[newsletter] Number 41
November/December 2003

IUR

Words from the General Secretary

A very profound evolution is currently underway in our world. Precursor signs have already become apparent in several layers of its organisation. Many believe that this is a necessity-driven process, but still non-obvious in its perception as we have not reached yet sufficient understanding and consciousness, or because we have psychological difficulties to face/accept its consequences (for example, climate change). One begins to understand that our well being is intimately bound to the quality of the environment, and that we cannot afford anymore neglecting to care for it. The race to growth and development is now facing the physical boundaries of our planet that cannot accommodate (dilute) anymore the parallel uncontrolled growth of some impacts which are now durably disturbing the overall ecosystem. Depending on how one goes through this, such an evolution can either drive to painful events or be producive of innovation.

A growing set of pioneer philosophers, economists, scientists and more recently politicians, led by their own conviction, has grasped the issue and promoted the emergence of the widely accepted concepts of sustainable development and its companion tool, precaution. Because of their impacts on the environment and health, human activities will need to be driven in conformity with these concepts. There are strong resistances however among traditional economical, industrial and institutional managers, still short-term driven, to accept this mental evolution towards a long-term driven decision making. Also, the trouble caused by this huge evolution is prompting fears which in turn generate retrograde and sterilising behaviours with a tendency to reject all technology-driven change. The best perennial solution that humankind can afford in this context is to adopt a movement that is **knowledge**-driven. Far from being banned, technological innovation is actively searched for, and especially to solve humankind dimension problems, but in an overall context that is complete, i.e. where impacts are anticipated, good and harm consequences are properly evaluated, and ultimately risk is known, mastered and accepted.

The environment, which is the core of our professional skills gathered within the IUR, is a central driver of this evolution. The Union holds an expertise which is located at the crossroad of radioactivity, the environment, health and the assessment of risk. This is a highly strategic position and a remarkable integration of skills that hardly exists elsewhere. Building an advanced knowledge on the relationships between ionising radiation and the environment is a prerequisite to further development and acceptance of the civil use of nuclear energy. All together, this challenges the Union's responsibility to play a central role in this evolution, as a minimum for what directly concerns radioactivity, but also as an experienced catalyst towards linking together different scientific fields that have evolved separately. As General Secretary of the Union, I am convinced that the current membership is quite capable of generating such an advanced knowledge with much creativity and cleverness. This is already on its way, irrespective of the criticisms from sceptics, and the full Board of Council reinforced with all members having taken action responsibilities, will follow up towards meeting these goals by undertaking and completing all necessary reforms.

François Bréchignac
General Secretary

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XXVI General Assembly

IUR management updates

After one year on duty, a small re-adjustment of the Board of Council management has been presented, with the Treasurer responsibility being transferred to Deborah Oughton in replacement of John Hilton, who becomes «Membership Secretary».

The detailed list of the Regional Coordinators forming the Advisory Panel has been presented, at the exception of a representing coordinator for the African continent, still to be identified :

CIS Countries:	Gennady Polikarpov
Asia:	Yongguan Zhu
Southern America:	Paulina Schuller
Australia/Pacific:	Alex Zapantis
Northern America :	Tom Hinton
Europe:	François Bréchignac
Africa :	tbd

A list of the 16 new members having been accepted within IUR has been presented along with a list of 9 new sustaining members. The General Secretariat reported on a wide undergoing effort directed towards rising funds through direct solicitation of industries/ companies/institutions to endorse sustaining membership.

Report by the President

After thanking the audience for attending, Per Strand gave a brief overview on the evolutions that have dominated IURs activities in 2003, and that have driven to undertake new developments and activities that will grow up in 2004. A special emphasis has been placed on acknowledging the launch of the Asian branch of IUR that will start with gathering scientists from China, Japan and Korea. Also, the current focus on protection of the environment that stimulates radioecologists towards tackling the impacts of ionising radiation on biota and related ecosystems has triggered new thinkings, new undertakings, and new plans for the future, that have been briefly addressed.

Task Groups activities

Exposure and effects in biota/Environment Protection

IUR Report 3 – Protection of the environment: Current status and future work , distributed to all IUR members

IUR Statement - Protection of the environment in the 21st century: Radiation protection of the biosphere including humankind, distributed to all IUR members

IUR members involved in ICRP Task Group on Protection of the Environment.

IUR to participate in UNSCEAR on-going work as an « observer ».

Task Group activities stopped in its previous configuration. New Task Group initiated (Leader: David Copplestone) with wider international representation, new objectives and new action plan, in particular:

- IUR to support new actions on the improvement of scientific knowledge
- Links initiated with environmental impact assessment for non-radioactive contaminants
- Linking different approaches to environmental protection
- Initiating work to establish worldwide network of experimental laboratories

Dr M. Balonov mentions the on-going project on «Effects on biota in Chernobyl» that is currently driven by IAEA, and that will form a source of new information for the Task Group.

Arctic and Antarctic regions

Overall objective of contributing to the understanding the processes governing the behaviour of radionuclides in Arctic and Antarctic ecosystems, covering a consideration of experimental activities, field studies and modelling.

No specific IUR direct activities within the current year, but various studies by members for possible Workshop discussion in 2004, and several papers and reports produced on Arctic and Antarctic contamination.

Current task group members from states with Arctic/ Antarctic territory, and also members with a general interest in this subject.

- Douglas Dasher. Alaska: Work proposed for Summer, 2004 in the marine environment around Amchitka. Current activities concern the study of ^{137}Cs in lichen, and the development of an updated real-time gamma monitoring system for Alaska.

- Michael S. Karcher, Alfred Wegener, Germany: Recently started a new project; RADNOR (Radioactive dose assessment improvements for the Nordic marine environment). Focusing on ^{99}Tc, the principle objective of the study is to further constrain dose assessments for the Nordic marine environment.

- Jerzy W. Mietelski, Poland: Looking at measurements for ^{137}Cs in a variety of samples including grass and animal bones, from King George Island and Arctic collections.

◆ Sigurdur Palsson, et al., Iceland: Continuing work being done to predict levels of global fallout in terrestrial and aquatic environments concentrating on relationship between precipitation and fallout. Various papers and reports are available.

◆ Lavrans Skuterud, Norway: Work looking at cadmium in reindeer, and ^{137}Cs in Lynx, Norway 1986-2001.

◆ Gennedy Polikarpov, Ukraine: Examination of samples collected during the 7th Ukrainian Antarctic Expedition (Dec. 2001- May 2002) to determine concentrations of ^{137}Cs and ^{90}Sr in seawater and ice.

◆ Paulina Schuller., Gabriele Voigt et al., Chile and Norway: Ongoing work in Chile on soil plant transfer data, which has lead to the production of several papers.

Radioecology and other contaminants (previously AROC)
(Hildegarde Vandenhove to carry on)

No specific action to report on this year, apart from the Board efforts to carry on with publication of the proceedings from the 2 Workshops held in 2002 (Antwerpen and Kiev).

New Task Group leader identified: Hildegarde Vandenhove, Belgium.

New Task Group objectives and planning to be worked out shortly including:

◆ Assessing Synergistic effects
◆ Comparing different approaches in environmental assessment (radionuclides/other contaminants)
◆ Establishing continuous contact/collaboration with SETAC
◆ Working towards a data base?

Philosophy, Ethics and Policy
(Deborah Oughton reporting)

Stopped as an official Task Group, but specific work to be continued in a new Task Group on communication and stakeholder issues.

Waste and radioecology (Rodolfo Avila reporting)

Launch in Nancy 2002,
1st Workshop held in Merlewood, 2003,
2d Workshop held in Madrid, 2003,
3d Workshop planned in Aix en Provence (ECORAD 2004).

Recommendation report foreseen, end 2004 (future IUR Report N°04).

Task Group activities closely coordinated with the BIOPROTA project.

Speciation (on behalf of Brit Salbu, excused)

Task Group started with a first Workshop in Monaco, September 2002

The main objective of this Task Group is to strengthen the competence internationally on environmental impact assessment

Currently seeking funds for a second Workshop (NATO,…)

Exploring potential for holding this Workshop in conjunction with ECORAD 2004.

Recent IUR Publications

Newsletter n° 40 (May/June 2003).

Newsletter n° 41 (November 2003).

IUR Report 3 – Protection of the environment: Current status and future work.

IUR/NKS Proceedings – Radiation Protection in the 21st Century including Oslo Consensus Conference.

IUR Statement - Protection of the environment in the 21st century: Radiation protection of the biosphere including humankind:
◆ Journal of Environmental Radioactivity (2003) 70:155-159.
◆ Ethics in Science and Environmental Politics ESEP (2003) 40-42.
◆ Radiation Biology Radioecology (2003) 43(4):494-496 *(in Russian)*.
◆ Marine Ecological Journal (2003) 2(2), 102-103 *(in Russian/English)*.

Nancy SETAC-IUR Conference on « Mobility in biosphere of I, Se, Tc and U » (2002) Published in Special Issue of JER N° 70, 1-2 (2003).

IUR Workshops and Conferences

◆ ICOBTE Symposium on the chemistry, bioavailability and recycling within biota: Towards and integrated approach in mobility assessment. Y. Thiry, M. Gerzabek & S. Staunton. Uppsala, Sweden, 15-19 June, 2003. 2 young radioecologists sponsored for attendence (See Reports in Newsletter N° 40)

News from the Secretariat

ICOBTE Symposium, Uppsala, June 2003

- 2 Workshops of the « Waste and Radioecology » Task Group:
  - Merlewood, UK, 27-28 March 2003 (^{237}Np, ^{14}C, ^{36}Cl).
  - Madrid, Spain, 3-4 November 2003 (U, Tc)

- IAEA Conference on « Protection of the Environment from Ionising Radiation », Stockholm, Sweden, 6-10 October 2003. Co-organised in collaboration with IUR, UNSCEAR and EC.

Legislation Committee

A Legislation Committee has been formed to deal with updates of the IUR constitution and bylaws. The follwong members have accepted to serve:

- Rudolf Alexakhin, Yongguan Zhu, François Bréchignac (as Secretary of the Committee)
- René Kirchmann (Honorary General Secretary), Marc Poncelet (ICSA Accounting advisor)
- R. Haninen, K. Higley, C. Robinson

Consultation of all IUR members: Current constitution and byelaws sent out to all members.

