JRC Information Day, BULGARIA
Sofia, 27 April 2004, Hotel Hilton, Moussala conf. room

INRNE – JRC Conference – Informational Days,
Sofia, 19 – 22 February 2003, Hotel Moscow, Kiev conf. room

Nuclear Science for Sustainable Environment and Security

JRC and INRNE Joint Activities

Past, Present and Next Future

Excellence, Sustainability, Integration

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Contents

Editorial

Prehistory. Acknowledgements

The collaboration between INRNE and JRC Institutes dated more than ten years and started in 1993. Today, looking back and making the balance of this successful joint activities, we could say, that the way was not easy at all.
Nevertheless in parallel with development methods, codes and studies, and execution of sophisticated projects, we create the base of durable friendship, of the mutual awareness that the close interrelations and full confidence are the only response to the giant challenges, posed both by building of a common Europe and rough world and global changes.

We are very thankful to all our colleagues and friends from JRC, who believed and helped us at the beginning of our collaboration, who supported the first joint activities and projects, spending their knowledge, experience and time.

There are several resent events that influenced strongly INRNE – JRC collaboration. These are: inauguration of FP6 Programme – Brussels conference European research 2002, where the INRNE delegation really saw the key role and leading position of JRC in ERA and the strong synergies among its Institutes; the INRNE – JRC Conference – informational days, as a new unconventional event, were the synergies between two traditional forms gives unexpected results and accelerates the collaboration toward a more close integration and finally – HIMONTONET project, which is a good example of synergies between Framework programmes projects – it provided a part of financial and technical resources for realization of environmental activities with IES, based on JRC methodological and organizational support.

We would like to thank especially the leadership of the JRC personally of Deputy Director General, Dr. Roland Schenkel, Dr.h.c.; Dr. Jiri Burianek, Enlargement Manager; Dr. Giancarlo Caratti, Head of JRC Enlargement Unit; the Coordinator for NUSES project from JRC part, Dr. Pascale Daures (ITU); Prof. Dr.h.c. Manfred Grasserbauer; Director of IES, JRC; Dr. Pierre Frigola, JRC, Directorate General and responsible for NUSES scientific officer Mr. Michele Genovese and financial manager Miss Régine Galas for the support needed for successful realisation of NUSES project and it's development and transition to a more broader and complex INRNE – JRC NUSES Programme.

We are very thankful to all participants from JRC Institutes and EC and to all other participants for professional presentations and discussions and especially the members of the International scientific and the Local organizing committee.

Finally we would like to thank NUSES sponsors – JRC, Bulgarian Nuclear Society, Nuclear Regulation Agency, NPP Kozloduy and the Ministry of Education and Sciences and National Science Fund for financial and organizational support.
Sofia, 26 April 2004

Prof. D.Sc. Jordan Stamenov
Director of INRNE
NUSES project Co-coordinator

Assist. Prof. Dr. Boyko Vachev
Head of Department of European projects
NUSES project Co-coordinator

NUSES 1 Year later

Main results of recent INRNE – JRC collaboration

NUSES joint INRNE – JRC project express survey analysis

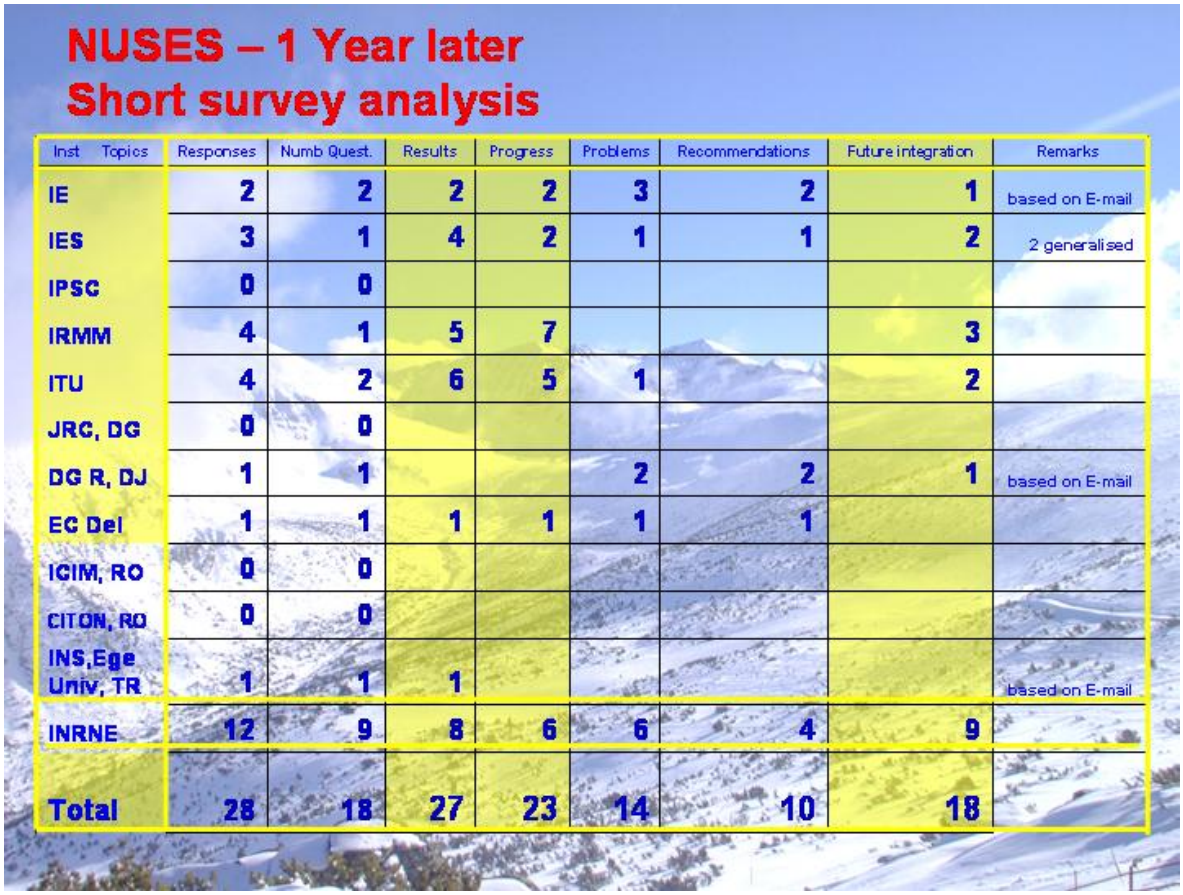
One year later, after NUSES INRNE – JRC Conference – Informational Days in Sofia'2003 and after completion of NUSES project, in accordance with proposal of Dr. Roland Schenkel (in his letter to Prof. Jordan Stamenov, dated 25 March 2003 – see NUSES CD or

http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html)

to make "*an interim review of the progress achieved within 12 month*", we proposed NUSES participants a short questionnaire.

From distributed to the colleagues 42 questionnaires we received 28 responses (66%) or 18 questionnaires (some of them have been filled up by more then one person), with around 92 opinions about 5 groups questions (Results, Progress, Problems, Recommendations and Future integration). The rough statistics is presented in the table below.

We classified the answers in the following groups of activities: **Projects and Projects proposals** (contracts, databases, networks, job opportunities, etc.); **Contacts and Collaboration** (visits, invitations, other joint activities, etc.); **Training** (different forms); **Workshops** (all types of conferment events); **Good practice** and **Technology transfer** (in different forms) and **Organisation**, **Financial**, **Management** and **Integration** aspects.



Inst Topics	Responses	Numb Quest.	Results	Progress	Problems	Recommendations	Future integration	Remarks
IE	2	2	2	2	3	2	1	based on E-mail
IES	3	1	4	2	1	1	2	2 generalised
IPSC	0	0						
IRMM	4	1	5	7			3	
ITU	4	2	6	5	1		2	
JRC, DG	0	0						
DG R, DJ	1	1			2	2	1	based on E-mail
EC Del	1	1	1	1	1	1		
ICIM, RO	0	0						
CITON, RO	0	0						
INS,Ege Univ, TR	1	1	1					based on E-mail
INRNE	12	9	8	6	6	4	9	
Total	28	18	27	23	14	10	18	

Institutions Topics	Responces	Number of Quest.	Results	Progress	Problems	Recommen-dations	Future intergration	Remarks
IE	2	2	2	2	3	2	1	based on E-mail
Projects and/or Projects proposals			1	1				
Contacts and/or Collaboration			2		1	1	1	
Training			1		1			
Workshops								
Good practice and/or Technology transfer								
Organisation, Finantial, Management and/or Integration				1	1			
IES	3	1	4	2	1	1	2	2 generalised
Projects and/or Projects proposals			1					
Contacts and/or Collaboration			4	2		1		
Training								
Workshops								
Good practice and/or Technology transfer							1	
Organisation, Finantial, Management and/or Integration			1		1		1	
IPSC	0	0						
IRMM	4	1	5	7			3	
Projects and/or Projects proposals			4					
Contacts and/or Collaboration							1	
Training				3			1	
Workshops				2				
Good practice and/or Technology transfer								
Organisation, Finantial, Management and/or Integration								
ITU	4	2	6	5	1		2	
Projects and/or Projects proposals			3	3				
Contacts and/or Collaboration			1	1				
Training			4	4			1	
Workshops			1	1			1	
Good practice and/or Technology transfer							1	
Organisation, Finantial, Management and/or Integration			1	1	1			
JRC, DG	0	0						
DG R, DJ	1	1			2	2	1	based on E-mail
Projects and/or Projects proposals					1	1		
Contacts and/or Collaboration								
Training					1	1		
Workshops								
Good practice and/or Technology transfer								
Organisation, Finantial, Management and/or Integration								
EC Del	1	1	1	1	1	1		
Projects and/or Projects proposals				1	1	1		
Contacts and/or Collaboration			1					
Training								
Workshops			1					
Good practice and/or Technology transfer								
Organisation, Finantial, Management and/or Integration								
ICIM, RO; CITON, RO	0	0						
INS, Egeln, TR	1	1	1					based on E-mail
IHRHE	12	9	8	6	6	4	9	
Projects and/or Projects proposals			8	3		1	3	
Contacts and/or Collaboration			6	5	3	2	6	
Training			2	4	1	3	1	
Workshops			1	2				
Good practice and/or Technology transfer			1	3	3	1	6	
Organisation, Finantial, Management and/or Integration			1	5	6	5	2	
Not IHRHE	16	9	19	17	8	6	9	
Total	28	18	27	23	14	10	18	92

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

All opinions and recommendations

4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	Exchanges with Krassimira Ilieva, with possibility for students to come to Petten. Contact with Evgeni Gabev, Institute of Experimental Pathology and Parasitology, Bulgarian Academy of Sciences, Sofia But I take this opportunity to ask you if you were interested in participating to the Users Group of a new Integrated Project called PERFECT, dedicated to prediction of radiation damage in reactor pressure vessel and core internals. There could be also a possibility to train young scientists on the use of the computer tools. 1) Possibile collaborations were discussed and 2 memoranda between IES and INRNE were signed for new collaborations, one concerning the JRC direct action programme (direct contracts) and one concerning JRC indirect actions and other FP6 activities: Environmental studies and Informational integration (see NUSES final report, NUSES CD or http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html) 2) Visit of Prof. Stamenov, INRNE director to IES, discussions with IES director and staff on the following areas of mutual interest, defining possible common work and collaborations in the field of: Forest-fires – Land Management Unit (with Mr. J. Meyer – Roux and J. San Miguel – Ayanz); Spectrometric gamma-background measurements from BEO Moussala, and their submission to the EURDEP database - Emission and Health Unit (Mr. M. de Cort and Mr. Gerhard De Vries); Expansion of atmospheric composition measurement capacity at BEO Moussala (Climate Change Unit Mrs. R. Van Dingen); Heavy metal pollution monitoring neutron activation elemental analysis of moss as a biomonitor (Soil and Waste Unit – Mr. D. G. Bidoglio) and also a meeting in IPSC - Continuation of joint activities connected with the control of illicit traffic of nuclear and radioactive materials and application of MCNP code for calculation of real complex neutron flux moderation (IPSC Nuclear Safeguards at JRC D. P. Peerani). 3) BEO Moussala (INRNE BEO Centre of Excellence) participation in EURDEP, with regular reliable automatic gamma background and meteorological data submission to the database from the middle of 2003 4) Ref. IES – J08 (Job opportunity): Capacity Building for Long Term Atmospheric Aerosol Monitoring in the Balkans, devoted to BEO Moussala, to enable BEO Moussala to participate in the GAW aerosol monitoring programme Discussion of common IRMM-INRNE projects: 1) capture measurements on ^{232}Th (work of N. Janeva from INRNE, working on several short-term stays as VS at IRMM) 2) progress of thesis work of K. Volev from INRNE, presently cat. 20 grantholder at IRMM 3) analysis of ^{239}Pu fission yield data (work of I. Ruskov of INRNE, working as SNE at IRMM) 4) EUR report on activation cross section measurements at IRMM by V. Semkova of INRNE; delivery of measurement results to the Exfor database 1. Training sessions related to combating illicit trafficking of nuclear and radioactive materials (Omer Cromboom) 2. Joint Transuranus project "Application of Nuclear Fuel Modeling Codes to Fuel Licensing (Claudio Ronchi, Paul van Uffelen) 3. Training course on Nuclides.Net (Joe Magill) 4. Harmonization of Techniques and Methodologies for Measuring Radioactivity in the Environment (Maria Betti) 1st Meeting: 10-07-2003 2nd Meeting: 15-10-2003 Workshop on "Radiation protection of the environment and human health", ITU, Karlsruhe,16-10-2003 Signature of a protocol for the continuation of the support in the field of combating illicit trafficking. The next project foresees the finalization of the RITNUM handbook (national response plan to illicit trafficking) and the provision of equipment and related training to allow Bulgaria to act as regional NDA expert laboratory. "My participation has been limited to the "Nuses – Information Day" conference. With respect to this, I must state that the quality of the presentations, the exchange of information among specialists and the overall organization of the conference has been very good". 1. Direct contacts with leading scientists and responsible persons from 5 of 7 Institutes of JRC (IE, IES, IPTS, IRMM, ITU), JRC DG, DG Research DJ an Delgation of EC in Bulgaria 2. The present state of ongoing and recent projects and collaborations have been discussed and 3 memorandums for their further development were signed in the field of nuclear forensics and combating illicit trafficking; neutron investigations and data measurements and nuclear spent fuel investigations The possibilities were discussed and 5 memorandums were signed for new collaborations based on JRC direct action programme (direct contracts) and JRC indirect actions - in the field of EURATOM programme and other FP6 activities: Environmental studies; Neutron therapy and Informational integration 3. Establishment of INRNE NUSES Programme. It is based on INRNE Programme for management and development for 2003-2007 years. The main goal of NUSES Programme is to develop and enhance the results and achievements of NUSES INRNE – JRC project. 4. Possibile collaborations were discussed and 2 memoranda between IES and INRNE were signed for new collaborations, one concerning the JRC direct action programme (direct contracts) and one concerning JRC indirect actions and other FP6 activities: Environmental studies and Informational integration (see NUSES final report, NUSES CD or http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html)

