XIXth ŠTIAVNICA DAYS 2018

BOOK OF ABSTRACTS

Banská Štiavnica, Slovak Republic

October 2. – 4., 2018

Association for Radon Risk Regulation, Banská Štiavnica

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THEMATIC SECTION
Radioenvironmental studies and peaceful use of nuclear energy;
Radiation protection and safety operation of nuclear power plants;
Protection against the effects of radon in buildings;
Environmental engineering and lysimetric research;
Workshop: Practical applications of ecosystem monitoring.

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Welcome to XIXth Štiavnica Days 2018!

Dear guests, colleagues, friends,

That was so close and we could celebrate the jubilee 20th anniversary of the conference Štiavnica Days today. Yes, it has been 21 years since the beginning of this regular meeting, initiated by Prof. Ján Chrapan, of the experts from the practice, students and their teachers to confront their opinions on the situation in the world of radiation and its overlaps into the life of professional and general public.

I would like to thank everybody who supported this periodical professional social event in the time where the opponents of the conference Štiavnica Days had the upper hand. Thus you helped to fulfil the Berber saying: "The dogs bark, but the caravan goes on". Therefore, we are coming back into the centre of Banská Štiavnica today, stronger than before, to participate with dignity in the XIXth conference Štiavnica Days, nowaydays generally acknowledged international conference.

The team of organisers created a new, more sumptuous appearance of the conference. Despite it I believe that in its core the conference Štiavnica Days will stay professionally interesting and inspiring meeting thanks to your contributions and presentations, as it has always been. I believe that both professional and accompanying programmes of the following days will meet your expectations.

Petr Škrabálek

XIXth ŠTIAVNICA DAYS 2018

PROGRAMME OF THE CONFERENCE

Tuesday 02.10.2018

10:00 – 13:00	Arrival and registration of participants
12:30	Lunch in restaurant Matej, Akademická 4
13:00 – 14:00	Joint meeting of Programme Committee and Organizing Committee
15:00 – 16:30	Opening of the conference
16:30 – 17:00	Break
17:00 – 19:00	*PLENARY LECTURES* (Restaurant Hotel Grand Matej)
20:00	Welcome party

Wednesday 03.10.2018

8:00 – 9:00 Breakfast

9:00 – 12:00 Excursion:

1. Allsaints mine (Hodruša-Hámre) - Underground exposure, a tour of the mines - a small circuit (about 1 hour) and a sightseeing tour of the surface exposition (min. 6 people, max. 30 visitors);
2. Slovak Mining Museum Banská Štiavnica - Exposition is divided to the surface and underground parts, min. 5 people);
3. The group of Piarg water reservoirs (min. 5 people).

12:30 Lunch

14:00 – 18:00 Presentations in sections

SECTION 1 - Radioenvironmental studies and peaceful use of nuclear energy (large meeting room)

SECTION 2 - Radiation protection and safety operation of nuclear power plants (small meeting room)

19:00 Discussion Evening

Thursday 04.10.2018

8:00 – 9:00	Breakfast
9:00 – 11:00	Presentations in sections

SECTION 3 - Protection against the effects of radon in buildings (large meeting room)

SECTION 4 - Environmental engineering and lysimetric research (small meeting room)

WORKSHOP: Practical applications of ecosystem monitoring

10:15 – 11:45	Practical demonstration – Lysimeter (resp. Matušek)
10:00 – 11:45	Practical demonstration – Monitoring vehicle SE, a.s., Nuclear power plant Mochovce (resp. Škrabálek,Horváthová)
11:00 – 12:00	Joint meeting of Programme Committee
12:00 – 12:15	Announcement of the winners of the Best Student Research Competition - Award of prof. Ján Chrapan, Dr.Sc.
12:30	Lunch
14:00	Closing session
14:00 – 15:00	Joint meeting of Programme Committee and Organizing Committee

XIXth ŠTIAVNICA DAYS 2018

TUESDAY

PLENARY LECTURES

Referee: **Prof. RNDr. Ľubomír Mátel, CSc.**

Lecture room –Restaurant

17:00 – 17:15	**Z. Martináková**	Ján Albrecht Music and Art Academy Banská Štiavnica – Seven Years of Existence
17:15 – 17:30	**J. Kuruc**	Banská Štiavnica - the residence of the first technical university in the world and her current inheritors in the Slovak Republic
17:30 – 17:45	**P. Novotný**	Roles, Activities And Practical Experiences of Control Chemical Laboratories Civil Protection of The Ministry of Interior Slovak Republic in The Field of Radiation Protection of Population
17:45 – 18:00	**M. Dubníčková**	Radiation Protection in the Slovak Republic - history, present and monitoring of the radiation situation
18:00 – 18:15	***Coffee Break***	
18:15 – 18:30	**H. Procházková**	Radiation Protection at Workplaces with Natural Sources of Ionizing Radiation in the Czech Republic

WEDNESDAY

SECTION 1 - Radioenvironmental studies and peaceful use of nuclear energy

Referees: **Doc. MVDr. Katarína Beňová, PhD.;**
Prof. RNDr. Ľubomír Mátel, CSc.