Call for suggestions and proposals.

Finances

The new Treasurer presented the operating statement for the years 2001 and 2002 as well as the anticipated budget for the year 2003. These have been endorsed by the General Assembly.

The 2004 rates for the membership fee have been retained at the rate of the previous year.

All members have been urged to clear their membership, when applicable, a duty now largely facilitated by the on-line information and procedures available on the web site.

OPERATING STATEMENT (Preliminary)	31/12/2001	31/12/2002
ORDINARY		
Income		
Membership fees	12 887	7 123
Interest	853	1 086
Transactions amendements	0	0
Third party support	0	0
Total Income	**13 740**	**8 210**
Expense		
General Assembly	-2 400	-9 699
Officers and Accountant	-3 564	-641
Board of Council	-8 716	-247
Newsletters and Website	-5 838	-242
Support for FSU participation in DGXII activity	0	0
Bank costs & interest & exchange difference	-540	-714
Total Expense	**-21 059**	**-11 542**
DEFICIT ORDINARY	**-7 318**	**-3 333**
SPECIFIC ACTIVITIES		
Contract DG XII	0	0
Doses to Biota	0	0
Arctic Activities	-13 064	-15 870
Antwerp Conference	0	7 775
Kiev Conference	0	1 044
Book sales (expenses)	0	-3 000
SURPLUS SPECIFIC ACTIVITIES	**-13 064**	**-10 051**
NET SURPLUS	**-20 382**	**-13 384**

Anticipated budget (2003 for 2004)

	Item	Euros	Euros
Income	Total fund balance	39 464	
	fees	7500	
	Sustaining members	15000	
	3d parties	2000	
	interest	500	
	total	**64 464**	
Costs			
	Council \ secretariat running costs		9500
	Newsletters, website		1000
	bank charges		600
	Initiating new task forces		5000
	total		16100
	waste biosphere		6000
	Antwerp conference (Publication)		2800
	total		**8800**
Totals		**64 464**	**24900**
Projected balance at end of 2003		**39 564**	
Start bank account		39 464	
Final bank account		39 564	

Outline of the programme for 2004

Active Task Groups, continuing or starting activity, in 2004 are as follows:

- Environment Protection (D. Copplestone)
- Arctic and Antarctic regions (B. Howard)
- Radioecology and other contaminants (H. Vandenhove)
- Waste and radioecology (R. Avila)
- Speciation (B. Salbu)
- Communication and Stakeholders issues (D. Oughton)
- Radioecological Parameters – IAEA-IUR joint TG on Revision of TRS 364 (P. Santucci)
- Radioecology of Rice (Y. Zhu)

The Asian branch of IUR will be launched in November 2003 at Beijing, along with its very first action, the Task Group on the Radioecology of Rice. The Asian branch, to be chaired by Yongguan Zhu (Vice-President of IUR) and co-chaired by Dr S. Hisamatsu (IES, Japan), will particularly coordinate on-going research and developments in Radioecology in China, Japan and Korea.

IUR will be co-organizing some key international conferences:

- ECORAD 2004: The scientific basis for environment protection against ionising radiation. IRSN, IUR, ICRP. Aix en Provence, 7–11 September 2004. It is emphasised that 13 IUR members are members of the Scientific Committee.

- International Radioecology Conference - Chernobyl International Centre. 2004. Dr Bondarkov.

Several Task Group Workshops are intended to be organised in 2004, potentially joint to the ECORAD 2004 Conference:

- Protection of the environment
- Waste and Radioecology
- Arctic and Antarctic regions
- Speciation…

The Legislation Committee will elaborate a proposal for update/change of the constitution and byelaws. The aim is to submit and adopt them at the next General Assembly (Aix en Provence, September 2004).

News from the Secretariat

A number of IUR publications are foreseen to be released in 2004:

- Kiev Conference 2002 (Equidosimetry), final editing, KLUWER Press, Financial support from NATO.
- IUR-SETAC joint Conference on « Exposure and effects, Modelling in Environmental Toxicology» (2002), to be published as special issue of JER.
- Recommendations report from the « Waste and Radioecology » Task Group – IUR Report n° 04.
- Selected papers from the IUR Monaco conference to be published as a special issue of JER.

IUR has started to work towards the construction of a **Worldwide Network of Radioecology** experimental laboratories. In the scientific world of radioecological sciences that is currently undergoing profound evolution, the objectives are:

- to identify the players worldwide and their research potential
- to open up new opportunities for wider collaboration
- to strengthen radioecology as a reknown scientific discipline dealing with the environment
- to ensure ultimate coordination of the scientific actions and programmes.

The work plan is expected to evolve in 3 three steps:

- Elaboration of a worldwide list of radioecology laboratories with experimental capabilities (Name, address, research team size, current leader, technical experimental features)
- Short description of scientific programmes and actions dealt with (transfers, effects, speciation, geochemistry, biology, scale of biological organisation dealt with, type of media considered, mechanisms and processes tackled, ...)
- Working out from the above a potential integrated international programme...

Other issues

Rudolf Alexakhin mentions the recent death of a prominent ecologist and radioecologist, Professor Eugen P. Odum, who set up in 1951 the Laboratory of Radiation Ecology at the US DOE Savannah River test site. He is thought to be amongst the first scientists to have introduced the scientific term «Radioecology» in 1956. An obituary will be published in the next Newsletter N° 41.

Upon proposal of the General Secretary, the General Assembly unanimously appointed 2 new Honorary members in recognition to their prominent past contributions to the IUR: Dr A. Cigna, former IUR President, and Dr. M. Frissel.

Concerning the IUR-IAEA Joint Task Group on Radioecological Parameters – Update of TRS 364, Brenda Howard mentions the further interest of FAO, that is connected to the use of this data base along with radioecological models in developing countries.

The next General Assembly is announced to be held during the International Conference ECORAD 2004, in September 2004, Aix en Provence, France.

Fees 2004 (and left-over from previous years)

Enclosed with this Newsletter is the 2004 Subscription Renewal Form. All practical details for payment procedures are included on the form. Please, note that the preferred method of payment is by providing the Membership Secretary with your credit card details. If you need to arrange another method of payment, please contact the Membership Secretary: Dr John Hilton (jho@ceh.ac.uk). The membership fee payment form can also be downloaded from the front page of the web site.

If you have not paid for several years, please could you do so promptly, as **non-paying members will be shortly withdrawn from the members list** (with no more access to specific areas on the web site).

Membership grade	CIS, China, Cuba, Colombia	Central Europe	Other countries	
	$	$	€	$
Student	7	10	20	20
Regular	14	20	50	50
Senior	21	30	70	70
Fellow	21	30	70	70
Emeritus	7	10	20	20
Honorary	0	0	0	0
Supporting organisation	>140	>200	>400	>400

New Sustaining Members

IRSN/DPRE/SERLAB	France
ANDRA	France
BNFL	United Kingdom
ENRESA	Spain
NIREX	United Kingdom
NUMO	Japan
POSIVA	Finland
SKB	Sweden
UKAEA	United Kingdom

News from the Secretariat

New members

ZAPANTIS Alex	Australia
LITTLEWOOD Karl	Scotland
OLEKSYK Tarek	USA
LEGARDA Fernando	Spain
DANESI Pier Roberto	Austria
HERRANZ Margarita	Spain
AKSOY Abdulkadir	Saudi Arabia
AL-AZMI Darwish	Kuwait
LEHTO Jukka Kalevi	Finland
DALE Paul Geoffrey	Scotland
KARCHER Michael	Germany
DOMEL Renate Ursula	Australia
AGUERO Almudena	Spain
SYSSOEVA Anastassiya	Russia
XU Shulan	Sweden
DUBOIS Grégoire	Italy
PUNT Adrian	United Kingdom
NILSSON Sverker	Sweden

Merry Christmas and Happy New Year

Union Internationale de Radioécologie
International Union of Radioecology
Secretariat

Website news

The reconfiguration of the web site has now been completed, with additional features and on-line facilities available. Visit it at:

www.iur-uir.org

It has been fully restructured, exhibits a more up-to-date look out, and features a number of useful tools at the disposal of IUR members (news, links, illustrations, publications, conferences, restricted area with members list, vacancies, dicussion forum and contacts).

All IUR members are encouraged to make maximum use of this web site, either directly, or through the webmaster (francois.brechignac@irsn.fr) when appropriate, to advertise, illustrate, exchange, on all relevant radioecological matters. The impact of the radioecological community can be greatly enhanced depending on the vitality exhibited on its web site, such as frequency updates, early news warning, expert analysis of current issues of high social relevance or concern.

Obituaries

In memory of Eugene P. Odum, an outstanding scientist

At the age of 88 in the USA of a heart attack died Eugene P. Odum. Gone away one of the patriarchs of ecology whose efforts in this area of human knowledge are hardly possible to be overestimated. E. Odum was a pioneer in developing the role of ecology as an exclusively integrated discipline that brought all the sciences together. E. Odum stressed that ecology was not a subdivision of biology but something more significant, he actually was a pioneer of an ecological approach in ecological studies.

With his name is the origin of radioecology as an independent branch of ecology in the 1950s connected. It is E. Odum who in 1956 introduced the term «radioecology» in a scientific vocabulary (note that simultaneously in the same year the term «radioecology» was suggested in the USSR by corresponding member of the USSR Academy of Sciences A.M. Kuzin and Professor A.A. Peredelsky).

The 50s-60s of the last century saw a great splash of radioactive studies, it especially concerned the nuclear states, the USSR and the USA, since it is exactly in that period evident became a crucial importance of a radiation factor effects on biota in the environment as a result of atomic energy usage by humans (unfortunately, initially it was done in the military sphere). One of the first American ecologists who recognized a crucial role of ionizing radiation as an ecological factor was E. Odum.