	5. Visit of Prof. Stamenov, INRNE director to IES, discussions with IES director and staff on the following areas of mutual interest, defining possible common work and collaborations in the field of: Forest-fires – Land Management Unit (with Mr. J. Meyer – Roux and J. San Miguel – Ayanz); Spectrometric gamma-background measurements from BEO Moussala, and their submission to the EURDEP database - Emission and Health Unit (Mr. M. de Cort and Mr. Gerhard De Vries); Expansion of atmospheric composition measurement capacity at BEO Moussala (Climate Change Unit Mrs. R. Van Dingen); Heavy metal pollution monitoring neutron activation elemental analysis of moss as a biomonitor (Soil and Waste Unit – Mr. D. G. Bidoglio) and also a meeting in IPSC - Continuation of joint activities connected with the control of illicit traffic of nuclear and radioactive materials and application of MCNP code for calculation of real complex neutron flux moderation (IPSC Nuclear Safeguards at JRC D. P. Peerani). 6. BEO Moussala (INRNE BEO Centre of Excellence) participation in EURDEP, with regular reliable automatic gamma background and meteorological data submission to the database from the middle of 2003 7. Ref. IES – J08 (Job opportunity): Capacity Building for Long Term Atmospheric Aerosol Monitoring in the Balkans, devoted to BEO Moussala, to enable BEO Moussala to participate in the GAW aerosol monitoring programme Start of project "Harmonization of Techniques and Methodologies for measuring of radioactivity in the environment" With ITU in Karlsruhe Germany As a result of NUSES joint INRNE – JRC collaboration, proposal for a new project has been done. The contracting parties are the European Atomic Energy Community and five Bulgarian organisations, constituting a joint team for Bulgaria. The team is led by Prof. Dr. Dancho Elenkov from the Nuclear Regulatory Agency of Bulgaria and the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Science. The project is aiming at helping Bulgaria in reforming activities related to the nuclear fuel cycle in the country. Preliminary contacts for databases integration in the field of radioactive and terrains and soils contamination. Contact person from JRC: Dr.Marc de Court Temporary job for 1 scientist as a Detached National Expert (DNE) working in the field of the reference materials & measurements at the EC-JRC-IRMM (Ref. IRMM-J06). 2 meetings on Harmonisation of Techniques and Methodologies for Measuring Radioactivity in the Environment Exchange of information and know-how Checking of sampling procedures, analytical methods, quality control programmes, data quality or data management. Quality control program is in process by supplying reference samples to check the measurement quality Capture measurements on ^{232}Th - N. Janeva participation as VS in IRMM Capture on ^{232}Th experimental data analysis in the unresolved resonances region – N. Koyumdjieva, A. Lukyanov, N. Janeva, K. Volev Progress of thesis work of K. Volev from INRNE, presently cat. 20 grantholder at IRMM Neutron activation cross sections for safety of nuclear power plants measurements – V. Semkova More than 10 joint publications and presentation on the international scientific conferences Participation of INRNE in the Project called "EC-SARNET, Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology and Management" within the frame of the 6th FP Contract № FI6O-CT-2004-509065 Network of Excellence Total Project Price: 6 mln euro
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	Regular exchange with Krassimira Ilieva, plus request made by myself regarding possible Post-Docs for IE/JRC, candidates considered but not available. Evgeni Gabev was invited to Petten to participate in a Workshop on Boron Drug Development 26/27 March 2004), but unfortunately could not make it, but did forward a contribution, which will be used with other partners to form a collaboration group. Direct contacts between IES, JRC Ispra and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined First concrete results were obtained Both institutes participate in an CRP on Thorium, organised by the IAEA Mrs. N. Koyumdjieva from INRNE is working as VS for one year at IRMM, on the interpretation of cross sections in the unresolved energy range Mr. I. Ruskov from INRNE is working as SNE for two years on measurements of neutron induced cross-sections of light elements, considered as neutron data standards A. Plompen and P. Schillebeeckx lectured at the Varna School in September 2003 Participation of several scientists from INRNE to the NEMEA workshop in Budapest (Nov. 2003) organised by IRMM and the Budapest Neutron Centre. Contract with INRNE on comparison of measurement results and evaluations for the NEA-WPEC subgroup 19 on Activation Cross Sections. EC Delegation is in charge of implementation of Phare projects in the field of Science and Research. We are calling for proposals from Bg institutions as the INRNE. the Law on the Ratification of the Memorandum of Understanding between the Republic of Bulgaria and the European Communities concerning Bulgaria's accession to the EURATOM 6th Framework Programme, for Research and Technological Development (2002-2006) has been approved (7 February, 2003 -SG 16/2003). This paves the way to Bulgarian participation.

	1. Direct contacts between IES, JRC Ispra and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined 2. Closer direct contacts between IE, JRC Petten and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined 3. First concrete results in collaboration with JRC Ispra institutes were obtained 4. NUSES made a transition to the NUSES Programme (INRNE) Synergies of joint JRC – INRNE projects and activities and other Frameworks projects Supply of common sources for r-spectrometry and tracers for 4- Spectrometry Training in the field Liquid scintillation counting for strontium-90, plutonium-241 and tritium Alpha spectrometry as instrumental technique and sample preparation for alpha spectrometry Data management: general statistics and applied Inter-laboratory on gamma spectrometry: distribute spectra and analyse in each laboratory with their programme Supply of Eichrom resin had not yet been sent to the laboratories. The materials have been purchased by ITU but, since the laboratories are still not members of the European Union, export licenses are necessary for sending the materials. ITU is working on getting these licenses. Work on Sr-90, Po-210, Cs radionuclides Sediment, water, soil, The proposal, mentioned above in item 4, was approved and on the 18 March 2004 the contract was signed for a period of 24 months. It is entitled "Research and Development for Licensing of Nuclear Fuel in Bulgaria" No. 370011−2004−02 F1FD KAR BG The experimental $^{10}B(n,\alpha)$ data obtained at the EC-JRC-IRMM GELINA TOF spectrometer (in the neutron energy interval bellow 1MeV) are in the process of analyzing. The final results will be used in the new evaluation of the neutron standard file for this reaction. both institutes participate in an CRP on Thorium Uranium fuel cycle, organised by the IAEA Mrs. N. Koyumdjieva from INRNE is working as VS for one year at IRMM, on the interpretation of cross sections in the unresolved energy range Participation of N. Janeva, V. Semkova, N. Koyumdjieva, K. Volev from INRNE to the NEMEA workshop in Budapest (Nov. 2003) organised by IRMM and the Budapest Neutron Centre. Contract with INRNE on comparison of measurement results and evaluations for the NEA-WPEC subgroup 19 on Activation Cross Sections -V. Semcova Petten, Holand, November 18-19, 2003 Training Workshop "Nuclear Safety: Technical and Scientific Support to PHARE Countries".
6. Open problems	Possibilities for students (physics) to come to Petten as Post-docs or trainees still exists. A proposal for a network for BNCT Drug developers will be made soon and will include Dr.Gabev Institutional status of INRNE within the EURDEP network Finalization of the RITNUM handbook I can now tell you that in our previous evaluation period, (deadline for submission of proposals 6 May 2003 that can be considered as too close to the NUSES event to have a real impact; the consortia were certainly already fixed) we had only 15 Bulgarian participations from which only 5 where still present in the ranked list (in a total of 458 participations in the ranked list). ECD has received no proposals so far for the 2004 Phare Programme. It is now probably too late and efforts should focus on the 2005 Phare Programme. 1. Institutional status of INRNE within the EURDEP network 2. Financing problems (reimbursement of expenses; bank guaranties; final payment of FP projects) 3. More intensive and extensive inclusion in JRC Enlargement action 4. More intensive, extensive and targeted human mobility (taking into account the urgent force coming needs of new joint application – BNCT and others) 5. Lack of contacts with IPSC, Seville and IHCP, Ispra BNCT device is planed to be developed at the reconstructed experimental reactor in Sofia. There are needs in 1) Experience in neutron source modeling and assessment of irradiation conditions 2) Dosimetry technique skills More acknowledgements on the material behavior assessment and the tools and results used for this assessment (to be applyied to our plant Kozloduy NPP) Administration bureaucracy from both parts
7. Recommendations	Regular emails on updates in collaborative, eg. Results of this form, would continue to encourage contact and possible collaboration. Continuing and developing collaboration in the fields described in 4.2 Moreover, unfortunately and surprisingly in a sense, we had no proposals from Bulgarian fellows in our Training and Mobility programme and this despite my insistence in promoting this instrument and the direct presence of young scientists during my presentation.

	I feel that Bulgarian participation to the 6th Framework Program should increase. 1. Continuing and developing collaboration in the fields described in 4 2. Solving of problems from 6 3. Continuing the periodical reviews of state, problems and prospects of JRC – INRNE integration 4. Intensify the exchange of information and discussion of problems of common interest 5. Develop the contacts and collaboration with IPSC, Seville (in the field of technological transfer, innovation management and prospective studies) and IHCP, Ispra (in the field of medicine (health) applications) Better coordination in the framework of the JRC-INRNE collaboration, including more intensive contacts between scientific personell on different levels. To stimulate the INRNE scientists to collaborate with EC-JRC colleagues in common research projects as PhD, Post Doc, DNE, visiting scientists. To make possible the IRNE scientists to apply for grants and to be grant-holders of their approved proposals. Further education of young researchers and professionals about the mechanisms of treatment of tumor by neutron irradiation Participation in the project PERFECT by neutron-gamma transport calculations and reactor pressure vessel Lifetime prognosis analyses. Further education of young researchers and professionals about the mechanisms of irradiation-induced degradation of materials
8. The future of JRC – INRNE integration	A serious consideration, worthwhile pursuing Exchange of best practices in research infrastructure development and enhancement Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area. joint evaluation of nuclear data, especially resonance shape analysis of high-resolution cross-section data, analysis of cross-sections in the unresolved energy range, and modeling of the fission process. Envisaged: exchange of personnel and grant holders for participation in joint experiments and data analysis • Specific training on NDA techniques related to nuclear material assay • Evaluation of the "state of the practice" during the workshop: "Experiences gathered on combating illicit trafficking of nuclear material" which will be organized in September (or October) 2004 in Vilnius This will be discussed at the forthcoming "JRC Information Day to Bulgaria" on 27 April 2004 at the Hilton hotel in Sofia. 1. Exchange of best practices in research infrastructure development and enhancement 2. BNCT technology implementation support, including qualification of the starting operational team 3. Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area. 4. Development of JRC – INRNE joint NUSES Programme 5. Development on the base of INRNE with JRC a joint HiTech Innovation Centre, directed not only in the field of Nuclear science, technology and techniques development and application Exchange of data, integration of databases, new joint projects, experiments and publication Experimental neutron data obtaining, analyzing and evaluation; Low level gamma-ray spectrometry; Radiochemistry; Partial decommissioning of the IRT-2000; Setup of a boron therapy neutron channel at the new BAS-INRNE research reactor. Collaboration with JRC IE, Petten, Netherlands in joint project of EC Collaboration with JRC IE, Petten, Netherlands in PERFECT project of EC Exchange of specialists in the field of radioactivity measurements, application of chosen methods for sampling, radiochemistry and analysis on sites joint evaluation of nuclear data, especially resonance shape analysis of high-resolution cross-section data, analysis of cross-sections in the unresolved energy range. Preparation of review paper on the resonance averaged cross sections in the unresolved region. Envisaged: exchange of personnel and grant holders for participation in joint experiments and data analysis

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

All opinions and recommendations sorted by categories

Projects and Projects proposals (contracts, databases, networks, job opportunities, etc.)

But I take this opportunity to ask you if you were interested in participating to the Users Group of a new Integrated Project called PERFECT, dedicated to prediction of radiation damage in reactor pressure vessel and core internals.

Ref. IES – J08 (Job opportunity): Capacity Building for Long Term Atmospheric Aerosol Monitoring in the Balkans, devoted to BEO Moussala, to enable BEO Moussala to participate in the GAW aerosol monitoring programme

discussion of common IRMM-INRNE projects:
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4) EUR report on activation cross section measurements at IRMM by V. Semkova of INRNE; delivery of measurement results to the Exfor database
Contract with INRNE on comparison of measurement results and evaluations for the NEA-WPEC subgroup 19 on Activation Cross Sections

Joint Transuranus project “Application of Nuclear Fuel Modeling Codes to Fuel Licensing (Claudio Ronchi, Paul van Uffelen)
Harmonization of Techniques and Methodologies for Measuring Radioactivity in the Environment (Maria Betti)
The next project foresees the finalization of the RITNUM handbook (national response plan to illicit trafficking) and the provision of equipment and related training to allow Bulgaria to act as regional NDA expert laboratory.

I can now tell you that in our previous evaluation period, (deadline for submission of proposals 6 May 2003 that can be considered as too close to the NUSES event to have a real impact; the consortia were certainly already fixed) we had only 15 Bulgarian participations from which only 5 where still present in the ranked list (in a total of 458 participations in the ranked list).

EC Delegation is in charge of implementation of Phare projects in the field of Science and Research.
We are calling for proposals from Bg institutions as the INRNE.
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ECD has received no proposals so far for the 2004 Phare Programme. It is now probably too late and efforts should focus on the 2005 Phare Programme.
I feel that Bulgarian participation to the 6th Framework Program should increase.

As a result of NUSES joint INRNE–JRC collaboration, proposal for a new project has been done. The contracting parties are the European Atomic Energy Community and five Bulgarian organisations, constituting a joint team for Bulgaria. The team is led by Prof. Dr. Dancho Elenkov from the Nuclear Regulatory Agency of Bulgaria and the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Science.
The project is aiming at helping Bulgaria in reforming activities related to the nuclear fuel cycle in the country.
The proposal, mentioned above in item 4, was approved and on the 18 March 2004 the contract was signed for a period of 24 months.
It is entitled "Research and Development for Licensing of Nuclear Fuel in Bulgaria"

No. 370011–2004–02 F1FD KAR BG

Participation in the project PERFECT by neutron-gamma transport calculations and reactor pressure vessel Lifetime prognosis analyses.

Participation of INRNE in the Project called "EC-SARNET, Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology and Management" within the frame of the 6th FP
Contract № FI6O-CT-2004-509065
Network of Excellence

Contacts and Collaboration (visits, invitations, other joint activities, etc.)

Exchanges with Krassimira Ilieva, with possibility for students to come to Petten.
Contact with Evgeni Gabev, Institute of Experimental Pathology and Parasitology, Bulgarian Academy of Sciences, Sofia
Regular exchange with Krassimira Ilieva, plus request made by myself regarding possible Post-Docs for IE/JRC, candidates considered but not available.
Evgeni Gabev was invited to Petten to participate in a Workshop on Boron Drug Development 26/27 March 2004), but unfortunately could not make it, but did forward a contribution, which will be used with other partners to form a collaboration group.
Regular emails on updates in collaborative, eg. Results of this form, would continue to encourage contact and possible collaboration.

1) Possibile collaborations were discussed and 2 memoranda between IES and INRNE were signed for new collaborations, one concerning the JRC direct action programme (direct contracts) and one concerning JRC indirect actions and other FP6 activities: Environmental studies and Informational integration (see NUSES final report, NUSES CD or http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html)
2) Visit of Prof. Stamenov, INRNE director to IES, discussions with IES director and staff on the following areas of mutual interest, defining possible common work and collaborations in the field of: Forest-fires – Land Management Unit (with Mr. J. Meyer – Roux and J. San Miguel – Ayanz); Spectrometric gamma-background measurements from BEO Moussala, and their submission to the EURDEP database - Emission and Health Unit (Mr. M. de Cort and Mr. Gerhard De Vries); Expansion of atmospheric composition measurement capacity at BEO Moussala (Climate Change Unit Mrs. R. Van Dingen); Heavy metal pollution monitoring neutron activation elemental analysis of moss as a biomonitor (Soil and Waste Unit – Mr. D. G. Bidoglio) and also a meeting in IPSC - Continuation of joint activities connected with the control of illicit traffic of nuclear and radioactive materials and application of MCNP code for calculation of real complex neutron flux moderation (IPSC Nuclear Safeguards at JRC D. P. Peerani).
3) BEO Moussala (INRNE BEO Centre of Excellence) participation in EURDEP, with regular reliable automatic gamma background and meteorological data submission to the database from the middle of 2003
Direct contacts between IES, JRC Ispra and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined
First concrete results were obtained

Joint evaluation of nuclear data, especially resonance shape analysis of high-resolution cross-section data, analysis of cross-sections in the unresolved energy range, and modeling of the fission process.