Lecture room –Large meeting room

14:00 – 14:15	**G. Buccheri**	Radon indoor measurements in tufaceous buildings located in Naples and surroundings, Italy
14:15 – 14:30	***A. Hamárová**	Effect of pH on Sorption ^{85}Sr, ^{137}Cs and ^{60}Co on Chitosan, Activated Carbon and Composite Chitosan-Activated Carbon
14:30 – 14:45	***D. Tatarová**	Phycoremediation as a potential method for the decontamination of wastewater using green microalgae *Chlorella vulgaris* a nd *Scenedesmus obliquus*
14:45 – 15:00	***V. Adamcová**	Imaging and quantification of microelements transport in plants using positron emission tomography
15:00 – 15:15	***Coffee Break***	
15:15 – 15:30	**K. Weis**	Monitoring of selected environmental variables in Banská Štiavnická mining area
15:30 – 15:45	**M. Vanek**	Basic parameters of gamma spectrometry system based on CZT crystal and its use in school didactic experiments
15:45 – 16:00	***S. Zvachová**	Characterization of the biosorbent for the determination of barium
16:00 – 16:15	*** V. Silliková**	Determination of ^{137}Cs using fly ash and carbon microfibers
16:15 – 16:30	***Coffee Break***	
16:30 – 16:35	**M. Bardáčová**	POSTER: Application of radioanalytical methods for studying heavy metal transport in soybean plants
16:35 – 16:40	**S. Zvachová**	POSTER: Comparison of commercial sorbents for ^{90}Sr determination in large-volume water samples
16:40 – 16:45	**M. Štofaníková**	POSTER: Sequential radionuclides determination in bones of wild animals
16:45 – 16:50	**B. Horváthová**	POSTER: Determination of β-emitting radionuclides ^{107}Pd and ^{79}Se in radioactive waste

XIXth ŠTIAVNICA DAYS 2018

WEDNESDAY

SECTION 2 - Radiation protection and safety operation of nuclear power plants

Referees: **Prof. Ing. Leonard Hobst, CSc.;**
Prof. RNDr. Beňadik Šmajda, CSc.

Lecture room - Small meeting room

14:00 – 14:15	**T. Melicherová**	Modernization of the Slovak Hydrometeorological Institute Radiation monitoring network
14:15 – 14:30	**V. Drábová**	Emergency response and HERCA – WENRA Approach for a better cross-border coordination of protective actions
14:30 – 14:45	**A. Kolros**	Radiation protection of workplaces at Research Centre Řež
14:45 – 15:00	**L. Hobst**	Possibilities of the Construction of Concrete Shielding Structures Against the Effects of Ionizing Radiation
15:00 – 15:15	***Coffee Break***	
15:15 – 15:30	**B. Šmajda**	Radiation hormesis: fact or myth?
15:30 – 15:45	**J. Helebrant**	Citizen radiation monitoring networks in the Czech Republic - RAMESIS project
15:45 – 16:00	**B. Remenec**	Correction of the heterogeneous weld of steam generator's cold collector on Unit 4 in Nuclear Power Plant Bohunice
16:00 – 16:15	**J. Plško**	Present situation of groundwater pollution in NPP A1 Jaslovské Bohunice
16:15 – 16:30	***Coffee Break***	
16:30 – 16:45	***M. Helej**	Development of continuous radon monitoring systems, for study of atmospheric processes
16:45 – 16:50	**J. Lesný**	POSTER: Determination of potassium in environmental samples using detection of ^{40}K
16:50 – 16:55	**E. Singovszká**	POSTER: Radioactivity assessment in historical building in Kosice