In 1951, E. Odum established the Laboratory of Radiation Ecology to study the impact of nuclear weapons production (and later nuclear power engineering) at the U.S. Department of Energy's Savannah River Site. Initially staffed only by E. Odum and a few graduate students, the laboratory has evolved into one of the largest radioecological centers of the USA. In the same 50s E. Odum for the first time in history recognized on the power of radioisotopes as a research tool in studying many ecological problems. His experimental studies using radioactive tracers in analyzing trophic chains in natural conditions were accepted as classical. In the 1950s, using radioisotope procedures, E. Odum studied problems of primary productivity of ecosystems, radionuclide metabolism in various organisms (including estimation of half-lives of biological clearance), energy flows in ecosystems.

Scientific efforts of E. Odum had received wide international recognition. He was elected a member of the National Academy of Sciences of the USA, received the Craaford Prize from the Royal Swedish Academy of Sciences (the equivalent of the Nobel Prize, which is not awarded in ecology). In 1957, he received the French prize from the Institute de la Vie and in 1977 the Tyler Ecology Award which was presented to E. Odum by the U.S. President Jimmy Carter in ceremonies at the White House, who said that «the work of Dr. E.Odum changed the way we look at the natural world and our place in it». Of unique importance for many generations of ecologists was published in 1954 monograph of E. Odum «Fundamentals of Ecology» that was translated into many languages (into Russian in 1975). It was an excellent textbook and for soviet ecologists - a handbook.

In 2000, the author of these lines had a lucky chance to meet E. Odum in his study at the University of Georgia (this meeting was organized by a known American radioecologist, Odum's pupil, Tom Hinton, the present head of the Savannah River Ecology Laboratory). In front of me was a short, 85-year-old man, very lively, with exclusively keen mind. During a continuous 4-hour conversation he was inquiring me about the achievements of radioecology in the USSR and CIS, Chernobyl radioecology, told me about the history of radioecology in the USA.

He earnestly spoke of a great social importance of ecological (including radioecological) studies in the contemporary world. In conclusion he presented me with his book «Ecological Vignettes. Ecological Approaches to Dealing with Human Predicaments» issued in 1987 and intended for general audiences. As it turned out it was the last monograph in the life of this remarkable scientist. It is symbolic that at the University of Georgia even in t he lifetime of E. Odum a bust of the scientist was erected, on the pedestal of which his words were cut which had become classical that an ecosystem is not just a sum of individual components but a series of interlocking communities, each of which embraced «a unique strategy of development».

Ecologists and radioecologists worldwide will remember Eugene Odum as one of the founders of this science.

RAAS Academician R.M. Alexakhin,
Vice-President of IUR

Gennady Nikolaevich Romanov (24 January 1935 - 24 September 2003)

On 24 September 2003 passed away G.N.Romanov – a well-known radioecologist, a specialist whose works in the field of environmental protection against ionizing radiation had gained wide international fame. The whole of his career and almost 50-year scientific and organizational activity were connected with only one institution – experimental scientific research station (ESRS) of the production plant «Mayak» in the town of Ozersk, a large reactor-radiochemical facility.

Within the ESRS, a unique test site was arranged for radioecological investigations established on the basis of the East Urals radioactive trail. There, under the scientific supervision of VASHNIL academician V.M.Klechkovsky, one of the founders of radioecology, the fundamentals were developed of this scientific discipline, in particular its agricultural branch.

At the ESRS, alma-mater of Russian radioecology, in the 1960s-1970s a range of comprehensive investigations were carried out to study radionuclide transfer in various natural environments – air, soil, plants, animals, water and ionizing radiation effects on natural and cultural ecosystems. Within the same contaminated area in the 1960s unique works were done on the rehabilitation of these lands by applying a system of countermeasures.

G.N. Romanov was an active participant, one of the leaders of these works, since 1970 when he first became deputy head and then head of the ESRS in 1987. Initially the sphere of his interests concerned problems of soil resuspension of radionuclides and their non-root accumulation by plants. Later he expanded it to include radionuclide transport via the major agricultural chains in the environment. He introduced to radioecology physico-mathematical approaches to estimating phenomena of the activity transfer in the natural environment and ionizing radiation effects on plants and animals. He was among the first to study problems of ^{129}I and actinide migration in natural and agricultural ecosystems. In the 1980s, G.N. Romanov headed the works on ionizing radiation effects on biota in its habitat. At the ESRS, under the leadership and active participation of G.N. Romanov, various large-scale radioecological experiments were conducted with the introduction into the environment of different radionuclides and arrangement in natural conditions of powerful sources of ionizing radiation.

From the first days after the Chernobyl accident in 1986 G.N. Romanov, together with his ESRS colleagues, was in the focus of events related to the mitigation of consequences of this disaster in agriculture and forestry. The experience accumulated during the activity within the EURT area proved to be in a great demand there, in the Chernobyl affected region. As early as in the first weeks and months, in the accident zone, very important scientific and practical results were obtained. This work was known to cover a very long period of time.

His guidebook «Liquidation of consequences of radiation accidents» published in 1993 is widely used for calculations of environmental impacts of radioactive contamination. The last work of G.N. Romanov was a collective monograph «Heavy radiation accidents: consequences and countermeasures» (2001), where he was a leading author in describing radioecological aspects of the accident.

RAAS Academician R.M. Alexakhin,
Vice-President of IUR

Arctic and Antarctic Regions

(Task Group Leader: Brenda Howard, bjho@ceh.ac.uk)

Arctic Studies are continuing in Iceland on prediction of the spatial variation in global ^{137}Cs fallout and several conference papers and reports have now been produced by Sigurður Emil Pálsson and his colleagues. In Norway, Lavrans Skuterud is investigating Cd behaviour in reindeer and ^{137}Cs in Lynx from Norway for 1986-2001. In the USA, Doug Dasher has a student carrying out a project on ^{137}Cs in lichen, and is involved in the development of an updated real-time gamma monitoring system for Alaska. Michael Karcher from Germany is involved in the RADNOR project (Radioactive dose assessment improvements for the Nordic marine environment); the project is focusing on ^{99}Tc. Jerzy Mietelski from Poland has students measuring ^{137}Cs in a variety of archived samples including grass and animal bones, from King George Island, Spitzbergen and Greenland and analyses of ^{90}Sr and $^{239+240}$Pu and ^{238}Pu are planned.

Prof. Polikarpov and colleagues from Ukraine are currently examining samples collected during the 7th Ukrainian Antarctic Expedition (Dec. 2001 - May 2002) to determine concentrations of ^{137}Cs and ^{90}Sr in seawater and ice. Ongoing work in Chile, by Paulina Schuller and Gabi Voigt on soil plant transfer data, has lead to the production of several papers on areas of high radioecological sensitivity.

Brenda Howard visited Icelandic members (Sigurður Emil Pálsson and Magnús Á Sigurgeirsson) at the end of 2003, and two papers arising from task force activities were prepared, one of which has now been submitted. In addition, joint work on radiocaesium contmaination of lynx in Sweden is ongoing with Birgitta Åhman , and a paper on these activites is in its final stages of preparation. Various measurements and other activities in both the Arctic and Antarctic by the TG members should provide a good foundation for a possible Workshop discussion in 2004.

Protection of the environment from ionising radiation

(Task Group Leader:
David Copplestone, copplest@liverpool.ac.uk)

Following the publication of the Task Group's report «Protection of the Environment: Current Status and Future Work», the main emphasis of this task group has changed to one that focuses on the identification and prioritisation of the research requirements in the field of protection of the environment from ionising radiation. There is a pressing need to identify and help to address through innovative research, knowledge gaps that affect our ability to make scientifically defensible decisions and risk assessments regarding the biological impact of ionising radiation released in to the environment. Many of us can already list a number of the key issues but there is a need to identify all the issues and to address those that are of highest priority in allowing the development of suitable assessment tools and to provide the science that underpins the acceptance of these tools in society.

This task group has therefore the following primary objectives:

- To identify knowledge gaps and to prioritise research requirements to address them;
- To identify researchers and facilities where the research may be conducted to address these knowledge gaps.

A secondary objective is to improve communication, particularly at an international level, on issues related to the protection of the environment from ionising radiation via setting up a virtual network for discussion. It is hoped that this will help to harmonise the approaches being developed and eventually to provide a forum for testing and validating assessment tools.

It is hoped that IUR members will become involved in this process initially through an interactive website and it is expected that there will be follow up meetings to discuss and, in particular, make recommendations on the research priorities that can be used to influence research programmes in the future. These recommendations will be transmitted to organisations that may have available research funds for work on the impact of ionising radiation in the environment in order to maximise benefit from the use of the available funds.

It is expected that this task group will have close links with other IUR task groups for example «Radioecology in a multipollution context» as well as organisations conducting research in this field and stakeholders.

IUR (2002) Protection of the Environment: Current Status and Future Work. International Union of Radioecology Report 3. 23pp. Task Group Chairs: Strand P. and Oughton D. Report contributors: Brechignac F., Brown J., Copplestone D., Domotor S., Howard B., Hunter G., Mobbs H., Oughton D., Pentreath J., Robinson C., Woodhead D., Zhu Y.

Radioecology and Radioactive Waste

(Task Group Leader: Rodolfo Avila, rodolfo.avila@facilia.se)

Two Workshops of the "Radioecology and Waste" Task Group have been conducted in 2003, the first one in Merlewood, U.K, and the second one in Madrid, Spain. A third Workshop is planned to be held during the ECORAD 2004 Conference in Aix-en-Provence, France. This should finally lead to a report that will include recommendations of further research needed to improve predictions of the radionuclide transfer in the environment in connection with safety assessments of repositories for high level radioactive waste. The following provides an overview of the curent achievements, with emphasis on the first Workshop output.

Neptunium 237

An overview of the behaviour of ^{237}Np in the environment has led to the suggestion of the following priorities for future research:

- Further development of analytical methods such as neutron activation techniques for measuring quantities such as in situ sorption in saline and fresh waters.
- Studies of Neptunium behaviour in anoxic fjords and meromictic lakes.
- Carry out food chain studies, such as the lichen-reindeer-man food chain, using available samples and applying new techniques.
- Studies of Neptunium metabolism in man.