Signature of a protocol for the continuation of the support in the field of combating illicit trafficking
Finalization of the RITNUM handbook

1. Direct contacts with leading scientists and responsible persons from 5 of 7 Institutes of JRC (IE, IES, IPTS, IRMM, ITU), JRC DG, DG Research DJ an Delgation of EC in Bulgaria
2. The present state of ongoing and recent projects and collaborations have been discussed and 3 memorandums for their further development were signed in the field of nuclear

forensics and combating illicit trafficking; neutron investigations and data measurements and nuclear spent fuel investigations
The possibilities were discussed and 5 memorandums were signed for new collaborations based on JRC direct action programme (direct contracts) and JRC indirect actions - in the field of EURATOM programme and other FP6 activities: Environmental studies; Neutron therapy and Informational integration

3. Establishment of INRNE NUSES Programme. It is based on INRNE Programme for management and development for 2003-2007 years. The main goal of NUSES Programme is to develop and enhance the results and achievements of NUSES INRNE – JRC project.
4. Possibile collaborations were discussed and 2 memoranda between IES and INRNE were signed for new collaborations, one concerning the JRC direct action programme (direct contracts) and one concerning JRC indirect actions and other FP6 activities: Environmental studies and Informational integration (see NUSES final report, NUSES CD or http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html)
5. Visit of Prof. Stamenov, INRNE director to IES, discussions with IES director and staff on the following areas of mutual interest, defining possible common work and collaborations in the field of: Forest-fires – Land Management Unit (with Mr. J. Meyer – Roux and J. San Miguel – Ayanz); Spectrometric gamma-background measurements from BEO Moussala, and their submission to the EURDEP database - Emission and Health Unit (Mr. M. de Cort and Mr. Gerhard De Vries); Expansion of atmospheric composition measurement capacity at BEO Moussala (Climate Change Unit Mrs. R. Van Dingen); Heavy metal pollution monitoring neutron activation elemental analysis of moss as a biomonitor (Soil and Waste Unit – Mr. D. G. Bidoglio) and also a meeting in IPSC - Continuation of joint activities connected with the control of illicit traffic of nuclear and radioactive materials and application of MCNP code for calculation of real complex neutron flux moderation (IPSC Nuclear Safeguards at JRC D. P. Peerani).
6. BEO Moussala (INRNE BEO Centre of Excellence) participation in EURDEP, with regular reliable automatic gamma background and meteorological data submission to the database from the middle of 2003

- Direct contacts between IES, JRC Ispra and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined
- Closer direct contacts between IE, JRC Petten and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined
- First concrete results in collaboration with JRC Ispra institutes were obtained

Preliminary contacts for databases integration in the field of radioactive and terrains and soils contamination.
Contact person from JRC: Dr.Marc de Court

Exchange of specialists in the field of radioactivity measurements, application of chosen methods for sampling, radiochemistry and analysis on sites

Preparation of review paper on the resonance averaged cross sections in the unresolved region.

Training (different forms)

Possibilities for students (physics) to come to Petten as Post-docs or trainees still exists.

There could be also a possibility to train young scientists on the use of the computer tools.

Both institutes participate in an CRP on Thorium, organised by the IAEA
Mrs. N. Koyumdjieva from INRNE is working as VS for one year at IRMM, on the interpretation of cross sections in the unresolved energy range
Mr. I. Ruskov from INRNE is working as SNE for two years on measurements of neutron induced cross-sections of light elements, considered as neutron data standards

Envisaged: exchange of personnel and grant holders for participation in joint experiments and data analysis

Training sessions related to combating illicit trafficking of nuclear and radioactive materials (Omer Cromboom)
Training course on Nuclides.Net (Joe Magill)
Harmonization of Techniques and Methodologies for Measuring Radioactivity in the Environment
(Maria Betti)
1st Meeting: 10-07-2003
2nd Meeting: 15-10-2003
Specific training on NDA techniques related to nuclear material assay

Moreover, unfortunately and surprisingly in a sense, we had no proposals from Bulgarian fellows in our Training and Mobility programme and this despite my insistence in promoting this instrument and the direct presence of young scientists during my presentation.

Further education of young researchers and professionals about the mechanisms of irradiation-induced degradation of materials
Further education of young researchers and professionals about the mechanisms of treatment of tumor by neutron irradiation

Participation of young specialists in the Laboratory in training courses

Petten, Holand, November 18-19, 2003 Training Workshop "Nuclear Safety: Technical and Scientific Support to PHARE Countries".

Workshops (all types of conferment events)

A. Plompen and P. Schillebeeckx lectured at the Varna School in September 2003
Participation of several scientists from INRNE to the NEMEA workshop in Budapest (Nov. 2003) organised by IRMM and the Budapest Neutron Centre.

Workshop on “Radiation protection of the environment and human health”, ITU, Karlsruhe,16-10-2003
Workshop: “Experiences gathered on combating illicit trafficking of nuclear material” which will be organized in September (or October) 2004 in Vilnius

My participation has been limited to the “Nuses – Information Day” conference.
With respect to this, I must state that the quality of the presentations, the exchange of information among specialists and the overall organization of the conference has been very good.

Petten, Holand, November 18-19, 2003 Training Workshop "Nuclear Safety: Technical and Scientific Support to PHARE Countries".

Good practice and **Technology transfer** (in different forms)

Exchange of best practices in research infrastructure development and enhancement

Evaluation of the “state of the practice” during the workshop: “Experiences gathered on combating illicit trafficking of nuclear material” which will be organized in September (or October) 2004 in Vilnius

1. Exchange of best practices in research infrastructure development and enhancement
2. BNCT technology implementation support, including qualification of the starting operational team
3. Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area.

Supply of common sources for r-spectrometry and tracers for 4-Spectrometry
Training in the field Liquid scintillation counting for strontium-90, plutonium-241 and tritium
Alpha spectrometry as instrumental technique and sample preparation for alpha spectrometry

Data management: general statistics and applied
Inter-laboratory on gamma spectrometry: distribute spectra and analyse in each laboratory with their programme

BNCT device is planed to be developed at the reconstructed experimental reactor in Sofia. There are needs in
1) Experience in neutron source modeling and assessment of irradiation conditions
2) Dosimetry technique skills
More acknowledgements on the material behavior assessment and the tools and results used for this assessment (to be applyied to our plant Kozloduy NPP)

Information on sampling procedures used by other participants
Information on the radiochemical procedures for "difficult" nuclides used by other participants
Obtaining reference materials

Organisation, Financial, Management and **Integration** aspects
Institutional status of INRNE within the EURDEP network
Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area.

Provision of equipment and related training to allow Bulgaria to act as regional NDA expert laboratory.

- NUSES made a transition to the NUSES Programme (INRNE)
- Synergies of joint JRC – INRNE projects and activities and other Frameworks

- Institutional status of INRNE within the EURDEP network
- Financing problems (reimbursement of expenses; bank guaranties; final payment of FP projects)
- More intensive and extensive inclusion in JRC Enlargement action
- More intensive, extensive and targeted human mobility (taking into account the urgent force coming needs of new joint application – BNCT and others)
- Lack of contacts with IPSC, Seville and IHCP, Ispra

  ⇒ Continuing the periodical reviews of state, problems and prospects of JRC – INRNE integration
  ⇒ Intensify the exchange of information and discussion of problems of common interest
  ⇒ Develop the contacts and collaboration with IPSC, Seville (in the field of technological transfer, innovation management and prospective studies) and IHCP, Ispra (in the field of medicine (health) applications)

- Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area.
- Development of JRC – INRNE joint NUSES Programme
- Development on the base of INRNE with JRC a joint HiTech Innovation Centre, directed not only in the field of Nuclear science, technology and techniques development and application

Export licenses are necessary for sending the materials. ITU is working on getting these licenses.

Better coordination in the framework of the JRC-INRNE collaboration, including more intensive contacts between scientific personnel on different levels.
Exchange of data, integration of databases, new joint projects, experiments and publication

Collaboration with JRC IE, Petten, Netherlands in joint project of EC, and especially in PERFECT project of EC

Administration bureaucracy from both parts

Quality control program is in process by supplying reference samples to check the measurement quality

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Raymond Moss
2. Affilation	Institute for Energy, JRC Petten, Netherlands
3. Address, FAX, Phone, E-mail	Westerduinweg 3, 1755 ZG, Petten, Netherlands Fax: 0031 224 565615, Tel: 0031 224 561526 Email: raymond.moss@jrc.nl
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	Exchanges with Krassimira Ilieva, with possibility for students to come to Petten. Contact with Evgeni Gabev, Institute of Experimental Pathology and Parasitology, Bulgarian Academy of Sciences, Sofia
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	Regular exchange with Krassimira Ilieva, plus request made by myself regarding possible Post-Docs for IE/JRC, candidates considered but not available. Evgeni Gabev was invited to Petten to participate in a Workshop on Boron Drug Development 26/27 March 2004), but unfortunately could not make it, but did forward a contribution, which will be used with other partners to form a collaboration group.
6. Open problems	Possibilities for students (physics) to come to Petten as Post-docs or trainees still exists. A proposal for a network for BNCT Drug developers will be made soon and will include Dr.Gabev.
7. Recommendations	Regular emails on updates in collaborative, eg. Results of this form, would continue to encourage contact and possible collaboration.
8. The future of JRC – INRNE integration	A serious consideration, worthwhile pursuing

If you need you can add additional sheets.
Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

Dear Boyko,

the workshop was certainly a very interesting event, both from the viepoint of scientific presentations and establishing contacts.
How is Prof. Stamenov ? Pass him please my best regards.

However in my particular field of activity (neutron embrittlement, structural integrity) I haven't had any new collaboration with your institute as a consequence of the workshop, so far.

But I take this opportunity to ask you if you were interested in participating to the Users Group of a new Integrated Project called PERFECT, dedicated to prediction of radiation damage in reactor pressure vessel and core internals.

I include some information on the project. The participation would consist in taking part to maximum 2 meetings per year, with the goal to assess the outcome of the models from the viewpoint of a final user.

There could be also a possibility to train young scientists on the use of the computer tools.

If this is of your possible interest, we can also write it in the evaluation table you sent to me. Otherwise my colleague Ray Moss can possibly include just his experience concerning contacts about BNCT.

Best regards
Filippo

Dr. Filippo Sevini
European Commission
Joint Research Centre
Institute for Energy

P.O. Box 2
1755 ZG Petten
The Netherlands

E-Mail: Filippo.Sevini@cec.eu.int
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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Julian Wilson
2. Affilation	**Climate Change Unit, Institute for Environment and Sustainability**
3. Address, FAX, Phone, E-mail	**TP280, Joint Research Centre, I-21020 Ispra (Va), Italy**
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	1) Possibile collaborations were discussed and 2 memoranda between IES and INRNE were signed for new collaborations, one concerning the JRC direct action programme (direct contracts) and one concerning JRC indirect actions and other FP6 activities: Environmental studies and Informational integration (see NUSES final report, NUSES CD or http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html) 2) Visit of Prof. Stamenov, INRNE director to IES, discussions with IES director and staff on the following areas of mutual interest, defining possible common work and collaborations in the field of: Forest-fires – Land Management Unit (with Mr. J. Meyer – Roux and J. San Miguel – Ayanz); Spectrometric gamma-background measurements from BEO Moussala, and their submission to the EURDEP database - Emission and Health Unit (Mr. M. de Cort and Mr. Gerhard De Vries); Expansion of atmospheric composition measurement capacity at BEO Moussala (Climate Change Unit Mrs. R. Van Dingen); Heavy metal pollution monitoring neutron activation elemental analysis of moss as a biomonitor (Soil and Waste Unit – Mr. D. G. Bidoglio) and also a meeting in IPSC - Continuation of joint activities connected with the control of illicit traffic of nuclear and radioactive materials and application of MCNP code for calculation of real complex neutron flux moderation (IPSC Nuclear Safeguards at JRC D. P. Peerani). 3) BEO Moussala (INRNE BEO Centre of Excellence) participation in EURDEP, with regular reliable automatic gamma background and meteorological data submission to the database from the middle of 2003 4) Ref. IES – J08 (Job opportunity): Capacity Building for Long Term Atmospheric Aerosol Monitoring in the Balkans, devoted to BEO Moussala, to enable BEO Moussala to participate in the GAW aerosol monitoring programme
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	Direct contacts between IES, JRC Ispra and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined First concrete results were obtained
6. Open problems	Institutional status of INRNE within the EURDEP network
7. Recommendations	Continuing and developing collaboration in the fields described in 4.2
8. The future of JRC – INRNE integration	Exchange of best practices in research infrastructure development and enhancement Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area.

If you need you can add additional sheets.
Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	F.-J. Hambsch, A. Plompen, P. Schillebeeckx, P. Rullhusen
2. Affilation	JRC - IRMM
3. Address, FAX, Phone, E-mail	Retieseweg 111 2440 Geel Belgium Tel: +32/14/571.476 Fax: +32/14/571.862 peter.rullhusen@cec.eu.int
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	discussion of common IRMM-INRNE projects: 1) capture measurements on ^{232}Th (work of N. Janeva from INRNE, working on several short-term stays as VS at IRMM) 2) progress of thesis work of K. Volev from INRNE, presently cat. 20 grantholder at IRMM 3) analysis of ^{239}Pu fission yield data (work of I. Ruskov of INRNE, working as SNE at IRMM) 4) EUR report on activation cross section measurements at IRMM by V. Semkova of INRNE; delivery of measurement results to the Exfor database
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	both institutes participate in an CRP on Thorium, organised by the IAEA Mrs. N. Koyumdjieva from INRNE is working as VS for one year at IRMM, on the interpretation of cross sections in the unresolved energy range Mr. I. Ruskov from INRNE is working as SNE for two years on measurements of neutron induced cross-sections of light elements, considered as neutron data standards A. Plompen and P. Schillebeeckx lectured at the Varna School in September 2003 Participation of several scientists from INRNE to the NEMEA workshop in Budapest (Nov. 2003) organised by IRMM and the Budapest Neutron Centre. Contract with INRNE on comparison of measurement results and evaluations for the NEA-WPEC subgroup 19 on Activation Cross Sections.
6. Open problems	
7. Recommendations	
8. The future of JRC – INRNE integration	joint evaluation of nuclear data, especially resonance shape analysis of high-resolution cross-section data, analysis of cross-sections in the unresolved energy range, and modeling of the fission process. Envisaged: exchange of personnel and grant holders for participation in joint experiments and data analysis

If you need you can add additional sheets.
Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Klaus Lützenkirchen, Joe Magill, Claudio Ronchi,
2. Affilation	ITU
3. Address, FAX, Phone, E-mail	European Commission Joint Research Centre Institute for Transuranium Elements P.O. Box 23 40 76125 Karlsruhe / Germany Phone: +49 (0) 7247 951-424 Fax: +49 (0) 7247 951-596 Email: luetzenkirchen@itu.fzk.de
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programs	1. Training sessions related to combating illicit trafficking of nuclear and radioactive materials (Omer Cromboom) 2. Joint Transuranus project "Application of Nuclear Fuel Modeling Codes to Fuel Licensing (Claudio Ronchi, Paul van Uffelen) 3. Training course on Nuclides.Net (Joe Magill) 4. Harmonization of Techniques and Methodologies for Measuring Radioactivity in the Environment (Maria Betti) 1st Meeting: 10-07-2003 2nd Meeting: 15-10-2003 Workshop on "Radiation protection of the environment and human health", ITU, Karlsruhe,16-10-2003 5. Signature of a protocol for the continuation of the support in the field of combating illicit trafficking. The next project foresees the finalization of the RITNUM handbook (national response plan to illicit trafficking) and the provision of equipment and related training to allow Bulgaria to act as regional NDA expert laboratory.
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	See 4.
6. Open problems	Finalization of the RITNUM handbook
7. Recommendations	
8. The future of JRC –	• Specific training on NDA techniques related to nuclear material

INRNE integration	assay • Evaluation of the "state of the practice" during the workshop: "Experiences gathered on combating illicit trafficking of nuclear material" which will be organized in September (or October) 2004 in Vilnius

If you need you can add additional sheets.
Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	DAURES Pascal
2. Affilation	**ITU**
3. Address, FAX, Phone, E-mail	**TP400 – 21020 Ispra (VA)** **+39 0332 78 5852** Pascal.daures@cec.eu.int
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	**Signature of a protocol for the continuation of the support in the field of combating illicit trafficking. The next project foresees the finalisation of the RITNUM handbook (national response plan to illicit trafficking) and the provision of equipment and related training to allow Bulgaria to act as regional NDA expert laboratory.**
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	**Since my departure from ITU to Ispra, please contact O. Cromboom (cromboom@itu.fzk.de) in charge of the follow-up of the project.**
6. Open problems	**See 5**
7. Recommendations	**See 5**
8. The future of JRC – INRNE integration	**See 5**

If you need you can add additional sheets.
Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

Dear Boyko,

Thank you for this excellent initiative.
It is also always nice to hear from you and Prof. Stamenov.

