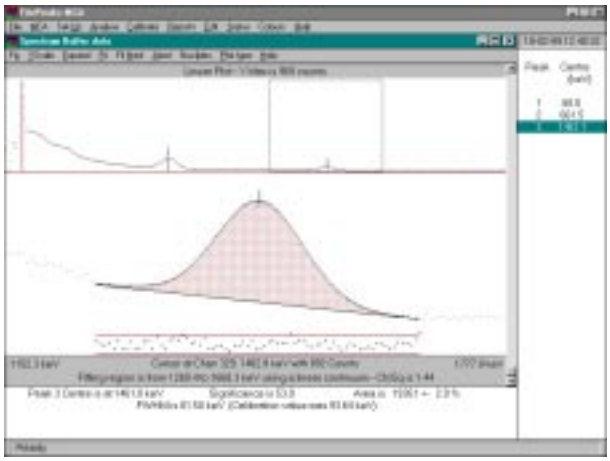
The Sodium Iodide Analysis software written by Jim Fitzgerald offers the user an intuitive interface and gives a full isotope identification. The analysis software will simply and automatically calculate qualitatively & quantitatively which isotopes are present. A coherent report is produced for each analysis. The software has many other features for the more ambitious radiochemist.

Extensive hands on training programs are available in conjunction with our Radiation Protection Advisory service.
We are involved with continuous product development and listen closely to customer requirements. Isotope Inventory Software is another software package we can offer
We would be pleased to hear from you.

Picture One



Picture Two



Picture 1 shows the real-time display whilst acquiring spectra.

Picture 2 is an example of Peak fitting when auto-analysis is selected.

Contact details:

BIC, Cinnamon House, Crab Lane, Fearnhead, Warrington, Cheshire, England WA2 0XP

Tel: +44 (0)1925 661793
Fax: +44 (0)1925 661800
Email: bic@cybase.co.uk

Radioecological and Dosimetric Consequences in France of the Chernobyl Accident: IPSN Report 97-03

Authors: Ph. Renaud, K. Beaugelin, H. Maubert, Ph. Ledenvic

The purpose of this study is to provide an overview of the radioecological and dosimetric consequences in France of the Chernobyl accident, and a prognosis for the years to come. It was completed at the request of the Nuclear Installation Safety Directorate (DISN) jointly with the various bodies that carried out measurements following this accident.
It is based on the combined use of measurement results and computer modelling, in particular the use of ASTRAL software developed by IPSN (see IUR Newsletter nr. 27).
The measurements available are varied: activity concentrations in air and water, specific activity in soils, of agricultural produce, of processed food products, of natural products. Their origins are diverse: OPRI (Office for Protection against Radiation), IPSN, DGCCRF (General Directorate for consumption, Competition and the Repression of Fraud), CNEVA (National Centre for Veterinary and Food Studies) CRIIRAD (Independent Commission for Research and Information on Radioactivity). However numerous they were, they would not have allowed to establish this summary, which was only possible through a computer modelling.

ASTRAL is a software product for assessing the radiological consequences of an accident. It establishes the correspondence between the Residual Surface Activities of the ground (RSA in $Bq.m^{-2}$), the specific activity of agricultural products and the individual and collective doses resulting from internal and external exposures (inhalation and ingestion of contaminated foodstuff).

The results of the main comprehensive documents on the Chernobyl accident and its consequences are also used, including those concerning the republics of the Former Soviet Union, either as a source of additional information and data, or as a basis for comparison with the results of this study.

The objectives of this report are:
- To draw up a map of the average deposits in France caused by the Chernobyl accident and to locate the areas where deposits are liable to be the largest;
- To compare the concentration measurements in the agricultural produce with the theoretical values derived from the computer models for both the mean and the maximum values;
- To finally evaluate the consequences of the accident in terms of dose by integrating both mean exposures and the case of highly exposed individuals.
- To draw attention to these areas and products where Caesium-137 (^{137}Cs) concentrations might still be high.
- To present an expert opinion together with the main results supporting it.

IAEA-TECDOC-1091
Protection of the environment from the effects of ionizing radiation: A report for discussion

The report was developed with the assistance of consultants under the leadership of Prof. Ward Whicker, USA, and reviewed at a Technical Committee meeting in January 1999.

K.L. Sjoeblom was the responsible officer at the IAEA.

The present publication represents a first step towards establishing an internationally accepted philosophy and associated methodology for protecting the environment against ionizing radiations. The report reviews the various related issues and examines possible approaches to establishing criteria. It is intended for use in stimulating discussion on the subject in Member States. For its part the IAEA intends to continue a programme of work in this area with the long term objective of providing scientific recommendations on primary protection criteria and methods for demonstrating compliance with such criteria.

Executive Committee

Editorial Board

Publisher:
IUR Secretariat
P.O.Box 55
N-1332 Østerås
Norway
Tel. +47 67 162604
Fax +47 67 145444
E-mail: iur@nrpa.no

Layout:
vibeke Thomsgård
E-mail: vibeke.thomsgaard@nrpa.no