The analytical techniques have greatly improved by using ICP-MS (Inductively Coupled Plasma Mass Spectrometry). However levels in environmental waters are in the order of less than 1 µBq l^{-1} and even with ICP-MS relatively large volumes are required. By using other mass spectrometric methods such as TIMS (Thermal Ionisation Mass Spectrometry) 1-2 l is enough-but these analysis are expensive.

It is possible that enrichment takes place in specific environments, as is the case for other actinides, especially the redox-sensitive ones such as Pu. Such environments are anoxic water bodies or waters with high humus content. From a waste management point of view such environments are of vital interest.

By present techniques it would also be possible to study Np behaviour in food-chains. The deposition of Np from Nuclear tests fall-out and Chernobyl has been investigated by using lichens. It would be a natural step to go further to different organs of reindeer. By doing that it would be possible to assess the gastro-intestinal uptake and estimate residence times under natural conditions. Our present knowledge of Np behaviour in the human body is based on experimental studies with rats. A study of reindeer is not ideal to describe the situation for man. There are short-lived Np isotopes which could be used with minimal dosed to study uptake and retention in man. There are also autopsy samples from the early fallout periods that could be used.

The lack of currently available environmental data on neptunium is emphasized. The low levels of this radionuclide in the environment mean that studies have largely been limited to the plume of Np from Sellafield. One area of research that was highlighted was the need to understand the effect of changing redox chemistry on neptunium solubility and mobility in the environment. All the studies thus far point to the fact that neptunium may be more soluble than either Am or Pu in oxidising systems, but that when reduction occurs, Np solubility may decrease. This is particularly important to consider in the context of waste management scenarios. Finally, there was some discussion about the approach of using laboratory simulation experiments with elevated and more easily detected levels of Np, or with ^{239}Np to understand some of the key environmental processes for transfer of Np. This approach have been successfully used to understand the environmental behaviour of actinide elements including U and Pu, as well as for fission products such as Tc.

The group considered that in general there are few environmental data for Neptunium, due to difficulties of measurement in the past and that there are gaps in the understanding of its environmental behaviour. This is reflected in the interaction matrix for this radionuclide (see attachment C), where there is no clear differentiation in the importance of the transfer processes. For some processes, Np mobility seems to be greater than that of Pu and Am. The relevance of Neptunium for waste management varies between different countries.

The following possible ways of filling knowledge and data gaps were suggested by different members of the group:

- To carry out studies of metabolism in large animals, for instance using ^{239}Np in bioavailability studies.
- To measure some of the samples existing in different laboratories taking advantage of recent development of measurement techniques.
- To analyse the database of information on workers' exposure to transuranic elements existing in the US (Registry of Workers exposed to Transuranic Elements).
- To carry out critical evaluation of existing databases with a focus on some key processes, such as the soil-plant-animal transfers, and the accumulation and bioavailability in soils.

Carbon 14

An overview of ^{14}C behaviour in terrestrial environments led to the suggestion of the following issues for consideration as priorities for research:

- Metabolism of methane in soil and the interaction between the soil solution and the soil atmosphere.
- Root uptake by plants.
- Uptake from the sub-canopy and above-canopy atmosphere.
- Losses from irrigation waters during extraction and application.
- Partitioning of uptake from the gastrointestinal tract.
- Characterisation of body pools

Post-closure radiological assessments of solid radioactive waste disposal have shown that the generation of ^{14}C-methane and ^{14}C-carbon dioxide can be of radiological significance. These gases are produced by microbial degradation of wastes and can be transported to the surface together with hydrogen produced from metal corrosion in reducing conditions. If continuous gas-filled pathways are produced, such transport can be rapid. ^{14}C-carbon dioxide may be a limited problem, as it would be expected to react with a cement/concrete in the near field. However, ^{14}C-methane is likely to be non-reactive in both the near field and geosphere, but will be subject to microbial metabolism to ^{14}C-carbon dioxide in the soil zone. In addition, ^{14}C may be released from a repository in solution in groundwater. Such groundwater may be abstracted from wells and used for irrigation and other purposes. It is not clear how much of the ^{14}C would be lost from abstracted groundwater before that groundwater was utilised. In particular, losses from solution during spray irrigation might be substantial.

Although the majority of plant carbon is generally obtained from the atmosphere by photosynthesis, significant root uptake has been observed and this may contribute up to a few percent of plant carbon. Also, if ^{14}C-carbon dioxide is released from soil, its concentration in the entrapped sub-canopy atmosphere may be much higher than in the above-canopy atmosphere. Model results were presented illustrating this effect.

Some ^{14}C entering the gastrointestinal tract may be completely broken down on ingestion and enter the bicarbonate pool in tissues. However, a substantial proportion may bypass the bicarbonate pool and be incorporated directly into carbon compounds in tissues. Loss from the bicarbonate pool occurs rapidly to exhaled air. Thus, although ^{14}C is generally completely taken up from the gastrointestinal tract, considerable distinctions exist relating to its subsequent partitioning between different forms and hence in its uptake and retention in tissues.

In assessment studies, consumption of ^{14}C in freshwater fish is often found to be an important pathway. This arises because of the artificial assumption that the specific activity of carbon in freshwater fish is equal to the specific activity in the surrounding water. An improved modelling approach is required that more correctly represents carbon (and hence ^{14}C) fluxes in freshwater ecosystems.

A comparison of different approaches for estimation of the halftime of ^{14}C in farm and wild terrestrial animals has been provided. It strengthened that the classical approach, based on body carbon content and digestible carbon intake, is an underestimation of real organic carbon metabolism by a factor up to 2. For farm and wild animals the whole body carbon halftime can be expressed using mass allometric relationships. For farm animals it is important to consider the effect of maturity on the carbon half times.

A general overview of carbon cycling models for terrestrial ecosystems and a conceptualisation of the transfer in terrestrial ecosystems of ^{14}C released into the atmosphere have both been provided.

An ecosystem model of carbon cycling in a coastal area of the Baltic Sea has been explianed. The presented model was developed for assessing the environmental transport and fate of a hypothetical discharge of ^{14}C during a period of 1000 years from the Swedish final repository for radioactive operational waste (SFR). The model involves identification, quantification and dynamic modelling of the main flows and storages of carbon, both in the physical environment as well as in the food web. The processes included in the model were primary production, respiration, consumption, faeces production and water exchange. ^{14}C was in the model introduced into the food web via photosynthesising organisms and then transferred to higher trophic levels in proportion to the general carbon flow in the system and the ratio of ^{14}C to other carbon isotopes in the ecosystem components. Respired ^{14}C was connected to a compartment for dissolved inorganic carbon, which also was the inorganic carbon source for primary producing organisms.

Thus, this mechanism provided re-circulation of respired carbon and ^{14}C in the system. A second pathway of re-circulation in the model was the excretion/loss of organic

material by organisms that was connected to a compartment for particulate organic carbon (POM). POM was modelled to settle out to the sediment and become consumed by benthos and could thus become introduced in the food web again. The implications of changes of two parameters on the ^{14}C fate were examined: route of ^{14}C entry in the food web and water exchange rate. In general, the highest ^{14}C-concentrations were observed in benthic plants and benthic macro grazers, followed by fish and other organisms. ^{14}C entry into the food web via benthic primary producers was found to lead to increased concentrations in biota (especially benthic organisms) and reduced rates of water exchange were also observed to significantly increase the ^{14}C exposure of the organisms compared to a reference case.

The group considered that the dynamics of carbon transport in both terrestrial and aquatic ecosystems is well understood. A matrix for each of these types of ecosystems was prepared at a rather high level of detail (see attachment C). The following processes were considered to have the highest importance for describing the cycling of ^{14}C in a terrestrial ecosystems: photosynthesis, respiration by the above ground vegetation and animals and the soil biota, fermentation by animals and soil biota, exhalation and diffusion of gases from the soil atmosphere, ingestion of vegetation by animals, litter fall and senescence, ingestion and utilisation of soil organic matter by soil biota. In the case of aquatic ecosystems, the processes classified as most important were: photosynthesis, consumption, respiration, decomposition and excretion by primary producers, herbivorous fish, carnivorous fish and detritivores.

The group noted that there exist good models of carbon cycling in all types of ecosystem, which could be adapted to the problem of long-term ^{14}C cycling. The selection of the appropriate model is a matter of defining appropriate time and spatial scale for the problem. For long time scales, consideration of the effects of climate change will be necessary, especially if there is an interest in protection of the environment.

The group was critical of the use of CF, in its classical definition, to describe ^{14}C transfer and recommends alternatives, such as the specific activity approach and dynamic models.

Chlorine 36

An experimental study of ^{36}Cl behaviour in the environment, which is part of the MITRIC-UA project «Studies of transfer of halogens to plants», financed by IRSN. The presentation was focused on ^{36}Cl behaviour in the soil-plant system, with especial emphasis on the following issues:

- The absence of absorption by soil, a prevailing role of fixation by biota and the migration with the soil moisture flux.
- The root uptake by plants, which is characterized by quite high concentration factors.
- The dependence of ^{36}Cl behaviour in the environment on stable chlorine content.

A study of the upward soil migration and plant uptake of ^{36}Cl has finally be presented. A soil column experiment was described in which the height of a ^{36}Cl contaminated water table within the soil columns was carefully controlled. The results showed that, compared to a fixed water table, increasing water table height markedly increased water transport, and hence ^{36}Cl migration, up through the soil. Kd values of zero could be estimated on the basis of the results. Over time, the soil profile of ^{36}Cl tended towards a uniform vertical distribution. Once present within the rooting zone of the soil column, ^{36}Cl was readily taken up by perennial ryegrass growing on the surface of the column. Soil-plant transfer values (dry weight basis) of around 200-400 were observed. The processes leading to vertical redistribution in the system were considered the key processes for describing the long-term behaviour of this radionuclide in terrestrial ecosystems.

The group recommended that special emphasis should be put on improving the description of the radionuclide recycling in the soil-subsoil system, which could result in accumulation of ^{36}Cl and pointed to the need for experimental studies on this topic. The group also considered that the balance of the input and output of stable chlorine into the system is an important factor that need to be taken into account when modelling ^{36}Cl migration in the environment. It is also important to improve the description of the dynamics of chlorine remobilisation (leaching) from soil organic matter due to disintegration of the organics.