Concerning your questionnaire, myself, I may present an exemption as myorganisation (DG/RTD) can not set up a direct collaboration with yours.
I can not fill in the questionnaire but I nevertheless profit to make some comments.
In our case, the success of the INRNE-JRC conference should be reflected
In the participation of Bulgarian organisations in the Euratom Framework Programme.
I can now tell you that in our previous evaluation period, (deadline for submission of proposals 6 May 2003 that can be considered as too close to the NUSES event to have a real impact; the consortia were certainly already fixed) we had only 15 Bulgarian participations from which only 5 where still present in the ranked list (in a total of 458 participations in the ranked list).

Moreover, unfortunately and surprisingly in a sense, we had no proposals from Bulgarian fellows in our Training and Mobility programme and this despite my insistence in promoting this instrument and the direct presence of young scientists during my presentation.

I am not yet able to make analysis of the evolution of the participation as our next deadline for reception of proposals is the 14 April. After the evaluation of these proposals I will certainly have an idea on the tendencies.
I think that the above demonstrate the need for an increased effort in communicating our programme in your Country from our part as well as an increased effort in developing collaborations with other European organisations from your part. I can thus only encourage you in pursuing communication/collaboration efforts such as the NUSES conference.

With my best regards and best memories from that last year event

Takis P. Manolatos

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Roberto PASSALACQUA
2. Affilation	**European Commission Delegation to Bulgaria**
3. Address, FAX, Phone, E-mail	**9, Moscovska 1000, Sofia, Bulgaria** **Roberto.passalacqua@cec.eu.int**
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	**My participation has been limited to the "Nuses – Information Day" conference.** **With respect to this, I must state that the quality of the presentations, the exchange of information among specialists and the overall organization of the conference has been very good.**
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	**EC Delegation is in charge of implementation of Phare projects in the field of Science and Research.** **We are calling for proposals from Bg institutions as the INRNE. the Law on the Ratification of the Memorandum of Understanding between the Republic of Bulgaria and the European Communities concerning Bulgaria's accession to the EURATOM 6th Framework Programme, for Research and Technological Development (2002-2006) has been approved (7 February, 2003 -SG 16/2003). This paves the way to Bulgarian participation.**
6. Open problems	**ECD has received no proposals so far for the 2004 Phare Programme. It is now probably too late and efforts should focus on the 2005 Phare Programme.**
7. Recommendations	**I feel that Bulgarian participation to the 6th Framework Program should increase.**
8. The future of JRC – INRNE integration	**This will be discussed at the forthcoming "JRC Information Day to Bulgaria" on 27 April 2004 at the Hilton hotel in Sofia.**

If you need you can add additional sheets.
Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Jordan Stamenov, Boyko Vachev
2. Affilation	Institute for Nuclear research and Nuclear Energy, Bulgarian Academy of Sciences
3. Address, FAX, Phone, E-mail	72, Tsarigradsko chaussee blvd., 1784, sofia, BULGARIA jstamen@inrne.bas.bg, tel.: (+359 2) 9743 761; vachev@inrne.bas.bg, tel.: (+359 2) 974 63 10 fax: , (+359 2) 975 36 19
4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	1. **Direct contacts** with leading scientists and responsible persons from 5 of 7 Institutes of JRC (IE, IES, IPTS, IRMM, ITU), JRC DG, DG Research DJ an Delgation of EC in Bulgaria 2. The present state of ongoing and recent projects and collaborations have been discussed and **3 memorandums** for their further development were signed in the field of nuclear forensics and combating illicit trafficking; neutron investigations and data measurements and nuclear spent fuel investigations The possibilities were discussed and **5 memorandums** were signed for new collaborations based on JRC direct action programme (direct contracts) and JRC indirect actions - in the field of EURATOM programme and other FP6 activities: Environmental studies; Neutron therapy and Informational integration 3. **Establishment of INRNE NUSES Programme.** It is based on INRNE Programme for management and development for 2003-2007 years. The main goal of NUSES Programme is to develop and enhance the results and achievements of NUSES INRNE – JRC project. 4. Possibile collaborations were discussed and 2 memoranda between IES and INRNE were signed for new collaborations, one concerning the JRC direct action programme (direct contracts) and one concerning JRC indirect actions and other FP6 activities: Environmental studies and Informational integration (see NUSES final report, NUSES CD or http://www.om2.inrne.bas.bg/dep/EU_PROJECTS/NUSES/NUSES_MENU.html) 5. Visit of Prof. Stamenov, INRNE director to IES, discussions with IES director and staff on the following areas of mutual interest, defining possible common work and collaborations in the field of: Forest-fires – Land Management Unit (with Mr. J. Meyer – Roux and J. San Miguel – Ayanz); Spectrometric gamma-background measurements from BEO Moussala, and their submission to the EURDEP database - Emission and Health Unit (Mr. M. de Cort and Mr. Gerhard De Vries); Expansion of atmospheric composition measurement capacity at BEO Moussala (Climate Change Unit Mrs. R. Van Dingen); Heavy metal pollution monitoring neutron activation elemental analysis of moss as a biomonitor (Soil and Waste Unit – Mr. D. G. Bidoglio) and also a meeting in IPSC - Continuation of joint activities connected with the control of illicit traffic of nuclear and radioactive materials and application of MCNP code for calculation of real complex neutron flux moderation (IPSC Nuclear Safeguards at JRC D. P. Peerani). 6. BEO Moussala (INRNE BEO Centre of Excellence) participation in EURDEP, with regular reliable automatic gamma background and meteorological data submission to the database from the middle of 2003 7. Ref. IES – J08 (Job opportunity): Capacity Building for Long Term Atmospheric Aerosol Monitoring in the Balkans, devoted to BEO Moussala, to enable BEO Moussala to participate in the GAW aerosol monitoring programme
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	1. Direct contacts between IES, JRC Ispra and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined 2. Closer direct contacts between IE, JRC Petten and INRNE, Bulgaria have been realised and concrete collaborations, joint projects and activities were outlined

	3. First concrete results in collaboration with JRC Ispra institutes were obtained **4.** NUSES made a transition to the **NUSES Programme (INRNE)** 5. **Synergies of joint JRC – INRNE projects and activities** and other Frameworks projects
6. Open problems	6. Institutional status of INRNE within the EURDEP network 7. Financing problems (reimbursement of expenses; bank guaranties; final payment of FP projects) 8. More intensive and extensive inclusion in JRC Enlargement action 9. More intensive, extensive and targeted human mobility (taking into account the urgent force coming needs of new joint application – BNCT and others) 10. Lack of contacts with IPSC, Seville and IHCP, Ispra
7. Recommendations	1. Continuing and developing collaboration in the fields described in 4 2. Solving of problems from 6 3. Continuing the periodical reviews of state, problems and prospects of JRC – INRNE integration 4. Intensify the exchange of information and discussion of problems of common interest 5. Develop the contacts and collaboration with IPSC, Seville (in the field of technological transfer, innovation management and prospective studies) and IHCP, Ispra (in the field of medicine (health) applications)
8. The future of JRC – INRNE integration	1. Exchange of best practices in research infrastructure development and enhancement 2. BNCT technology implementation support, including qualification of the starting operational team 3. Closer integration of BEO Moussala into the GAW aerosol program and EURDEP as well as other IES activities, continued collaboration with INRNE as a focal point for the Balkan area. 4. Development of **JRC – INRNE joint NUSES Programme** 5. Development on the base of INRNE with JRC **a joint HiTech Innovation Centre**, directed not only in the field of Nuclear science, technology and techniques development and application

If you need you can add additional sheets.

Please, return questionnaire **no later 17 April 2004** to Boyko Vachev
by E-mail: vachev@inrne.bas.bg or by fax: +359 2 975 36 19

NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	**Alexander Slavtchev Strezov**
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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	**Start of project "Harmonization of Techniques and Methodologies for measuring of radioactivity in the environment"** **With ITU in Karlsruhe Germany**
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	Supply of common sources for r-spectrometry and tracers for 4-Spectrometry Training in the field Liquid scintillation counting for strontium-90, plutonium-241 and tritium Alpha spectrometry as instrumental technique and sample preparation for alpha spectrometry Data management: general statistics and applied Inter-laboratory on gamma spectrometry: distribute spectra and analyse in each laboratory with their programme Supply of Eichrom resin had not yet been sent to the laboratories. The materials have been purchased by ITU but, since the laboratories are still not members of the European Union, export licenses are necessary for sending the materials. ITU is working on getting these licenses. Work on Sr-90, Po-210, Cs radionuclides Sediment, water, soil,
6. Open problems	
7. Recommendations	
8. The future of JRC – INRNE integration	

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Dancho Elenkov
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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	As a result of NUSES joint INRNE–JRC collaboration, proposal for a new project has been done. The contracting parties are the European Atomic Energy Community and five Bulgarian organisations, constituting a joint team for Bulgaria. The team is led by Prof. Dr. Dancho Elenkov from the Nuclear Regulatory Agency of Bulgaria and the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Science. The project is aiming at helping Bulgaria in reforming activities related to the nuclear fuel cycle in the country.
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	The proposal, mentioned above in item 4, was approved and on the 18 March 2004 the contract was signed for a period of 24 months. It is entitled "Research and Development for Licensing of Nuclear Fuel in Bulgaria" No. 370011–2004–02 F1FD KAR BG
6. Open problems	
7. Recommendations	
8. The future of JRC – INRNE integration	

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Chavdar Stoyanov, Latshesar Kostov, Hristo Protohristov
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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	Preliminary contacts for databases integration in the field of radioactive and terrains and soils contamination. Contact person from JRC: Dr.Marc de Court
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	
6. Open problems	
7. Recommendations	Better coordination in the framework of the JRC-INRNE collaboration, including more intensive contacts between scientific personell on different levels.
8. The future of JRC – INRNE integration	Exchange of data, integration of databases, new joint projects, experiments and publication

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Ivan Ruskov, PhD
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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	**Temporary job for 1 scientist as a Detached National Expert (DNE) working in the field of the reference materials & measurements at the EC-JRC-IRMM (Ref. IRMM-J06).**
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	**The experimental ^{10}B(n,α) data obtained at the EC-JRC-IRMM GELINA TOF spectrometer (in the neutron energy interval bellow 1MeV) are in the process of analyzing.** **The final results will be used in the new evaluation of the neutron standard file for this reaction.**
6. Open problems	
7. Recommendations	**To stimulate the INRNE scientists to collaborate with EC-JRC colleagues in common research projects as PhD, PostDoc, DNE, visiting scientists.** **To make possible the IRNE scientists to apply for grants and to be grant-holders of their approved proposals.**
8. The future of JRC – INRNE integration	**Experimental neutron data obtaining, analyzing and evaluation;** **Low level gamma-ray spectrometry;** **Radiochemistry;** **Partial decommissioning of the IRT-2000;** **Setup of a boron therapy neutron channel at the new BAS-INRNE research reactor.**

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Krassimira Ilieva
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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	No
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	No
6. Open problems	BNCT device is planed to be developed at the reconstructed experimental reactor in Sofia. There are needs in 1) Experience in neutron source modeling and assessment of irradiation conditions 2) Dosimetry technique skills More acknowledgements on the material behavior assessment and the tools and results used for this assessment (to be applyied to our plant Kozloduy NPP)
7. Recommendations	Further education of young researchers and professionals about the mechanisms of treatment of tumor by neutron irradiation Participation in the project PERFECT by neutron-gamma transport calculations and reactor pressure vessel Lifetime prognosis analyses. Further education of young researchers and professionals about the mechanisms of irradiation-induced degradation of materials
8. The future of JRC – INRNE integration	Collaboration with JRC IE, Petten, Netherlands in joint project of EC Collaboration with JRC IE, Petten, Netherlands in PERFECT project of EC

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

1. Name	Lidia Kinova
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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	2 meetings on Harmonisation of Techniques and Methodologies for Measuring Radioactivity in the Environment Exchange of information and know-how Checking of sampling procedures, analytical methods, quality control programmes, data quality or data management. Quality control program is in process by supplying reference samples to check the measurement quality
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	Information on sampling procedures used by other participants Information on the radiochemical procedures for "difficult" nuclides used by other participants Obtaining reference materials Participation of young specialists in the Laboratory in training courses
6. Open problems	**Administration bureaucracy from both parts**
7. Recommendations	
8. The future of JRC – INRNE integration	**Exchange of specialists in the field of radioactivity measurements, application of chosen methods for sampling, radiochemistry and analysis on sites**

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	**Capture measurements on ^{232}Th - N. Janeva participation as VS in IRMM** **Capture on ^{232}Th experimental data analysis in the unresolved resonances region – N. Koyumdjieva, A. Lukyanov, N. Janeva, K. Volev** Progress of thesis work of K. Volev from INRNE, presently cat. 20 grantholder at IRMM **Neutron activation cross sections for safety of nuclear power plants measurements – V. Semkova** **More than 10 joint publications and presentation on the international scientific conferences**
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	both institutes participate in an CRP on Thorium Uranium fuel cycle, organised by the IAEA Mrs. N. Koyumdjieva from INRNE is working as VS for one year at IRMM, on the interpretation of cross sections in the unresolved energy range Participation of N. Janeva, V. Semkova, N. Koyumdjieva, K. Volev from INRNE to the NEMEA workshop in Budapest (Nov. 2003) organised by IRMM and the Budapest Neutron Centre. Contract with INRNE on comparison of measurement results and evaluations for the NEA-WPEC subgroup 19 on Activation Cross Sections - V. Semcova
6. Open problems	
7. Recommendations	
8. The future of JRC – INRNE integration	joint evaluation of nuclear data, especially resonance shape analysis of high-resolution cross-section data, analysis of cross-sections in the unresolved energy range. Preparation of review paper on the resonance averaged cross sections in the unresolved region. Envisaged: exchange of personnel and grant holders for participation in joint experiments and data analysis

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NUSES (Nuclear Science for Sustainable Environment and Security)
INRNE – JRC Conference – Informational Days - One Year Later

Questionnaire

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4. Main results of NUSES joint INRNE – JRC collaboration: projects and proposals; exchange of specialists, information and know-how; databases integration; participation in the workshops organized by EU; realization of JRC and INRNE policies and programmes	**Participation of INRNE in the Project called "EC-SARNET, Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology and Management" within the frame of the 6th FP** **Contract № FI6O-CT-2004-509065** **Network of Excellence** **Total Project Price: 6 mln euro**
5. Progress in the collaboration (due to NUSES project) of Your institution and INRNE since Sofia Conference	Petten, Holand, November 18-19, 2003 Training Workshop "Nuclear Safety: Technical and Scientific Support to PHARE Countries".
6. Open problems	
7. Recommendations	
8. The future of JRC – INRNE integration	

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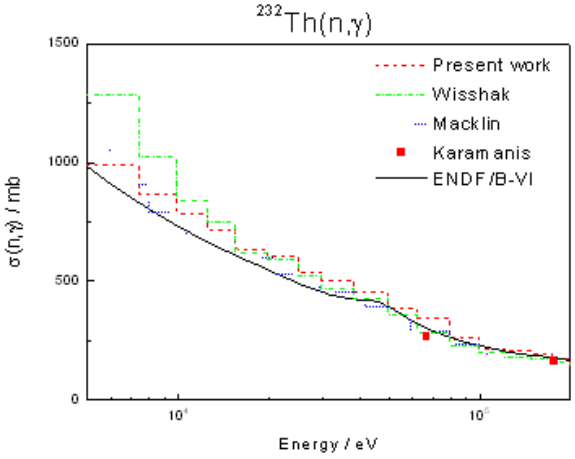
Top quality neutron data for new concepts in nuclear technology

A thorough knowledge of the interaction of neutrons with matter is of fundamental importance to assess the safe operation of nuclear reactors, model the ageing of presently operating power plants, develop new and advanced reactor concepts and for various technological applications in energy production, mining, non-destructive testing, etc. The JRC has an active program in the measurement for basic neutron data, data for application in nuclear safety, advanced fuel cycles and waste management strategies like transmutation, accelerator driven systems and the possible use of Thorium fuel cycle. The Neutron Data Laboratory of INRNE is developing collaboration with IRMM-JRC Institute that is a major contributor of neutron data, important for various sciences (physics, medicine, astrophysics, etc.) and technology.

Th neutron cross sections investigations

The thorium-uranium fuel cycle is very attractive because the natural resources of thorium exceed considerably those of uranium and because this cycle limits the build-up of highly radioactive transuranium nuclides. Accelerator Driven Systems, based on the Th – U fuel cycle, are also studied to incinerate the waste of the first generation of nuclear power plants. The ^{232}Th(n,γ) cross section has a strong impact on the performance and safety assessment of such advanced systems. In a sensitivity study of a fusion-fission hybrid system, the production rate of ^{233}U can be predicted within 1%, provided that the ^{232}Th(n,γ) cross section between 3 keV and 3000 keV is known to within 2 %. For fast breeder reactors the most important region for capture in ^{232}Th is from 10 keV to 100 keV. A 10% uncertainty on the data can produce a 30 % uncertainty on the proton current requirement to operate an ADS at the sub-critical level of k_{eff} ~ 0.97.

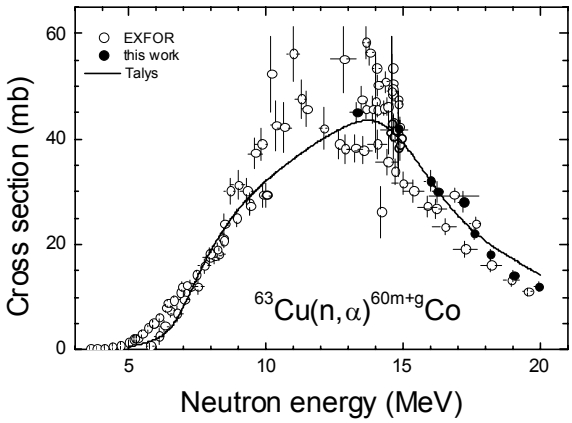
The neutron capture cross section of thorium has been measured in the energy region from 4 keV to 140 keV at the Time-of-Flight facility GELINA of the Institute for Reference Material and Measurements in Geel (Belgium). The capture events were detected by two C_6D_6 liquid scintillators, placed at 14.37 m distance from the neutron source. The systematic uncertainties related to the normalization and weighting function, using an internal saturated resonance, is less than 1%. An additional systematic uncertainty of 0.5 % results from the self-shielding and multiple scattering corrections. Using the level statistical models the average resonance parameters for the unresolved resonance region have been derived.



Activation neutron-induced reaction cross section measurements

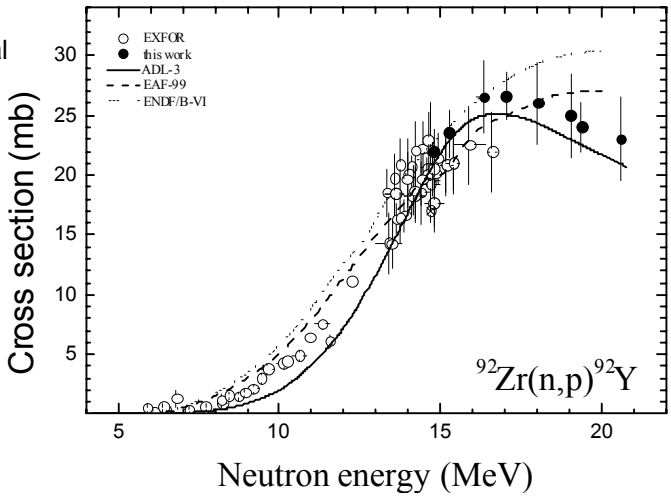
Activation cross sections are needed to determine activity levels induced during the reactors operation and for low-activation materials development. Of special interest is production of long-lived radionuclides whose decay activities impact the scenario of waste management and materials recycling.

One of the major radionuclides of importance to the medium-term waste management consideration is ^{60}Co. Two of the important reactions leading to the production of ^{60}Co, namely ^{nat}Ni(n,p)$^{60m+g}$Co, and ^{63}Cu(n,α)$^{60m+g}$Co have been studied.

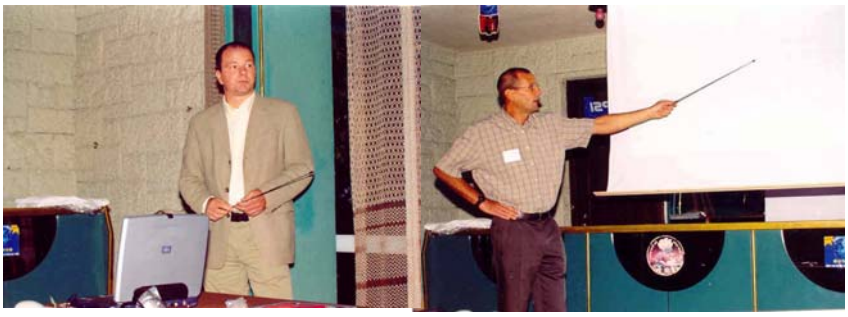


The processes of hydrogen and helium gas production, caused by (n,xp), (n,xα) reactions, make an impact on mechanical characteristics of structural materials. In total 21 (n,α), (n,p), (n,np), (n,n´γ), (n,2n) activation reactions on different isotopes of Co, Ni, Cu, Zr, and Pb have been measured from the threshold to 20 MeV, predominantly above 13 MeV.

The investigations were performed in conformity with requirements of high priority request list that is edited by the OECD Working Party on International Evaluation Co-operation (WPEC). The irradiations were carried out at 7 MV Van de Graaff accelerator. In addition new results have been obtained for the isomeric cross section ratios of the ^{58}Ni(n,p)^{58m,g}Co, the ^{60}Ni(n,p)^{60m,g}Co and ^{59}Co(n,2n)^{58m,g}Co reactions. Ten reactions have been measured for the first time in this energy range.



Two Bulgarian specialists obtained the position of visiting scientists in IRMM, two became grant holders as detached national experts and post doc and one young physicist is completing now his PhD thesis. Two IRMM scientists presented lectures on the summer school for young physicists in Varna, Bulgaria in 2003.



Contact

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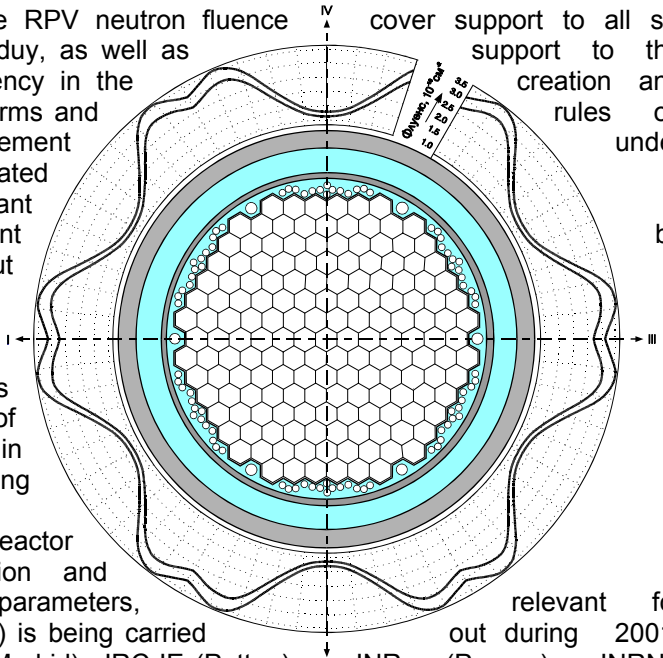
Neutron Fluence for Reactor Vessel Embrittlement

The neutron exposure of the reactor pressure vessel (RPV) and reactor internals is one of the key factors that should be quantified reliably when assessing the life of these components. Irradiation embrittlement is the most important degradation mechanism in the RPV life evaluation. The steel embrittlement of a RPV caused by the neutron irradiation during the operation of NPP could be the reason for a break of the vessel integrity when accident shutdown of the unit is performed.

The assessment of the fast neutron fluence onto the RPV is therefore required for evaluation of vessel steel degradation and for revision of the safety margins limits. These limits determine the lifetime of the reactor relevant to the irradiation embrittlement.

Since 1987, INRNE has developed methodology for neutron dosimetry and neutron embrittlement assessment of vessels of Russian design VVER-1000 and VVER-440 reactors. The works are being performed applying up-to-date calculational and experimental methods, based on the long-standing world-acknowledged.

Azimuth Neutron Fluence on VVER-1000 RPV



The INRNE activities referring the RPV neutron fluence cover support to all six reactors of Bulgarian NPP Kozloduy, as well as support to the Bulgarian Nuclear Regulatory Agency in the creation and revision of safety requirements, norms and rules on determination of metal embrittlement under neutron irradiation. INRNE participated in 1996 in the very important investigation of metal embrittlement by templates taken out from the KNPP Unit 1 RPV.

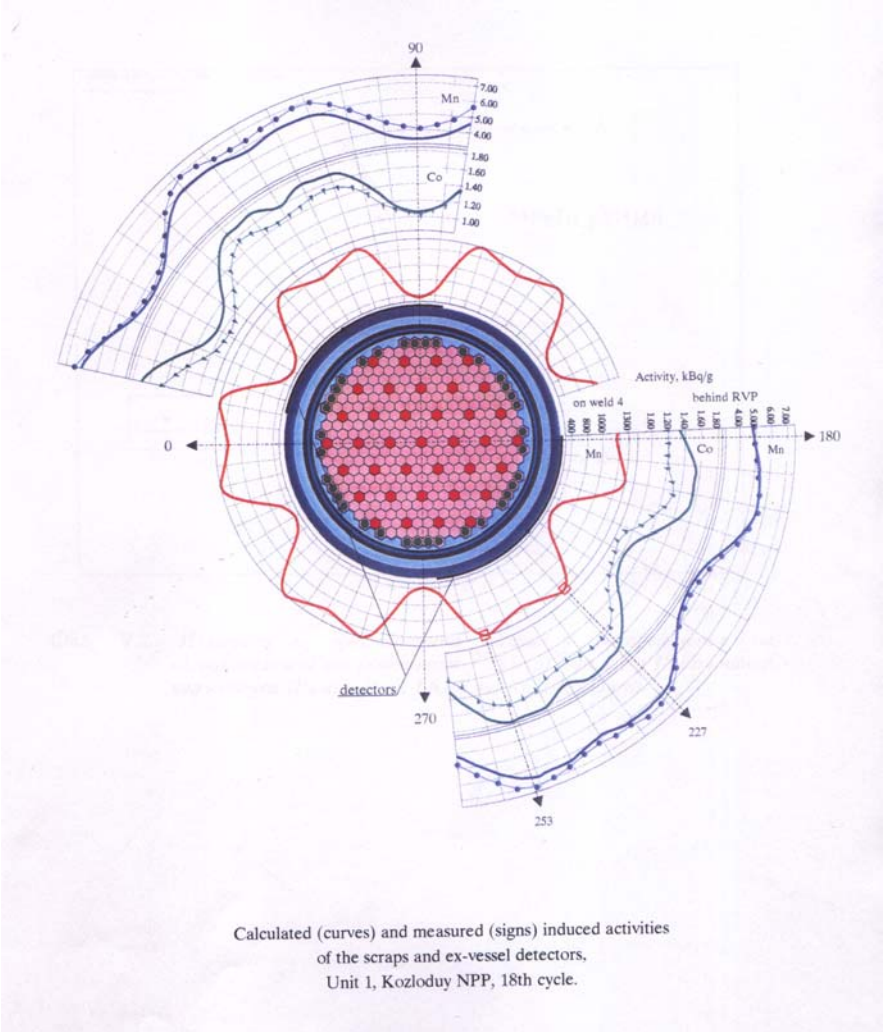
The refining and verifying of the RPV neutron fluence methodology is being performed under the support of IAEA, Vienna, TACIS and Euratom in close collaboration with world leading institutes.

The Euratom project REDOS (Reactor Dosimetry: Accurate determination and benchmarking of radiation field parameters, relevant for reactor pressure vessel monitoring) is being carried out during 2001-2004 in joint works of Tecnatom (Madrid), JRC-IE (Petten), INR (Prague), INRNE (Sofia), Skoda (Plzen), KFKI (Budapest), INR (Rossendorf), Framatome (Erlangen).

The INRNE participates in the works on:

- Neutron and gamma transport calculations of VVER440 and VVER1000 RPV benchmarks. The results of the calculations and experimental gamma-ray spectra measurement and extended neutron spectra measurements, in a mock-up in LR-0 reactor (Rez, Czech R), will be compared with purpose of creating a three dimensional engineering VVER-1000 RPV benchmark.
- Data and analyses of ex-vessel detectors measurements on Kozloduy NPP reactors.
- Calculations of neutron and gamma fluxes and radiation damages on VVER1000 and VVER440 RPVs.

INRNE is interested to participate in the project PERFECT (IE, Petten) of Euratom FP6 for further assistance to Kozloduy NPP into assessment of RPV metal embrittlement induced by neutron and gamma irradiation by applying the surveillance specimens data and new experimental data for materials behavior under irradiation.
INRNE could participate with all necessary neutron-gamma transport calculations as well as with RPV Lifetime prognosis analyses.
INRNE is interested in further education of young researchers and professionals about the mechanisms of irradiation-induced degradation of materials.
INRNE is interested to be more acknowledged with the material behavior assessment and the tools and results used for this assessment, and this way to be in help for our plant Kozloduy NPP.



Calculated (curves) and measured (signs) induced activities
of the scraps and ex-vessel detectors,
Unit 1, Kozloduy NPP, 18th cycle.

INRNE intends to participate in WP4 "Material and equipment ageing" of the project COVERS (NUCTECH-2004-3.4.3.1-2VVER Safety Research) (IE, Petten) that has been proposed to FP6 Euratom. We are proposing Workshop on "State of art of reactor dosimetry for needs for metal embrittlement surveillance of VVER-1000 and VVER-440" with participants as follows
- participants who created the VVER-1000 and VVER-440 benchmarks: to present the results and to hear the opinion and additional needs of the another participants;
- regulatory bodies: to take the results as a tool for estimation of the surveillance' results;
- NPP- to be acquainted with the last results and the level of the knowledge;
- students: for further education of young researchers and professionals on reactor dosimetry calculations and measurement technique as a tool for prediction of the irradiation-induced degradation of VVER RPVs metal.

Contact

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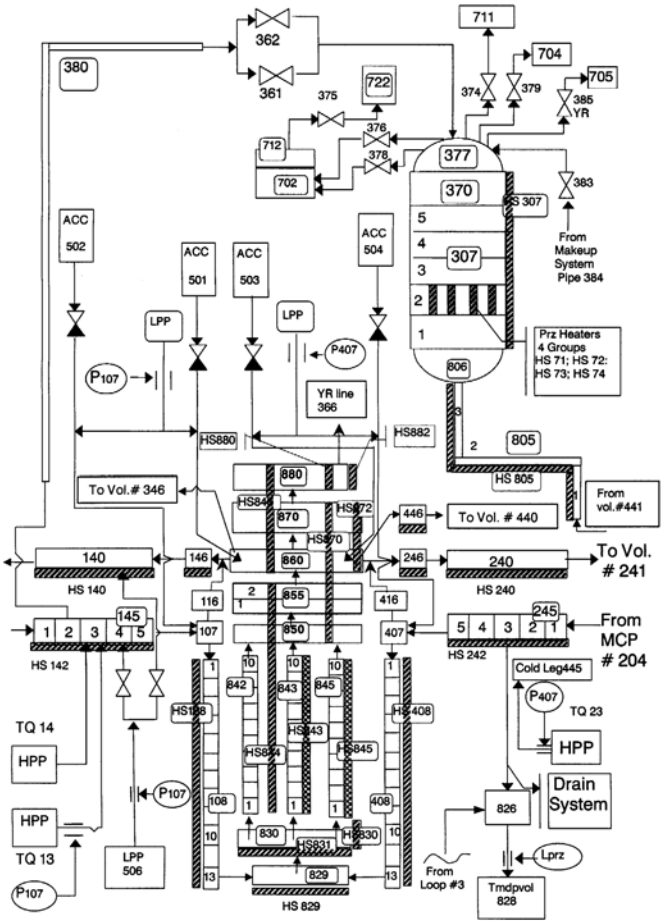
Nuclear Power Plant Safety Analysis

- **Principal areas:** Operational safety; Operation-related issues; Safety Research
- **Computer Program tools:** RELAP5/MOD3.2, MELCOR 1.8.4., ASTEC

The Laboratory is currently involving in the Euratom Framework Programmes in joint projects with JRC institutes (FR5 and FR6): SARNET, IMPAM and LACOMERA.