Radioecological Parameter Values: an introduction to new developments

Joint IAEA/IUR Task Group on Update of TRS 364; Task Group Leader, Pascal Santucci: pascal.santucci@irsn.fr)

The IAEA TRS 364 «Handbook of parameter values for the prediction of radionuclide transfer in temperate environments» was published in 1994, based on data available up to 1992. Since that period, new data have also been produced, such as post-Chernobyl information, and new experimental results, potentially completing the existing data and syntheses, which are now more than 10 years old.

TRS 364 is widely used as a major source of information, because it addresses numerous environmental transfers and radionuclides. It is thus quoted in nearly all impact assessments, even if amended or completed by the scientific community (radiation protection, radioecology). In particular, it is used in the most recent international methodologies, like the IAEA SRS 19 published in 2001. It is consequently important to keep such a document as accurate, relevant, complete as possible.

Among the various issues which had to be discussed, there were two major items which are prominent because belonging to the driving process of the revision :

1) The question of the implicit assessment purpose which would be borne in mind when selecting data : should the parameter values considered as realist, reflecting a given reality, or best estimates, as average of relevant source data, or conservative, as used in numerous impact assessments ? The answer was not straightforward, since prominent international documents like SS 57 (1982) and its revision SRS 19 (2001), as well as TRS 364 itself were not clear and consistent about that matter. There is certainly a need to homogenise these views and be more careful about uncertainty specifications.

2) The question concerning the implicit modelling assumptions : most often, steady state modelling has been assumed as a general feature of most existing methodologies (previous assessments, IAEA documents), and this view should be kept due to some scientific necessities (lack of knowledge) or due to the required technical consistency with previous assessments. However, it is well known that the equilibrium assumption may be wrong (e.g. soil migration and accumulation, animal physiology), and that there are domains where time dependency is prominent (accidental release, routine release when not averaged over the year). Therefore, the introduction of dynamic parameters should be considered when possible.

The first activity for revising TRS 364 will consist in reanalysing and completing existing data. Due to the age of data and reviews (sometimes 20 years old, or at least 10 years), new data will be considered such as those from Chernobyl studies, routine release analyses, and new experimental results. There is also a need to improve the quality and consistency between the different tables in different chapters. Special attention is to be given on those data where information is scarce (especially for less mobile radionuclides). There is also a need to address uncertainty and quality management such as data format, average / best-estimate, range / confidence interval, statistical results / expert judgement, classification systems (e.g. plant types), co-factors to be introduced, consistency with existing nomenclatures, tools or reference documents.

The second activity should consist in extending the scope of TRS 364 to cover more compartments and processes. At least improvements can be obtained by including modelling assumptions and data for existing natural and semi-natural environments. Concerning aquatic systems improvement is envisaged by increasing the level of mechanistic modelling and including dynamic modelling of some processes. It is also necessary to extend the TRS with data for other non temperate environments or environmental conditions, such as cold and tropical climates, and to include data for inhabited environments.

Currently, the Task group is working on:

- a critical analysis of TRS 364,
- an assessment of the potential level of involvement of the participants (responsibility for a chapter, contribution to a chapter, data providing)
- an agreement on the general work plan
- an agreement on the first year organisation (interim meeting(s), deliverables, home work).

Expected contributions will cover the following topics:

- use of chemical analogies for deriving values
- interactions between atmosphere and plants : update and revision of deposition/ interception
- translocation through plant compartments
- alternative modelling and co-factors of interest for soil Kds and soil to plant transfer factors
- status of the IUR database on soil to plant transfer factors
- modelling of resuspension and associated data
- transfer to fruits (volunteer still to be identified)
- revision of the transfer to animals and animal products (volunteer still to be identified)
- revision of the transfer through aquatic systems
- wash-off
- update on semi-natural systems
- new data on food processing
- Asian food chains
- inhabited environments

Radioecology boosted in Asia

Electricity generated by nuclear plants accounts for about 2 per cent of China's total power output, much lower than the 17 per cent in developed countries. Currently the Chinese government is investing billions of dollars to develop nuclear industry for the energy-scarce coastal provinces. It was estimated that China's total installed nuclear power capacity is expected to reach 8.7 million kilowatts by 2005. With the boosting application of nuclear industry, there is a general need on radioecological research on the fate of radionuclides in the environments and the remediation of uranium mining sites across the country.

In order to promote radioecological research in Asia and in China in particular, an Asian Branch of the International Union of Radioecology has been launched on 19 Nov

2003 in Beijing. The launch coincided with the 3rd International Conference on contaminants in the soil environments in Australiasian region and the China National Symposium on Radioecology. Asian and worldwide experts attended to present their recent research developments.

In porder to emphasize the high prospects that IUR expects from launching this Asian branch, a formal opening ceremony has been held. It was chaired by Dr Gabriele Voigt, Director of the IAEA Seibersdorf Laboratories. Professor Y-G Zhu, vice president of IUR, Professor Xianfang Wen, president of the Chinese Society of Nuclear Agricultural Sciences, and Dr ZR Shang from China State Environmental Protection Administration (SEPA) delivered congratualational speeches at the ceremony. Two leading radioecologists, Professor Chen Ziyuan and Professor Pan Zhiqiang also congratulated to the establishment of the branch.

After the ceremony, expert radioecologists, Dr Gabi Voigt from IAEA, Professor Nigel Bell from Imperial College, London and Dr S Yoshida from Japan National Institute of Radiology gave lectures on recent developments in radioecology from their own perspectives. Following the international spreakers, local participants Dr Chen Baodong and Dr Chen Shibao gave talks on the possibility of phytoremediation of uranium-contaminated soils.

Following a previous decision made during the XXVI General Assembly of IUR, in Stockholm (October 2003), Professor Y-G Zhu and Dr S Hisamatsu from IES, Japan, confirmed their aceeptance to co-chair this new branch of IUR, such as to ensure appropriate vitality and coordination of radioecological activities in Asia. Currently, a committee is being organized.

A first action of this new branch concerns the establishment of a rice Task Group of IUR, which will be headed by Dr Uchida and Dr H Tsukada from Japan with membership from China, Korea and Japan.

Radioecology and Other Contaminants

(Task Group Leader: Hildegarde Vandenhove: hvandenh@sckcen.be)

Pollution science combines a multitude of highly specialised disciplines and the Task Group attempts to bridge the gap between radioecology and other areas of environmental contamination and toxicology through identification of synergies. The Task Group is in a starting phase, and seeks to attract the interest of specialised scientists from different disciplines as well as user groups in the world of environmental engineering and decision making.

Environmental contamination by heavy metals and other conventional contaminants and radionuclides is a phenomenon that has accompanied human activities, mainly associated with mining activities, industrial processes, energy production, manufacturing, and the disposal of domestic and industrial wastes. The most prominent examples of multipollutioin is the pollution associated with the NOR-industry (naturally occurring radionuclides) associated with abandoned waste dumps and the surroundings of industries involved in the extraction or processing of raw materials containing NORs. Examples are the residues of uranium mining and milling, the sludge heaps and the surroundings of the phosphate processing industry, the ashes from power production from coal and the surroundings of metal smelters.

Contamination with NORs is often accompanied with contamination by heavy metals. Radioactive elements such as ^{238}U, ^{226}Ra and ^{232}Th, and non-radioactive elements such as Cd, Zn, Cu, Ni, and As can simultaneously occur in a polluted area. When evaluating the impact of a contamination at a site the multipollution and mixed nature of this contamination should not be neglected because an action decreasing the exposure to one contaminant possibly enhances the availability of other contaminants present. Element availability, bioaccumulation patterns and effects may also be changed in a multipollution context: effects caused by a single pollutant may be exacerbated or reduced by the interaction with other pollutants present simultaneously.

Appropriate predictions of potential future environmental impact and public exposure and the development of adequate remedial technologies or landuse, requires the understanding of the mechanisms ruling element mobility and behaviour in and between the different environmental compartments (mineral, solution, microbial, phytobiomass, ...). One of the first steps in assessing the effects of a (multi)pollution is knowledge on how soil, plant and microbiota properties influence the availability and the uptake of the contaminants. A second step is to know how the multipollution context will affect the behaviour of each single contaminant. A third step is to know how and from which critical concentration pollutants affect the organisms considered and if multipollution effects play a role.

Currently, the proposed objectives are:
- A comparison of approaches in study of environmental behaviour, environmental risk assessment and effects analysis in the study of conventional contaminants and radiocontaminants,
- Effect of the multipollution context on the behaviour induced by a single pollutant,
- Effect of multipollution context on the effects induced by a single pollutant and study of occurrence of synergestic/additive effects.

IUR Statement on Protection of the Environment

Protection of the Environment in the 21st Century: Radiation Protection of the Biosphere including Humankind

1. Introduction:

The issue of protection of the environment is now more and more debated in connection to human health. This is prompting significant evolutions in the field of radioprotection. After prior and successful emphasis placed directly on human health, radioprotection currently enlarges its scope and concerns to consider also the fauna, flora and abiotic compartments of the environment, recognising that human health requires a healthy environment. Radioecology, which addresses the environmental impact of radioactivity, both plays a central role and holds a particular responsibility in this context. Given the proliferating initiatives which are currently growing worldwide, from science to ethics, philosophy, legal and regulatory aspects, and the variety of potential approaches and views which they generate, the International Union of Radioecology has built a consensual statement in order to define its position and future directions of work. In brief, the IUR recommends that further development of the scientific basis for protection of the environment from radiation is to be undertaken to fill some crucial knowledge gaps. Whilst ensuring their future credibility, this should be carried out in parallel with current activities aimed at producing interim practical regulatory frameworks.