Kozloduy VVER-1000 Reactor and Pressurizer RELAP5 Model



General objective:

The general objective of the Laboratory's work is in the area of Nuclear Power Plant (NPP) safety. The activities are as followed:

- **Analytical Code Validation** - In the field of analytical code validation the use of plant and test facility (PSB VVER 1000) data in the code assessment process is a valuable additional to the validation process. The overall objectives are to assess computer codes used in the safety analysis of VVER power plants. A Quality Assurance (QA) program is developed, database for thermal hydraulic modelling of KNPP reactors (VVER44 and 1000) are created, thermal hydraulic models of VVER 440, VVER 1000 and PSB VVER 1000 with RELAP5/MOD3.2 are developed and validated based on a transients and abnormal events, provided from KNPP.

- **Analytical validation of Emergency Operating Procedures** (EOP) for Kozloduy Nuclear Power Plant - safety analysing and resolving a generic issues identified during the initial analytical validation of Emergency Operating Procedures (EOP) for Kozloduy Nuclear Power Plant Units 5 & 6. Such kinds of analyses are important for SARs (Safety Analysis Reports) and there is additional need for further investigation due to modernization of safety system of VVER 1000 reactors. Recently KNPP did a lot of changes in equipment, which needs an additional safety analyses.

- **Severe Accident Analysis** - Developing a database for modelling of KNPP VVER 1000, developing a thermal hydraulic model for VVER 1000 with MELCOR 1.8.4. and performing MELCOR analyses, for supporting VAB, level 2 for KNPP 1000.

Contact

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NET - Neutron Techniques Standardization for Structural Integrity

The Institute for Nuclear Research and Nuclear Energy is a partner in the European Network on Neutron Techniques Standardization for Structural Integrity (NET), which is operated by JRC – IE in Petten. The main objective of the NET European Network is performance and safety enhancement of European Nuclear Power production by supporting the structural integrity and the safe operation of ageing reactors. The Network aims at the development and standardization of novel experimental (e.g., neutron diffraction, Small Angle Neutron Scattering) techniques and advanced numerical modelling methods for the investigation of residual stress and defects in welded structural components. NET supports CEN & ISO standardization activities, interacts with other nuclear Networks under the JRC-IE institutional project SAFELIFE, and supports NET related competitive activities concerning investigations of materials ageing, structural integrity and NDE for welded RPV internals and primary piping joints.

The INRNE participation in NET will be realized partly by joint research performed at the HFR-Petten by Dr. D. Neov, postdoctoral fellow on leave from INRNE.

It is also envisaged that other scientists of INRNE will perform research work relevant to the NET activities at JINR, Dubna and BNC, Budapest.

The scope of the research work of Dr. Neov comprises:

Neutron diffraction

- Research on micro-structural characterisation, residual stress analysis, defects and precipitation analyses, grain size and texture investigations based on neutron diffraction;
- Evaluation of the effects of thermal and irradiation exposure to the evolution of microstructure, defects and internal stresses.

Small Angle Neutron Scattering

- Renovation of the SANS facility operating at the 45 MW High-Flux Reactor of the European Commission in Petten and its application for characterization of thermal ageing effects (micro-structure analyses) on cast duplex stainless steels.

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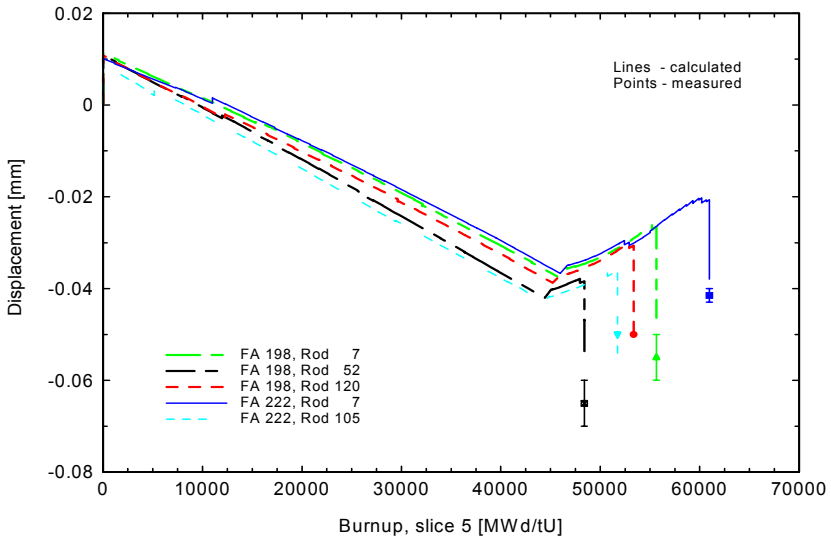
Nuclear Fuel Modelling

According to the working program of the PECO Project, INRNE – Sofia, Bulgaria, had to perform verification of the latest TRANSURANUS-VVER versions on the basis of the IFPE-OECD/NEA-IAEA database. The work was planned in a working program, consisting of 3 tasks. Since the contract was extended up to June 2002, three additional tasks were included into the working program.
The results, obtained from the analyses of some fuel experiments are presented. The most important of them follow below.
In the frames of the Sofit-1.1 database, calculations have been performed on the burn-up, fuel central temperature (FCT), fission gas release (FGR) and geometrical change. Within the Kola-3 data base, calculations have been done of the burn-up, FCT, geometrical changes, inner gas pressure and FGR. Typical examples are shown in the figures below.



Diameter change, comparison experiment – TU calculation

Conclusions to TRANSURANUS-VVER calculations

- the burn up calculations are in excellent agreement;
- the fission gas release calculations are in very good agreement;
- the size changes of the cladding are reproduced satisfactorily;
- the gas pressure is reproduced very well.

Such calculations have been performed for the experiment CONTACT, HBEP, OSIRIS and TRIBULATION, containing experimental results on the temperature (CONTACT) and FGR – HBEP, OSIRIS and TRIBULATION

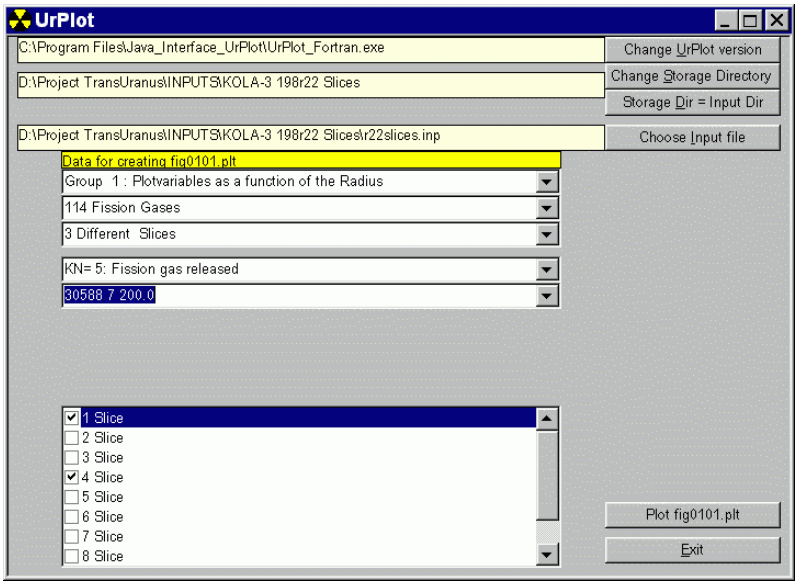
A program package has been developed - a graphic user's interface which works by using a TRANSURANUS input file

TRANSURANUS Verification Data Base (TUVDB) was developed in order to keep in archived form the whole history of the verification procedure of a given TRANSURANUS version.

The main results are:

- the TRANSURANUS-VVER latest versions were verified against the IFPE-OECD/NEA-IAEA Data base;
- the existing creep correlations were studied against experimental data;
- creation of TRANSURANUS Verification Data Base (TUVDB) for data storage of a given verification procedure

- a program facilitating a user in working by the TRANSURANUS post-processor URPLOT, was written
- detailed analysis of the documentation of 6 IFPE-OECD/NEA-IAEA Data base was done, some errors and omissions in the data base were corrected;
- analyses of selected experiments on the behavior of Western type of nuclear fuel – CONTACT, OSIRIS, HBEP and TRIBULATION – have been done.
- more than 80 cases altogether were analysed within the contract.



Besides the scientific achievements, the project is important from point of view of implementing sophisticated scientific tools into the practical nuclear industry. For commercial VVER's, operated in the East European countries, the TRANSURANUS-VVER code is a powerful tool for assessing fuel performance.

View of the screen, all items selected

On this basis, projects like the reported here, are important for further development of the studies in this area, especially in the field of:

- Fuel behavior modelling as a part of reactor material research;
- Fuel performance modelling as a component of fuel design;
- Fuel modelling as a component of commercial fuel licensing;
- Fuel modelling for NPP's operational needs and decision making;
- Training of research and operational NPP staff for fuel licensing by using TRANSURANUS code.

Future of the collaboration

As a result, new contract 370011–2004–02 F1FD KAR BG was signed on the 18–th March 2004, for a period of 24 months. The contracting sides are the European Atomic Energy Community, on one side and the five Bulgarian organizations: the Nuclear Regulatory Agency, the Institute for Nuclear Research and Nuclear Energy of the Bulgarian Academy of Sciences, the Nuclear Power Plant "Kozloduy", Physics Department of the Sofia University and the Technical University in Sofia, on the other. The contract sum is 78000 Euro, all of which are meant for Bulgaria. The contract has similar tasks as the previous 4 contracts, dealing with the latest versions of the TRANSURANUS–VVER code.

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Safety Analysis for Spent Fuel Facilities

Calculatonal analyses of the spent fuel storage facilities are needed for substantiation of their nuclear safety. Continuous improvement of models and calculational methods has been carried out in INRNE.

The main analysis tools used are the SCALE system developed by the Computational Physics and Engineering Division at Oak Ridge National Laboratory in the US and the MCNP code developed at Los Alamos National Laboratory in the US. The SCALE system is intended for performing standardized computer analyses for licensing evaluation of nuclear systems and includes a number of selected data libraries, as well as various calculational modules (code's sequences interfaced with data libraries) for performing depletion, criticality, shielding, and heat transfer analyses. The MCNP code is a general purpose particle transport code used worldwide basically for reference calculation.

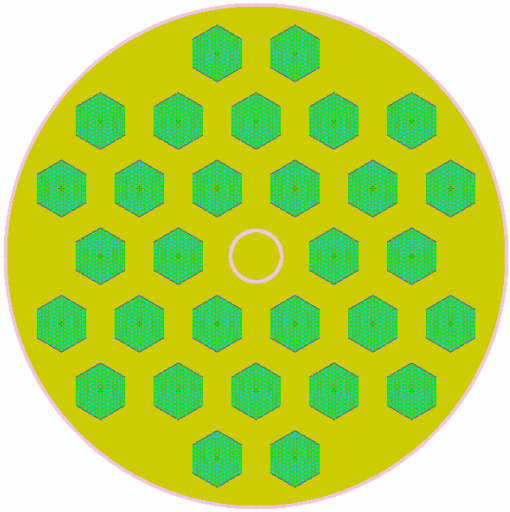
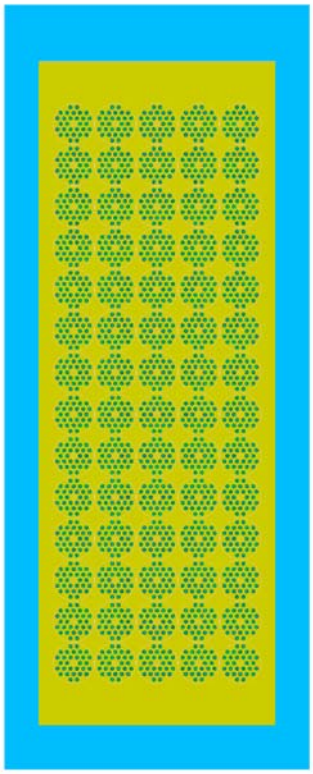


Figure 1. Radial Model of Basket T12 Containing 30 VVER-440 Spent Fuel Assemblies



The SCALE system VVER applicability is currently in progress. The main differences are related to the fuel content, as well as to spent fuel casks, and storage facilities design.

The main SCALE system tools are the Safety Analysis Sequences (SAS) for shielding analyses and the Criticality Safety Analysis Sequences (CSAS) for criticality analyses.

The subcriticality in all operating conditions in conformity with the design criteria has been assessed for KNPP facilities. The characteristics of the spent fuel transport/storage casks and storage facilities have been evaluated.

The further VVER SCALE applicability aspects discussion is planed to be performed in the frames of WP3 "Operational safety" of the project COVERS (NUCTECH-2004-3.4.3.1-2VVER Safety Research) that has been proposed to FP6 Euratom In collaboration with IE, Petten.

Figure 2. Radial Model of a Storage Pool Containing 70 Baskets T12 with VVER-440 Spent Fuel Assemblies

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Nuclear Medicine

BNCT Application of IRT-200 Research Reactor

Boron Neutron Capture Therapy (BNCT) is a form of radiotherapy that has the potential to selectively kill the cancer cells embedded within normal tissue. It uses boron-10 isotope, which emits two short-lived high-energy alpha particles when irradiated a beam of thermal energy neutrons. The tumour treatment goes through two stages:

- A tumour-seeking chemical compound, which contains a predefined concentration of boron atoms, is loaded intravenously in the patient
- The tumour area is then irradiated with thermal neutrons from nuclear reactor

Due to very short mean free path of the alpha particles, of about cell dimensions, the treatment is lethal to cancerous cell containing the boron atoms, but has a much less damaging effect on the surrounding normal tissue.

The current worldwide practice in BNCT is to irradiate the patients with neutron beam from reactors.

According to the decision of the Bulgarian government from 2001 year the research reactor IRT-2000 will be reconstructed into a reactor of low power 200 kW. The utilization of the reconstructed reactor aims to satisfy the society needs for development and sustainment of nuclear science, the skills and knowledge for elaboration of applied methods and studies.

The reconstruction project foresees development of BNCT.

For the performance of neutron based therapy it is required a very large infrastructure:

- A reactor facility with well-filtered and collimated neutron beam.
- Medical facilities (e.g. patient preparation, patients' irradiation room and patients' monitoring room, blood laboratory) at the reactor building. These facilities should provide a hospital atmosphere for the comfort of the patients.
- Collaboration with of physicians and a medical staff associated with a near-by hospital

The reconstructed water-moderated water-cooled pool type research reactor IRT-200 will be capable to meet all of the above requirements.