2. The Challenge:

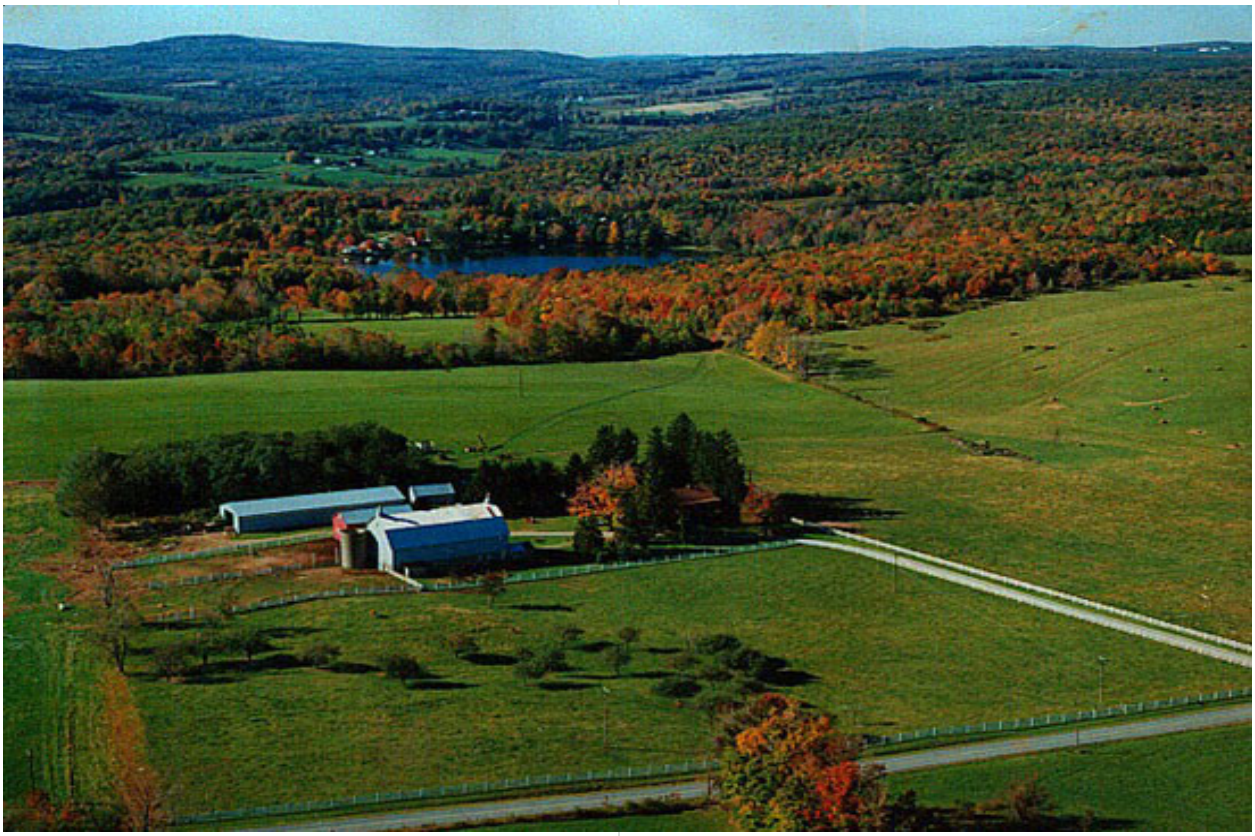
The start of the 21st Century is marked by a growing societal concern over human-driven impacts on the environment. This concern is exacerbated by both global environmental problems and a growing awareness that human health is strongly influenced by the quality, or healthiness, of the environment. Radioecology, which addresses the impacts of environmental radioactivity, is therefore called on to enlarge its focus from a prior emphasis on the goal to protect humans, to the protection of the environment as a whole, including humans. This evolution requires a reappraisal of the link between human health and environmental protection in general. Furthermore, the development of ecologically acceptable and justified use of nuclear power and radioactive materials (including issues such as waste disposal and enhanced natural radiation) require robust and transparent understanding of the radioecological consequences as well as consideration and accurate evaluation of the risks associated with potential accidents.

3. Historical context:

The IUR was established in 1970 as an international scientific organisation to develop, inform and advise on all aspects related to radioactivity in the environment. While other international bodies were developing general principles of environment protection that were being consolidated in various regulatory frameworks (UN conventions, EU Directives, etc.), the IUR pioneered, in 1997, the first attempts to incorporate these into a framework for environmental radioprotection. These ideas were presented to the wider radiological protection community in 2000, and especially at the IRPA-10 symposium (Strand et al., 2000). Next in 2001, the IUR jointly arranged a consensus conference (IUR, 2001) to discuss ethical, philosophical and environmental issues related to this theme. The Union has consequently been closely associated with further developments undertaken under the auspices of various international organisations (IAEA, UNSCEAR, NEA/OECD, ICRP, EC, WHO, FAO, and national institutions) which, today, tackle various facets of the problem - safety standards, international guidance, consensus on ethical and legal aspects, framework for future regulations, assessment of the existing scientific knowledge and international trading. A document presenting IUR's standpoint on protection of the environment from ionising radiation which underpins scientific but also ethical, legal and social aspects of the subject, was published in 2002 (IUR, 2002). Being the only organisation that is fully centred on, and dedicated to, radioactivity in the environment, the IUR holds, in this context, a particular responsibility. Due to its historic origins and constitution, the IUR is well suited to provide guidance on the coordination of international efforts in a balanced, cooperative and complementary manner.

4. Scientific basis for environment radioprotection:

The extensive effort devoted to the protection of humans from radiation has resulted in considerable advances in radiobiological and toxicological understanding of the interaction of radioactivity with life. Since the beginning of radioecology, a large amount of scientific information has accrued on the behaviour and impacts of radionuclides in the environment. The historic focus on anthropocentric problems such as contamination of food-stuffs resulted in a strong emphasis on transfer of radionuclides through food chains. Widening the scope of radioecology to consider also the radiation protection of non-human biota requires a transition to a truly ecocentric approach in order to address the composite effects of ionising radiation on man, biota and the ecosystems that they inhabit. Currently, those effects are much better known in situations of acute exposure to high doses of radiation upon individuals. However, a



strong consensus exists that to address protection of the environment it is necessary to consider impacts on populations/ecosystems of low doses of radiation in chronic exposure to multi-pollutant mixtures. Whilst this requires assimilation of knowledge from numerous disciplines ranging from environmental toxicology to ecology, it also requires action to fill the specific knowledge gaps listed below.

5. Gaps in scientific knowledge and development requiring consideration:

- Knowledge on the transfer, bioaccumulation and metabolism of both naturally occurring and anthropogenic radionuclides in a variety of ecosystems (specifically non-human food-chains) and a better understanding of the processes and mechanisms that influence transfer and bioavailability.

- Understanding the effects of low doses of radiation to biota in chronic exposure, over several generations, with further emphasis on bioaccumulation. Development of a general conceptual model describing the effects of long-term exposures to ionising radiation (including á and â emitters) at all existing and possible dose rates upon all life s organisation levels, based on the study of the most radiosensitive structures and functions. Clarification of the significance of the low-dose driven cytogenetic and by-stander effects currently observed.

- Identification of a variety of pertinent endpoints/ criteria (effects), at individual and community/ecosystem levels, to allow for rating comparisons in impact assessments, and the development of suitable biomarkers and biomonitors correlated to those endpoints.

- Consideration of effects resulting from multi-pollutant mixtures containing radioactive and non-radioactive pollutants.

- Coping with extrapolation problems across levels of biological organisation (from molecular through individuals to ecosystems).

- Comparative analysis of simultaneous radiation protection aspects of both, humans and biota as components of single ecosystems in particular situations. Harmonization of the future system of radioprotection and the system of protection against chemical toxicants (compatibility with Ecological Risk Assessment approach).

- Development of Quantities and Units relating the detriment to biota and the biosphere resulting from radiation and chemical pollutants, and permitting comparison of their relative and synergistic effects.

6. Principles of radiation protection of the environment:
Whilst acknowledging the advances achieved through the strict anthropocentric approach that previously dominated radiation protection, the IUR supports a transition to a globally ecocentric approach that aims to preserve the integrity of ecosystems due to both their inherent value as well as their essential supplies to humankind such as life support and various services. This could be summarized by «human health requires a healthy environment». Principles of radiation protection of the environment need to address various aspects of ecological risk assessment and management (sustainable development, conservation, biodiversity maintenance, responsibility, human dignity) as well as practical solutions directed at reducing these risks (precautionary approach, prevention, best available technology, substitution, polluters-pay, stakeholder participation, environmental impact assessment).

7. Management and recommendations:
To date, the development of a radioprotection system of the environment has focused on a dosimetric assessment of radiation effects on «reference» individual organisms through a set of «umbrella endpoints» (mortality, morbidity, reproductive success, scorable cytogenetic effects). While this preliminary approach is a necessary component of any environmental impact assessment, and forms a fundamental evaluation scaled to the current scientific knowledge, it is not sufficient to address the complexity of the problem. The IUR stresses that quite significant gaps still lie between the ultimate goal of protection (individuals, populations and ecosystems exposed to chronic and low doses of mixed pollutants) and the currently feasible practical approach to achieve it. The IUR therefore recommends that further development of the scientific basis for protection of the environment from radiation, addressing the issues outlined above, be carried out in parallel with current activities aimed at producing interim practical regulatory frameworks. By such means, both these goals may be secured with objective and scientifically sound justification and synergy.

8. Perspectives and goals for IUR:
In this context, the goals that are to be pursued by the IUR through forthcoming actions revolve around several issues identified above. It is of primary importance to recall that the Union's main role is based on science, promoting its advancement, the dissemination of its knowledge and the communication of this to society. As such, the IUR does not set out to promote particular standards and/or regulations, but to contribute to the international effort aimed at developing a general framework that will allow such management tools to be derived from a sound scientific basis. A further strength brought by the IUR is the capacity of the multidisciplinary scientific community gathered within the Union to provide expert, informed, up-to-date and independent scientific advice, incorporating the knowledge from wider environmental fields not focused uniquely on radioactivity. Finally, the ultimate goal of the IUR is to ensure that the radioprotection of both man and the environment are considered with a scientifically sound, balanced, appropriately precautionary approach that permits sustainable development and technical innovation.