The BNCT channel

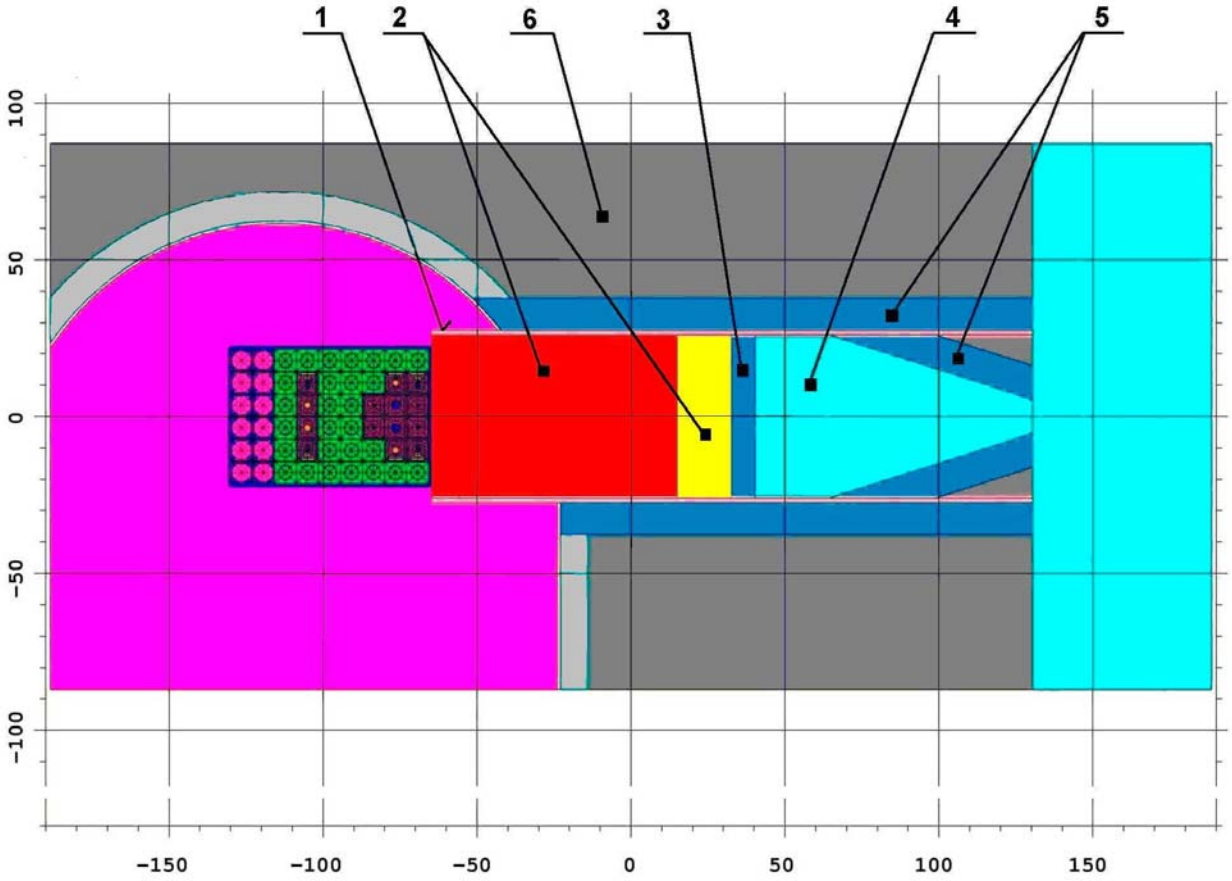
According to the technical design the channel for BNCT (Figure 2) will be made of stainless steel plate, 15 mm thick, with a rectangular profile of size 700x550 mm welded onto the pool bottom section wall. The channel face will be made of stainless steel sheet of 2 mm thickness and from the poolside face will be reinforced by screwed-on aluminum plate of 9 cm thickness, which at the same time will form the first part of the neutron filter. The whole channel will be coated by lead of thickness 10 cm.

Calculations of different variants of BNCT filter have been made for selection of the most suitable variant for the IRT-200 reactor. The calculations are carried out by the MCNP 4C code in the critical calculation mode (Kcode) using the set of DLC-200 libraries. Filter with 80 cm aluminum (including 9 cm aluminum plate of channel) + 17 cm CF_2 + 0.04 cm Cd followed by 8 cm of lead has been recommended.

The collimator will be made of 10 cm lead, with inner diameter - 70 cm, length - 90 cm and its ascent is 17˚.

For the selected filter and collimator and for reactor power 200 kW the epithermal neutron flux is estimated to be equal to ~ $0.9 \cdot 10^{9}$ n/cm^{2}s.

The dose of fast neutrons in tissue per one epithermal neutron is estimated as $1.95 \cdot 10^{-11}$ cGy.cm^2.n^{-1}. The dose of gamma ray per one epithermal neutron is estimated as $1.98 \cdot 10^{-11}$ cGy.cm^2.n^{-1}.



The BNCT Channel
1. Vessel of Channel; 2. Filter (80 cm Al + 17 cm CF_2 + 0.04 cm Cd); 3. Lead Shielding; 4. Collimator; 5. Lead Shielding of Channel; 6. Concrete.

Open problems

For developing BNCT on IRT-200 Research Reactor is needed gaining experience in:

- The assessment of the irradiation conditions
- Modelling of the neutron reaction distribution in the living tissue
- Dosimetry technique skills

which could be obtained in collaboration with the Institute for Energy, JRC – European Commission, Petten, Netherlands, having large experience in the development of a special system for BNCT.

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Combating Illicit Trafficking of Nuclear Materials

The suitable geographical situation on the crossroad between Europe, the former Soviet Union and the Middle East puts Bulgaria into the stream of many illegal traffics – people, arms, drugs etc.
The illicit traffic of nuclear and radioactive materials is a serious violation nonproliferation laws as well as a risk for the health of the population. Criminal diversion of fissile materials could lead to the potential construction of nuclear weapon or applied with conventional explosives the radioactive material could pose a threat to dwelling places, water supplies etc. The traffic of nuclear and radioactive materials in Bulgaria can be divided in two main parts – internal and transit.

I. Internal traffic
The internal traffic consisted of stolen radioactive sources mainly imported with the Soviet equipment from companies or plants that were privatized or stopped functioning due to the economic changes in the country. There were attempts to divert and transport materials from the Uranium mining industry including different amounts of "yellow cake", depleted Uranium containers or shielding.
These devices consisted of level and dense meters, irradiation devices, removing static electricity, smoke detectors etc. mainly containing the isotopes ^{137}Cs, ^{60}Co, ^{192}Ir, ^{226}Ra, ^{241}Am etc.

II. External traffic
The external traffic of illicit nuclear materials is connected with the transfer of raw materials and expensive metals from the former Soviet Union towards Western Europe and the Middle East. This traffic included
Al, Os, Cs, Sc, Rare earth elements, Red Mercury, Pu, Enriched U.
The traffic of the last three items is of greatest concern and should be addressed with highest priority.

Creation of specialized Laboratory for Non-destructive Analysis of Illicit Nuclear and Radioactive Materials

The Institute for Nuclear Research and Nuclear Energy and its experts are performing, together with the other institutions, the following tasks:

a. improve the quality of analysis of nuclear material particularly in the field of:
   - Non Destructive Analysis (NDA) measurement of the nuclide concentration of Uranium and Plutonium;
   - NDA determination of the matrix;
   - Analysis of matrix impurities
b. participate in intercomparison of NDA measurements and equipment of well defined samples, e.g. standards); with experienced laboratories from European Countries
c. extend the international data base by all the related data and results of measurements made accessible by the Institute
d. -establish a Specialized laboratory procedures in the measurements of seized nuclear material and in the definition of its origin and intended use.
e - organize effective system for detection, identification, analysis and exchange of information to prevent of illicit trafficking
f - Ensure fast and reliable determination of the total weight of uranium and plutonium samples.
g -improve R&D and apply national, regional and international safeguards systems
f - Improve national system of safeguard system by helping in introducing proper border control at check points and customs
j - help in strengthening efforts in safeguards of nuclear storage facilities
k -Organize seminars, workshops on topic related to illicit trafficking of nuclear materials, methods of analysis, application of modern equipment, Quality Assurance analysis etc.

Partners involved:

1. Institute for Transuranium Elements, Karlsruhe, Germany
2. National Security Service of Bulgaria
3. Ministry of Inferior Affairs of Bulgaria
4. Chief Department of Customs of Bulgaria

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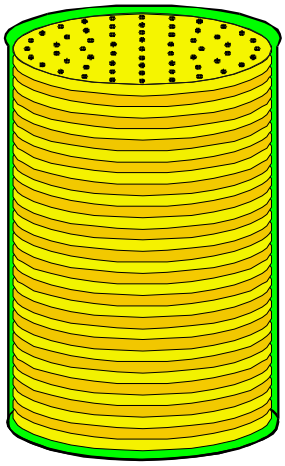
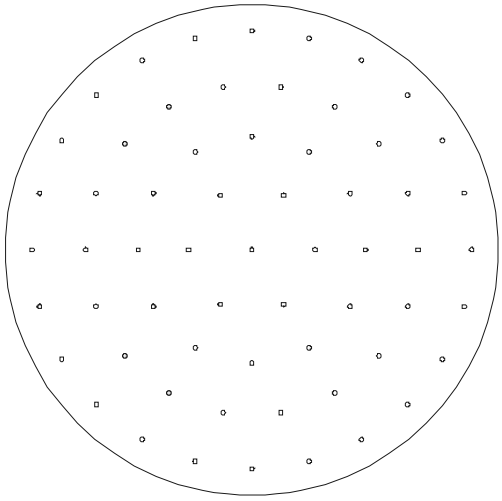
Environmental and manmade radioactivity

The role of Laboratory for Radioanalytical Methods is to measure radioactive samples - environmental and man-made. Analysis is performed on soil, plants, water, sediments from the environment, as well as samples from uranium mining and milling industries, emergency samples and samples from NPP. This includes sampling, radiochemistry and analysis.
Laboratory is responsible for setting up of analytical methods for detection of radioactive emissions in case of verification and/or radiological alarm. Also standard methodologies for environmental monitoring are being developed with the aid of advanced analytical systems such as low-level background radiometric instruments and clean-room laboratory. Laboratory developed methodology for preparation of secondary efficiency calibration standards with different geometries and density. An unique product of our Lab is a 200 l barrel – efficiency calibration standard for Waste Department of NPP "Kozloduy".

Under a contract with IAEA a reference material for determination by alpha spectrometry of naturally occurring uranium series has been prepared and characterized. Standard and special radiochemical procedures for separation of radionuclides, including so called "difficult" ones, alpha, beta and gamma emitters are used in the Laboratory.





V = 207 dm ^{3}
P = 0,449 kg/dm^3
A = 29488 kBq

All the ISO 9001:2000 requirements are applied in the Lab, which is, along with the institute, certified for ISO 9001:2000 by an international certification body ŐQS.

Under the "INRNE – JRC Integration" agreement Checking of sampling procedures, analytical methods, quality control programmes, data quality or data management are
Undertaken. The Lab personnel is being trained in more sophisticated methods of analysis.

Collaboration with scientists from Member States and accession countries is contributing to the EU-wide harmonisation of analytical procedures and the development of a common quality assurance/quality control programme. Participation of the Lab in such cooperation is ensuring a compliance with basic safety standards of EU

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BEO Centre of Excellence

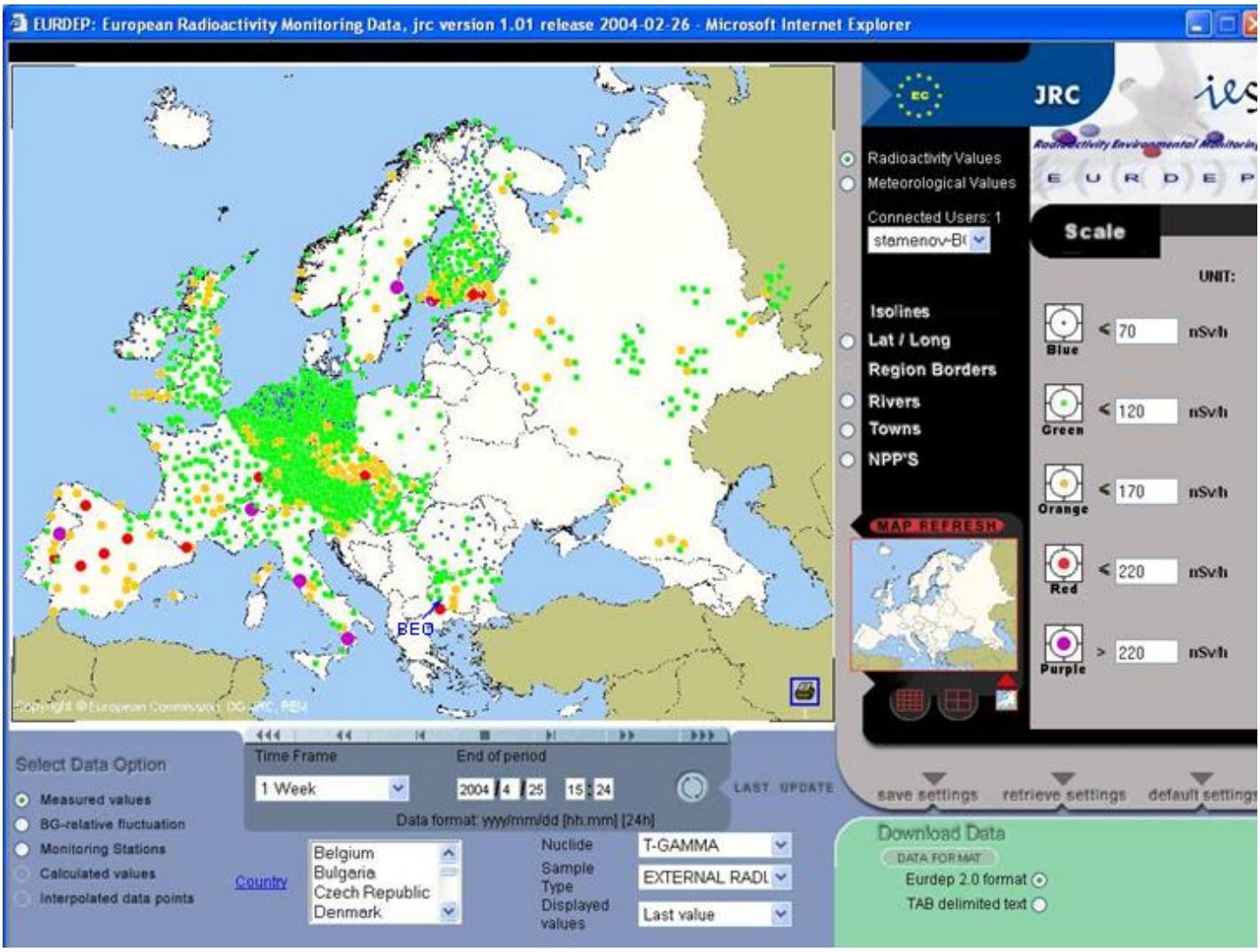
BEO Moussala

HIMONTONET FP5 project

Global Change and Climate Research, Natural Hazards and Technogenic Risks, Aerospace and Terrestrial Environment

EURDEP:
European Radioactivity Monitoring Data

JRC, IES, Ispra



EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

Monitoring of the Radioactivity and Heavy Metals in Aerosols

The object of the study in this article is the influence of the human activity on air and on the environment in Rila national park (on the pick Moussala, BEO) in and some typical industrial area in Bulgaria. There are several reasons for this choice. The pick is the highest in Balkan Peninsula and place with strong exchange air mass and humidity. It is located relatively faraway from the cities and industrial zones. It is very suitable for broad spectrum of investigations, including problems of atmosphere a, cosmic rays and environmental. From other side, Shumen, a middle size settlement about 130 000 habitants, is in Northeast Bulgaria, at low level, under the influence of human activity of the population living and working there.
The comparison of the presence of heavy metals and radio nuclides in both of the places, including their trends in time, is very important for conclusions of the quality of the air and life. It is interesting to compare the contents in the most clear area, without human activity, with some other, which is for a long time exposed on the industrial influence.
Except the pick Moussala some other places were included for comparison.

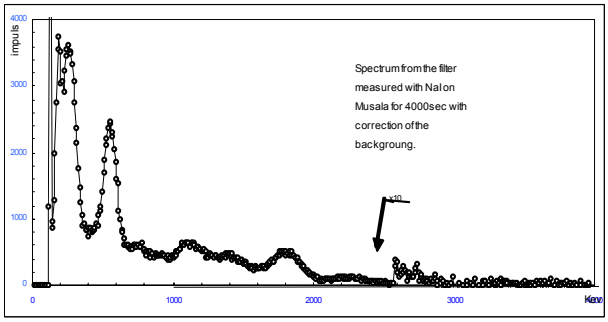
EXPERIMENTAL EQUIPEMENTS AND METHODS OF MEASUREMENTS
For collecting of the aerosols are using 3 different devices, mounted on different places. The first one is done on BEO Moussala, with air capacity on ~ 80m^3/h. The filter holder is shown on Fig.1
Other two devices are realized, to. One is portable for using in emergency situation, now it is located in the area of the Shumen University, it is shown on fig.... This one is with high capacity, till 1500m^3/h, but it is possible to work on several times lower capacity, to. It is done with higher possibility in the case of emergency to take a sample more fast. In normal situation it is enough 1500-2000m^3 per day, like for example in the similar works in Finland, US, UK and others for scanning of the natural and industrial radioactivity.
The next one is new, for ~ 800m^3/h. It can be used in lower volume, too. But when the weather is not convenient for sampling it is possible for a short time to do this. There is new measuring device for the air flow, which is connected to the PC, and the volume of the air passed through the filter at every moment is known.
The filter used it is organic, ФПП-15 with high coefficient, more then 95%, of seizing for aerosols bigger then 0.1-02μkm . After sampling the filter is pressed to the size convenient for gamma-rays measurements.
In the laboratory of BEO-Moussala there is a scintillation gamma-spectrometer for fast analysis of the radioactivity of the air aerosols. The detector is NaI with volume ~2l (ф150 x 110mm). Absolute efficiency of the detector was determined like 27 ± 4% from 4π in the geometry on the centrum of the flat side of the detector. It is almost constant in energy interval 200-2000keV. The spectra are measured on PC with ADC and suitable software. A typical spectrum is shown on Fig.4

Fig.1 The holder of the filter device sampling on Moussala.