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The authors of this statement are forming the current elected Board of Council of the IUR. Whilst expressing this consensual viewpoint in their respective names, they have drawn this position by synthesizing the many discussions and brain stormings held with the members at large, and particularly those actively contributing to the IUR Task Groups (IUR, 2000, 2001, 2002). This statement could not have been achieved without their continuous and dedicated involvement.

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PhD training research offer at SCK-CEN Mol, Belgium

Study of biological effects induced by bioaccumulation of Ra and Cd for Phaseolus vulgaris and Agrostis capillaris applying a multi-biomarkers approach

Promotor: Jaco Vangronsveld, Limburgs Universitair Centrum, Belgium.
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1. Introduction

Several radionuclides (RN) and heavy metals (HM), are naturally present in the environment at trace level. If present at background levels they may be without discernable hazard or can act as essential nutrients for plant growth. When present at high concentration, they can be toxic for the soil microflora and fauna, for plants and animals and for humans via the food chain.

Environmental contamination by RN and HM is a phenomenon that has accompanied human activities. It is mainly associated with mining activities, industrial processes, energy production, manufacturing, and the disposal of domestic and industrial wastes. Enhanced levels of naturally occurring radionuclides (NOR) may be associated with abandoned waste dumps and the surroundings of industries involved in the extraction or processing of raw materials containing NORs.

A number of sites in Belgium are contaminated as a result of processing of material containing naturally occurring radionuclides (NOR). There are in Belgium several industries treating material with a probability of occurrence of high levels of NOR in parent material, (by-products and waste: phosphate industry, metal mining and smelting, coal mining and power generation from coal, petroleum industry, rare earths and titanium oxide industry, zirconium and ceramics' industry, water treatment facilities and building materials. The major contributor to environmental radioactive contamination in Belgium is most likely the phosphate industry. Residues from the production of phosphoric acid and various phosphates may cause contamination of the environment from the naturally present U and Th and their daughters in the parent material. The surface disposal of phosphogypsum or the direct discharge of phosphogypsum into rivers are sources for enhanced natural radioactivity which can increase the collective radiation dose to human populations in the area. In some cases residues from the processing of such ores have been used as the foundations for roadways and buildings or have been dumped into spoil heaps.

Since the dominant radionuclide in the waste products of the phosphate industry is radium, radium (and its daughters) is expected to be the most important contributor to the radiological dose. Radium (^{226}Ra) is a natural decay product of ^{238}U and is present in the soil at concentrations of 10-100 Bq kg^{-1}. Its half-life is about1600 years. Therefore, this study will concentrate on radium. However, radioactive elements such as ^{238}U, ^{226}Ra and ^{232}Th, and non-radioactive elements such as Cd, Zn, Cu, Ni, and As can simultaneously occur in a polluted area. When evaluating the impact of a contamination at a site the multi-pollution and mixed nature of this contamination should not be neglected because an action decreasing the exposure to one contaminant possibly enhances the availability of other contaminants present.

Apart from the obvious concern of public exposure following the ingestion of radium containing food, the protection of the environment and sustainable development have presently become subject to public concern, the political world and the scientific community.

There is an increasing interest for studying the effects of pollutants at the molecular, biochemical and genetic level. In plants, environmental adversity often leads to the increase in formation of highly reactive oxygen species (ROS). Under natural (non-stress) conditions ROS occur in the plant cell and therefore plants possess several antioxidative defence mechanisms to control the redox state of the cell which is essential for normal physiological and biochemical functioning. The defense systems comprise antioxidative enzymes (superoxide dismutases, peroxidases, catalases, glutathione reductase) and antioxidants (e.g. glutathione, ascorbate,…). HM toxicity results in an enhancement of the antioxidative defence system (Clijsters et al., 1999, Cuypers et al., 2002). Resistance to such conditions may be correlated with enzymes in oxygen detoxification (Bowler et al., 1991). Exposition to radionuclides and heavy metals may also result in direct or indirect (oxidative stress mediated) genotoxic effects. With respect to the effect of radiation dose rate at the molecular and genetic level, most studies were performed on animal cells or cell culture used as a model for studying the effect of radiation dose to man. Studies of the radiation dose on the plant and microbiota community is scant. If data are available they are mostly obtained under acute high external dose (Unscear, 1996). Only very few studies deal with the effect of low-chronic external exposure on the plant (e.g. Okamoto and Tatara, 1995; Zaka et al., 2002a,b; Ptacek et al., 2002) and even less studies or performed on the biological effects of RN incorporation.

Appropriate predictions of potential environmental impact of radium contamination requires the understanding of the mechanisms ruling element (in casu radium) mobility and uptake and distribution in the plant.

Depending on the geofysicochemical conditions of the plant environment, a higher or lower percentage of the radium present will be available for bio-incorporation. At present, there is not an in-depth knowledge on the processes which govern the bioavailability of radium.

As mentioned, radionuclides (radium) often occur in a multipollution context, certainly when the radioactive contamination is linked with NORM. The presence of HM may affect the availability of the radionulcides and will also induce biological effects which may overrule the effects observed for radionuclides.

This proposal is part of a larger research project on the behaviour of radium in the Winterbeek area, contaminated by RN, As and HM from a phosphate fertilizer production facility. River sediments, river borders and inundated areas are contaminated. River borders were contaminated following disposal of dredged river sediments. Contamination is mostly linked with radium and cadmium.

2. Research proposal

2.1. General objective

The present proposal aims to analyze the biological effects induced by bioaccumulation of radium by test plants while applying a multi-biomarkers approach focused on subtle effects (DNA damage, oxidative stress…) viewed as early responses for individual disturbances (growth, reproduction). The effects observed for radium will be compared with the effects observed for a more conventional pollutant (Cd).

In a second step, the soil-solution, soil and plant factors affecting radium bioaccumulation will be studied to some extent.

2.2. WP1: Literature review

In order for the candidate to get familiar with the subject a literature review is recommended on existing methodologies for assessment of effects at molecular-biochemical (activity and gene expression of stress enzymes, quantification of antioxidants) and genetic level (comet assay) and the factors affecting the bioaccumulation of radium and cadmium

2.3. WP2: Dose-effect-relationships for Phaseolus vulgaris

The impact of the pollutants on plant development will be evaluated by growing the test plant *Phaseolus* in a hydroponics system. Pollutants studied will entail Ra and Cd. Emphasis will be on radium.

In a conventional nutrient solution (Hoagland), the test plants will be subjected to increasing concentrations of the pollutant and dose-effect relationships will be established for the single pollutant, in function of plant growth stage, in function of plant compartment, and in combination with the other contaminant.

Plant development will be evaluated by evaluating biomass of the different plant compartments.

Effects at molecular-biochemical (activity and gene expression of stress enzymes, quantification of antioxidants) and genetic level (comet assay) will be screened. The pollutant concentration resulting in no effect (NOEL) of the lowest effect (LOEL) will be determined.

The results of the different measurements will be compared and the effects of sampling time and plant compartment will be analysed to check the sensitivity and the accuracy of the different parameters.

Expected output

These data will allow us to come forward with an efficient and standardised test protocol for assessing the biological effect of pollutants.

The test results will enable us to describe dose-effect response curves, determine LOEL, to compare the effects obtained following bioaccumulation of different contaminants supplied as single contaminants or in a multi-pollution context to identification potential synergistic effects, to weigh the effects of different pollutants.

2.4. WP3: Dose effect relationships for an ecologically relevant test plant Agrostis capillaris

Existing methodologies for assessment of effects at molecular-biochemical (activity and gene expression of stress enzymes, quantification of antioxidants) and genetic level (comet assay) will be adapted and worked out for *Agrostis capillaris.*

The same test procedure as for *Vicia faba* as described under WP2 will be followed.

Effect of plant characteristics on pollutant uptake and resulting dose effect relationships will be examined based on study of root exudates for both test plants.

2.5. WP4: Effect of geochemistry on radium accumulation and resulting biological and genetic effects.

In a next step, the effect of the geochemistry of the nutrient solution (pH, Ca/Mg content, presence of As/Cd) on radium accumulation and distribution will be studied for *Agrostis capillaris*. Pollutant speciation will be studied in relation to the conditions of the growth medium and the presence of other pollutants. Speciation data will be related to contaminant uptake and distribution in the plant.

In a next step, radium accumulation and resulting biological effects will be studied for 2 Winterbeek soils with diverging characteristics. Soils will be thoroughly characterized in terms of general soil characteristics and radium availability and radium concentration in the soil solution (solid liquid distribution coefficient).

Expected output
The test results will enable us to describe the effect of environmental conditions on the dose-effect response curves and the LOEL.

The soil test to study accumulation and resulting effects will give us a preliminary idea of how results obtained for hydroponics can be extrapolation to soil conditions.

3. Expected output

1. Come forward with an efficient and standardised test protocol for assessing the biological effect of pollutants.
2. Dose-effects relationships for the single pollutants and identification of LOEL
3. Comparison of effects obtained following bioaccumulation of different contaminants supplied as single contaminants or in a multi-pollution context.
4. Effect of environmental conditions on dose-effect curves and LOEL
5. Role of plant factors in dose-effect response

4. Benefits

The proposed research project is completely corresponding to one of the major actual of the Radiation Protection Division at SCK-CEN which is the study of the effect of radiation on the environment. This is also an issue of growing international interest. This project will contribute to increased in-depth knowledge on the effects of radiocontaminants on biota.

Secondly, the PhD-project will also unravel some fundamentals of the behaviour of radium in the soil-plant environment. Radium is one of the major radiopollutants in the Belgian context.

Finally, the study will also deal with the issue of multipollution; Most contaminated sites are polluted with a series of contaminants. The behaviour of a single pollutant may be affected by the presence of other radionuclides. This interaction is very seldom studied. The biological effects observed following radiological and heavy metal contamination will be compared. This may serve to build a system of 'equivalent harm' which will allow for a comparison of harm of the form of pollution.

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Announcements

Meetings and Workshops

XXVIIth IUR General Assembly

The next General Assembly will be held during the ECORAD 2004 Conference on «The Scientific Basis for Environment Protection against radioactivity» which will be held in Aix en Provence, France, 6-10 September2004. Practical details will be provided in due time, both on the IUR website http://www.iur-uir.org and on the ECORAD Conference website http://www.irsn-dpre.com.

Workshop of the Joint IAEA/IUR Task Group on Update of TRS 364, Radiecological Parameter Values

This new Task Group, which was launched in 2003, will hold its second working meeting at the IRSN premises, in Cadarache, France, on 1-4 June 2004 (dates to be confirmed). (Contact: Pascal Santucci: pascal.santucci@irsn.fr)

Other Task Groups Workshops

Currently, a number of Task Groups are intended to hold small Workshops during, or in parallel to, the ECORAD 2004 Conference. More Workshops may appear to be formalised elsewhere during the year 2004, and will be announced accordingly on the IUR web site.

Forthcoming Conferences

IRPA 11- International Radiation Protection Association.

The 11th Assembly of the International Radiation Protection Association will be held on 23-28 May 2004, in Madrid, Spain.
(http://www.irpa11.com)

As the world becomes smaller and more interactive the need to keep up to date with what is happening in other countries intensifies. It has since its inception been one of the major achievements of IRPA to organise World Congresses covering all aspects of radiation protection. These Congresses provide an unrivalled opportunity for professionals from all countries to interact with each other and inform themselves as to the latest developments in radiological protection. Especially at this time when major changes concerning standards are under discussion, the IRPA Congresses are significant milestones in the development process. This 11th Congress will cover development of standards not only for protection of people, but also for protection of the environment.

ECORAD 2004: The scientific basis for environment protection against radioactivity.
Organised by IRSN in collaboration with IUR and ICRP.
6–10 September, 2004, Aix en Provence, France.
(http://www.irsn-dpre.com/ecorad)

Congress objectives

Under strong social pressure driven by current environmental concerns, all environmentalists are called to construct scientific knowledge, concepts and principles suitable to ensure acceptable mastering of ecological risk. Environment Protection against radioactivity is certainly the new challenge for radioecology. Originally, radioecology has evolved with the primary goal of assessing the impact of radioactivity on man, and as such, was focused on transfer to man through the environment. Now, following a trend that is already underway for other toxicants, the environment itself is also considered as a target requiring protection.

As compared to the past, this new focus of radioecology is even more «science demanding», particularly for basic understanding in biology and ecology. In addition to the knowledge on acute effects of high «doses» of radioactivity on small human critical groups, it is needed to know what happens to large ecosystems when loaded with small, but long-lasting, amounts of radiotoxicants. In addition to «simple» direct transfer, it is needed to take into account complex interaction processes and cycling that may lead to the redistribution of radionuclides, and eventually to their bioconcentration. In addition to «classical» situations like external irradiation, inhalation and wounding, it is necessary to study more thoroughly the effects of internal contamination following trophic chains. In addition to the most studied physical transfer and dispersion phenomena, it is mandatory to clarify how the many differentiating processes at work in the biosphere are acting on bioavailability, a feature that is overlooked in the current homogeneous approach of simplistic models.

For all these reasons, today's radioecology has to deepen its roots in the main stream of environment protection and the most advanced, or actively evolving, associated set of sciences. Practical implications of radioecology are huge. International organisations are already thinking of future regulations. It is hence of paramount importance to ground a strong scientific basis such as to avoid the development of inappropriate regulations. This congress will therefore be devoted to reviewing the state of the art on all aspects of radioactivity interactions with the environment and to promoting innovative research approaches.

In following its predecessor event, ECORAD 2004 will be a science-oriented congress. It will offer a meeting place for fruitful exchanges across the radioecology community and all environmental specialists sharing the same concerns. Regulators, stakeholders and all users of radioecology are welcome.

Preliminary scientific programme

1 Measurement methods and technologies for environmental protection

- α, β and γ spectrometry,
- mass spectrometry,
- others.

2 Speciation and bioavailability

The biogeochemical behaviour of elements/radionuclides in the environment determines their mobility, their bioavailability and the exposure modalities of living organisms (fauna and flora). This session will be devoted to review and discussion on our current understanding of the physical-chemical-biological mechanisms that control the bioavailability of inorganic contaminants in aquatic and terrestrial environments. The following questions will be addressed : How to identify and quantify the fraction of contaminant that is biologically available and may cause adverse effects? How to predict/validate speciation in the exposure media? How to improve our understanding of the conditions controlling exposure, bioaccumulation processes, and potential induced effects?…

3 (Eco)toxicology of low doses with multi-pollutant exposures

One difficulty in the implementation of ecological risk assessment methodology for both stable chemicals and radionuclides, is the lack of data for chronic low level exposure in a multipollution context. This session will deal with current advances in ecotoxicology and radioecology, including results, tools and methods, obtained within this framework. A focus will be put on bioaccumulation processes which are primordial with regard to internal exposure to long-lived radionuclides since they increase locally both the radionuclide concentration and the biological effect of the delivered dose.

4 Radionuclides fluxes in, and effects on, continental ecosystems

This topic will be devoted to redistribution processes : exchanges inside and between

- stock compartments (soil, sediments),
- vector compartments (water, atmosphere),
- target compartments (biota).

The topic includes also :

- Differentiating processes responsible for spatial variability.
- Interpretation of complex situations involving many radioactivity sources including accumulated secondary sources from old releases.
- Application of knowledge to define an optimal monitoring strategy.

5 Radionuclides fluxes in, and effects on, marine ecosystems

- Sources and stocks,
- Use of radionuclides as tracers,
- Sea-atmosphere exchange,
- Behaviour of radionuclides in sediments,
- Transfer to biota,
- Effect on biota.

6 Nuclear installations and Environment.

Measurements around nuclear facilities. Chemical associated to radioactive impact for nuclear waste management. Optimisation of monitoring programmes environmental impact survey. International practices and trends. Discharges of radioactivity and strategies for effluents management.

7 Post-accident management and remediation of contaminated sites

Definition of rehabilitation objectives. Methods and tools for post-accident management. Rehabilitation feedback experiences. Comparisons of indicators (in terms of health, technical, economic, psychological and social aspects). Practices, and guides for management and remediation of contaminated sites. Technics efficiency for decontamination.

8 Ecological Risk Assessment and regulatory guidance

A large array of international effort aims now at addressing ecological risk in complement to human health exclusively, altogether from a scientific, methodological and regulatory perspective. This session seeks to yield an up-to-date review of the different approaches, either conceptual, under development or currently in use. A central challenge lies in the overall goal to reach consistency with both, the human radioprotection system in the one hand, and the «ecological risk assessment» in use for protection of the environment against non-radioactive toxicants in the other hand. This particularly fosters critical gaps in knowledge.

9 Social, ethical and philosophical background of environment protection

Due to recent planetary-wide environmental concerns, there is a general debate leading to a renewed consideration of the link between human health and environment protection. Although «protection» gathers unanimous consensus, the «what», «why» and «how» to protect reflect a number of perceptions, objectives and considerations which all need to be clarified. Environment protection is a societal issue for which science needs to bring the most advanced and objective information such as to allow for the system of protection to effectively meet society's goals.

International Scientific Workshop «Radioecology of Chornobyl Zone».

Organised by the Chornobyl Center for Nuclear Safety, Radioactive Waste and Radioecology, with the support of IUR, IAEA, US DoE, Administration of the exclusion zone. Slavutych, Ukraine, 13-14 September 2004. (http://www.chornobyl.net)

For more informations, contact the Organizing Committee at : inform@chornobyl.net.

Recent Journals, Books, Reports

Agricultural production in radioactively contaminated regions (radionuclides in food products), by B.N. Annenkov, V.S. Averin. Minsk (Belarus), Propilei, 2003.

The book describes the basic regularities of ^{90}Sr and ^{137}Cs migration in the biological chain «soil-plant-animal-agricultural produce»; formulates the initial postulates and principles of farming in conditions of large-scale contamination of the agricultural land by long-lived radionuclides; discusses the most effective countermeasures and ways to reduce the radionuclide contamination of farm products and foodstuffs.

The book is intended for agriculturalists and interdisciplinary specialists engaged in the development and introduction into practice of measures for reducing the radiation risk for the public, as well as researchers, post-graduates and higher school lectures.

RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation

The RESRAD-BIOTA code for biota dose evaluation was approved for public release in September 2003 and can be downloaded at no cost from the U.S. Department of Energy's Biota Dose Assessment Committee Web Site (http://homer.ornl.gov/oepa/public/bdac). The RESRAD-BIOTA code was principally sponsored and developed by the U.S. Department of Energy (DOE), with support from the U.S. Environmental Protection Agency (EPA) and the U.S. Nuclear Regulatory Commission (NRC). A User's Guide, made available in January 2004, can also be downloaded at no cost from the BDAC Web Site.

The RESRAD-BIOTA code provides a complete spectrum of biota dose evaluation capabilities, from methods for general screening, to comprehensive receptor-specific dose estimation. The code was designed to be consistent with and provide a tool for implementing the DOE «Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota» (DOE voluntary consensus Technical Standard DOE-STD-1153-2002), and to provide advanced analysis capabilities in a manner that will support the anticipated needs of DOE and other organizations nationally and internationally. The RESRAD-BIOTA code is user-friendly and easy to install. The code utilizes the concepts of primary and secondary reference organisms, and provides flexibility and advanced features such as:

- ability to modify default environmental transfer factor parameters, organism exposure profiles, dose rate guidelines, allometric relationships, and dose rate modifiers;
- dose conversion factors for eight size-specific organism geometries spanning the expected size range of organisms employed in biota dose assessment;
- pre-derived concentrations of radionuclides in environmental media (Biota Concentration Guides, or BCGs) for use in screening evaluations;
- sensitivity analysis for studying parameter sensitivities;
- text and graphic reports for easy interpretation of data;
- an advanced «Organism Wizard» for configuring user-defined secondary organisms; and
- capabilities to save and retrieve evaluation data and user-defined secondary organisms.

Contact: S. Domotor (Stephen.Domotor@eh.doe.gov) for additional information concerning the RESRAD-BIOTA code and for availability of RESRAD-BIOTA Training Workshops. Comments in the form of recommendations, pertinent data, and lessons learned from implementation of the RESRAD-BIOTA code that may improve future versions of the code are also welcome.

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