Fig. 2 Portable aerosol sampling device on the street in Shumen University

Fig.3 The new device for aerosols sampling in BEO

For more precision gamma-rays measurements are used two Ge-detectors, one H.P., in INRNE and other, Ge-Li, in Shumen University. In all measured spectra is identified only natural radioactivity.

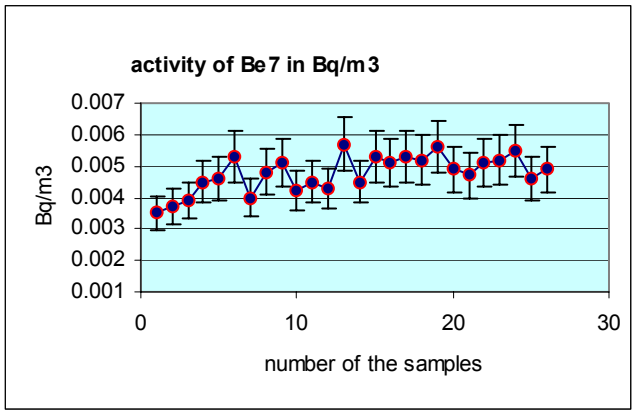


Additional samples for analysis are taken from the places around Shumen, like Varbitza, Palamara, and others, some of them without industrial activity. The concentration of the natural radioactivity depends on the weather at the moment, wind, temperature and pressure. These samples are more important from the point of view of the presence of heavy elements, which is subject of study in the future.

Fig. 4 Spectrum measured on gamma spectrometer on peak Moussala

One of the most abundant cosmogenic radio nuclides is ^{7}Be. About 75% of ^{7}Be is produced in the stratosphere and 25 % in upper troposphere /1/. From our measurements the activity of Be^{7} vary in the interval 2 - 5mBq/m^3, which is in good agreement with literature. For example some date from pick Moussala are shown on the Fig.5, date for January-February 2004, in mBq/m^3.

Fig.5 Activity of Be^{7} on Moussala, 01-02, 2004



For analysis of the metals in the aerosols other methods is used. The filter after gamma-measuring is processed by chemical procedure and al inorganic substance is extracted for X-ray analysis. For some filters X-ray spectra are measured, one of them is shown on Fig.6., but only in relative units. We can say that many elements are presented. For better calibration of these measurements and comparison with other method it is planned quantitative element analysis of the inorganic matter from the filters using Proton Induced X-ray Emission (PIXE) analysis at the 2MeV AN2000 accelerator of the National Laboratories of Legnaro, INFN. These measurements will be done in May, 2004.

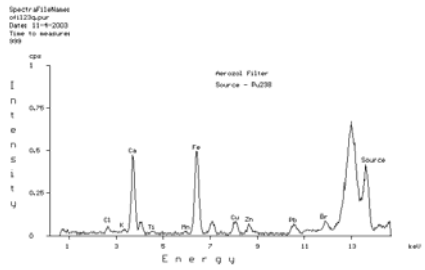


Fig.6 X-ray spectrum with different elements in the filter in relative units.

CONCLUSION

Collecting of the aerosols from air volume in the frame of 1000 to 30000m^3 is demonstrated in different places in Bulgaria. Analysis of these samples and comparison of the date from different places is under process. Measurements of the activity of natural and industrial radionuclides can be done with existing techniques and experience in INRNE and University of Shumen. Determination of the quantity of the heavy elements in aerosols runs into the problem of the calibration in absolute units.

Some cooperation in this area is urgent, including measurements in laboratories of JRC (IES, Ispra). All these results are more significant only in the case of long term of the measurements. Other one problem in this case is supplying with filter for sampling which is at the moment limited.

Receiving of new H.P.G detectors will improve the date for radio nuclides and reduce the time for analysis.

The complex date from aerosols will give a rich information for the changing of one of most important component of the environment – the air, which is absolutely necessary for every one every where.

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Environmental Radiation Monitoring

Historical background, Development, Dynamics

The environmental radiation monitoring in INRNE started as a part of the radiation control around the nuclear research reactor IRT-2000 6 months before the reactor was commissioned in September 1961. Since 1982 a gamma-background monitoring by means of TLDs from $CaSO_4$:Dy, developed in the Institute, was introduced in the monitoring programme.

Now the environmental monitoring covers the areas of INRNE (including the area of IRT-2000), the area of the National Radioactive Waste Final Repository Site in Novi Khan and 2 referent sites (mountain Vitosha and BEO Moussala). More than 40 years this monitoring is carried out at the same sites with the use of same or compatible techniques, leading to the accumulation of a significant data base, including the period of atmospheric nuclear tests and the Chernobyl accident.

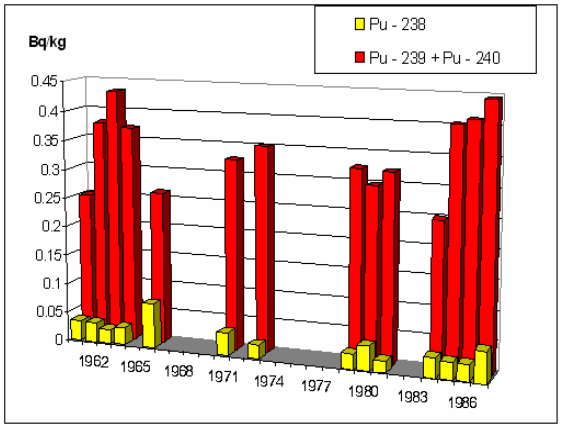
The Control Laboratory for Radiation Protection (CLRP) is directly responsible for the environmental monitoring, but by far this is not the only unit of INRNE involved in this research field. During the last years the networking became a way of thinking at our Institute which raised the efficiency of the research by enabling us to concentrate the resources, on the one hand, and to utilize fully the results, on the other. CLRP is involved in the interactions and collaborations in the framework of the BEO Moussala and BEO Centre of Excellence. This permits on specific occasions to mobilize in the field of radiation monitoring considerable human resource, comprising between fifty and sixty specialists and technical staff.

The last 3 years the work performed by CLRP rose in volume and responsibility in connection with the forthcoming reconstruction of the nuclear research reactor, the comprehensive and reliable radiation monitoring being an important requirement for licensing of any nuclear installation. Dating from the spring of 2004 CLRP is a part of the Institute's System for Management of the Quality and Environment, certified according to ISO 9001:2000 and ISO 14001:1996 Standards.

Regarding the responsibilities, mentioned above, an very important stage of the laboratory development started with our integration with the EC JRC activities, joining in 2003 the ITU project "Harmonization of techniques and methodologies for sampling and measuring radioactivity in the environment, 2003-2005.

Themes and specific research agenda

1. Analysis of samples from soil, water, plants, fallout, aerosols, small mammals and fishes etc. - total beta-activity, gamma-spectrometry, determination of ^{90}Sr content, determination of Pu content in soil and plants using radiochemical technique, electrochemical deposition and alpha-spectrometry;
2. Gamma-background monitoring by means of thermoluminescent dosimeters (TLD);
3. Development of the technique for measurement of radon in soil gas using TLDs and SSNTDs. (Collaboration with the Nuclear Physics Institute (NPI) in Prague);
4. Monitoring of the cosmic neutrons at BEO Moussala.(Collaboration with NPI in Prague);



Plutonium concentration in soil samples from the INRNE

The JRC Project "Harmonization of techniques and methodologies for sampling and measuring radioactivity in the environment"
Participants: ITU, Karlsruhe and laboratories from Hungary, Romania, Bulgaria, Slovenia, Poland, Turkey Slovakia;

Objectives:

- Organization of inter-laboratories exercises
- Harmonization of procedures as for different ecosystems and matrices
- Training on analytical procedures and techniques
- Development of protocols for harmonized procedures for the measurement of radioactivity in different ecosystems
- Creation of a network of Nuclear Environmental Safeguards in Candidate Countries and initiation of an "enlarged" European Research Area for Measurement of Radioactivity in the Environment
- Development of a data base of validated analytical procedures accessible to all Candidate Countries.

During 2003 two meetings of experts were carried out in ITU. The problems discussed were connected mainly with harmonization of the sampling procedures. The third meeting is planed for may 2004.

We expect in the frame of the project to validate our procedures for analyzing alpha-emitters and Sr and to get able to perform more sophisticated and "deep" environmental analysis of some areas of particular interest.

A good example is the complex investigation of the pollution in the catching area of "Beli Iskar" dam in collaboration with the Institute of Geography – BAS, IRE – Belgium and NPI, Prague.

The Beli Iskar dam lake – one of the lakes, supplying Sofia with drinking water, is situated at 1900 m altitude in Rila mountain. The dam was built in the first quarter of the former century. In the summer of 2002 the lake was drained for repair of the barrage. This presented an unique opportunity for a direct access, immediately measurement and sampling of the bottom depositions. Two sampling expeditions were carried out in 2002 and about 150 sediment, water and plant samples were taken. In situ measurements of the radiation background and the chemical characteristics of the affluent water were performed. The laboratory analysis started in 2003 with the total beta determination of all samples. Limited number of sediment samples was analyzed concerning the content of radionuclides (including Pu), heavy metals and toxic elements. The techniques developed and validated in the frame of the JRC mentioned Project will permit more comprehensive analysis – more radionuclides - actinides, Sr etc. as well as the activity depth distribution.

Sampling of sediments from the bottom of the "Beli Iskar" dam

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Hot Projects, New Ideas

JRC – INRNE Joint Scientific Programme

In the frame of NUSES at the middle of 2003 was established an **INRNE NUSES Programme**.

The main reasons of this are:
- The **good estimation** of INRNE – JRC Conference – Informational Days and NUSES project from JRC and **proposal of Dr. Roland Schenkel for monitoring of project progress after 12 month**
- **Wide response and good exception of NUSES project events and activities** from scientific community and grand public
- Inclusion in the INRNE Programme for management and development for 2003-2007 years **the enhancement of the integration with European research centers, especially with JRC** as a basic task.

Now we propose the formation **of the JRC – INRNE NUSES Joint Scientific Programme.**

The main goal of the NUSES Programme is the integration between INRNE and JRC and with other leading European and international research centres and institutions and has the following basic objectives:

- To develop and enhance results, **to implement and exchange the good practice of NUSES INRNE – JRC joint project** and other joint projects and activities, toward the reaching of **synergetic, multiplication and long – term effec**t;
- **Regional and Global aspects,** diversification and deepening the joint activity of JRC and INRNE with neighboring countries.
- **Sustainability and Durability of the programme**

The management and organizational structure of NUSES Programme **has to be discussed.** It is proposed to create **Joint Scientific Council,** with members - heads of all JRC and INRNE collaborating laboratories, co- headed by the directors of JRC and INRNE.

It will be an ***e*-Programme**, where discussion, statements and opinions exchange will be realized in a sophisticated informational and Internet environment, towards to reach better direct information and coordination.

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Development of radio pharmaceuticals for nuclear medicine diagnostics with ^{99m}Tc

Objectives:

The purposes of the proposed project are investigations in area of chemistry of Tc (V) complexes with respect to development new for Bulgaria radiopharmaceuticals. The introduction of myocardial perfusion agents, tumor specific agents, renal function agents and receptor imaging agents into production parallel with lower price of Bulgarian SPET tracers will expand diagnostic possibilities in the country.

In the research stage it is important application of sensitive analytical methods for separation of various chelate fractions. Three of the developed kits are tested clinically but due to the lack of funds are still not registered. Their licensing is other problem we have to solve.

INRNE works in close connection with five renowned Bulgarian medical institutions. Scientific visits, doctoral and post doctoral specializations in collaboration with leading world research centres, would prove valuable to our current team efforts.

INRNE is a member of the TESLA Scientific Centre (a regional research centre for fundamental and applied research) along with the prominent institutions form Yugoslavia, Romania, Greece and Italy. Our further research for developing of contemporary SPET tracers will substantially increase the number of patients and diseases studied, thus rendering positive social effect.

Description of activities:

On the first place our work will be aimed to the already known SPET tracers that still do not find wide application in Bulgaria for the high prices of import analogues.

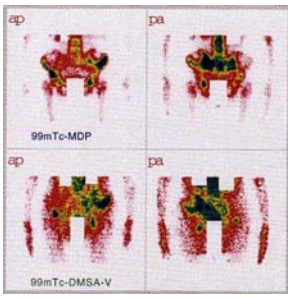
We will define conditions for reduction of $^{99m}TcNaO^{-}_{4}$ to stage of oxidation (V) and design of ^{99m}Tc(V)-dimercapto succinic acid (DMSA) radio pharmaceutical proper for medical diagnostic of thyroid medullary carcinoma. Since ^{99m}Tc(V)-DMSA molecule is not commercially available, we intend to introduce “instant” kit easy for hospital use. We are planning also optimization of chromatographic analytical techniques for proper assessment of ^{99m}Tc(V)-DMSA, ^{99m}Tc(III)-DMSA, $^{99m}TcO_2$ and $^{99m}TcNaO^{-}_{4}$.

Development of renal function agents will start with syntheses of L, L-ethylenedicysteine (EC) and determination term for optimal labeling yield. Analyses of labeled EC will be perfected using thin layer chromatography (TLC) with different elution phases. Application of High Performance Liquid Chromatography (HPLC) will allow highly precise separation of ^{99m}Tc-L, L-EC fraction.

Technology and installation for radiochemical separation from proton irradiated target of myocardial perfusion agent production ^{201}Tl will be designed. Two methods, sorption and extraction, will be investigated. The equipment will ensure radiochemical yield, purity and sterility of ^{201}TlCl.

On the second place, our efforts will be directed to the ^{99m}Tc labeling of development of bioactive molecules for brain imaging – HMPAO kit. Investigation will concern coordination chemistry of polar Tc(V) complexes and methods for ligand separation.

All developed radio pharmaceuticals will pass biodistribution and clinical survey according to the Bulgarian legislation.



Partners involved:

1. National Oncological Centre, Sofia, Bulgaria
2. Military Medical Academy, Sofia, Bulgaria
3. Medical Academy, Sofia, Bulgaria
4. Vinca Institute for Nuclear Research, Belgrade, Yugoslavia

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The Thracian tumuli as analogue of the radioactive wastes repository protective embankment

The safety assessment of the radioactive wastes (RAW) repository is made using very conservative assumptions. It is accesepted in the international practice that the water infiltrations through the protective soil embankment could reach to 20% of total rainfall. The atmospheric agents after some centuries could destroy the embankment, the RAW containers and the radionuclides will migrate to the environment.

In the same time some natural and archaeological analogues permit to think that these assumptions are very conservative. In this respect the Thracian tumuli in Bulgaria (which number reaches about 60,000) could give very useful information.

The height (up to 12m) and the form of the tumuli are saved 2500 years after the construction. The bas – reliefs and mural paintings In the funereal chambers of the tumuli are excellently conserved.

The main idea of proposed project is by analyzing existing archaeological, geo archaeological and paleo seismological information and making multidisciplinary investigations to achieve new data for the real water infiltration through the tumuli embankment, for the eventual leaching of the soluble substances into embankment, for the slopes stability, for the temperature – water regimen in the funereal chambers, for paleo seismological impact and etc.

The project results will serve as strong evidence and proof that:

1) the accepted conservative assumptions about water infiltration and embankment stability are not correct
2) the protective embankment will not be destroyed during repository life time
3) the water infiltration into the RAW repository containment is negligible
4) the probability of leaching and migration of radionuclides in environment is very low
5) the Thracian embankment practice could be useful for argumentation of modern embankment parameters

Multidisciplinary team includes scientists from Geological Institute, Archeological Institute and Institute for Nuclear Research and Nuclear Energy of Bulgarian Academy of Sciences and collaboration with scientists from JRC is seeking.

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