THURSDAY

SECTION 3 - Protection against the effects of radon in buildings

Referee: **RNDr. Helena Cabáneková, PhD.**

Lecture room – Large meeting room

9:00 – 09:15	**P. Škrabálek**	The results of the first use of RAMARN dosimeters are encouraging
9:15 – 09:30	***A. Brisudová**	Study of the relationship between radionuclide concentrations in the soil environment
9:30 – 9:45	***T. Eckertová**	Time variability of radon activity concentration in waters of Považský Inovec
9:45 – 10:00	***Coffee Break***	
10:00 – 10:15	**R. Šináglová**	Protection against natural radionuclides in building materials, release of radioactive substances from workplaces and the possibility of their use for building materials
10:15 – 10:30	**K. Beňová**	Monitoring of radiocesium, signaficance of sampling
10:30 – 10:45	**M. Špalková**	Possibilities of decreasing azoxystrobin residues after high doses of ionizing radiation
10:45 – 11:00	**T. Kovalovský**	Configuration management at nuclear power plants
11:00 – 11:05	**M. Babková**	POSTER: Radiation Calibration Chamber and NuEM LUCAS Detection System as part of the Radon Monitoring Program Montenegro

XIXth ŠTIAVNICA DAYS 2018

THURSDAY

SECTION 4 - Environmental engineering and lysimetric research

Referees: **Ing. Miroslav Vanek, PhD.;**
Dr.rer.nat. Sascha Reth

Lecture room – Small meeting room

9:00 – 09:15	***A.Bouzidi**	A simple and effective method to eliminate PAHs of oilfield wastewater

WORKSHOP: Practical applications of ecosystem monitoring

9:15 – 09:30	**S. Reth**	Weighable Lysimeters - a perfect tool to observe phytoremediation processes in undisturbed soil columns
9:30 – 9:45	**M. Horník**	Application of sewage sludge into the soils as sources of microelements: a laboratory lysimeter study
9:45 – 10:00	**CH. Heerdt**	Evapotranspiration: model versus measurements
10:00 – 10:05	**A. Tall**	POSTER: Determination of actual evapotranspiration using water balance on lysimeters

**Participants of the Best Student Research Competition - Award of prof. Ján Chrapan, Dr.Sc.*

CONTENTS

PLENARY LECTURES 17

Radiation Protection in the Slovak Republic - history, present and monitoring of the radiation situation

M. Dubníčková 18

Banská Štiavnica - the residence of the first technical university in the world and her current inheritors in the Slovak Republic

J. Kuruc, S. Kurucová 19

Ján Albrecht Music and Art Academy Banská Štiavnica – Seven Years of Existence

Z. Martináková, E. Krák. 20

Roles, Activities And Practical Experiences of Control Chemical Laboratories Civil Protection of The Ministry of Interior Slovak Republic in The Field of Radiation Protection of Population

P. Novotný, K. Jaššová 21

Radiation Protection at Workplaces with Natural Sources of Ionizing Radiation in the Czech Republic

H. Procházková 22

SECTION I Radioenvironmental studies and peaceful use of nuclear energy 23

Imaging and quantification of microelements transport in plants using positron emission tomography

V. Adamcová, K. Kuglerová, M. Horník, J. Lesný, P. Kováč, L. Klčová, M. Gubišová..... 24

Application of radioanalytical methods for studying heavy metal transport in soybean plants

M. Bardáčová, I. Matušíková, M. Horník, J. Moravčíková, Z. Gregorová, V. Adamcová .. 25

Monitoring of radiocesium, signaficance of sampling

K. Beňová, M. Špalková. 26

Effect of pH on Sorption ^{85}Sr, ^{137}Cs and ^{60}Co on Chitosan, Activated Carbon and Composite Chitosan-Activated Carbon

A. Hamárová, O. Rosskopfová. 27

Determination of β-emitting radionuclides ^{107}Pd and ^{79}Se in radioactive waste

B. Horváthová, S. Dulanská, V. Silliková, Ľ. Mátel..... 28

Determination of ^{137}Cs using fly ash and carbon microfibers

V. Silliková, S. Dulanská, B. Horváthová, S. Zvachová 29

Possibilities of decreasing azoxystrobin residues after high doses of ionizing radiation

M. Špalková, K. Beňová. 30

Sequential radionuclides determination in bones of wild animals

M. Štofaníková, S. Dulanská, Ľ. Mátel..... 31

Phycoremediation as a potential method for the decontamination of wastewater using green microalgae Chlorella vulgaris and Scenedesmus obliquus

D. Tatarová, D. Galanda, J. Kuruc, B. Gaalová 32

Basic parameters of gamma spectrometry system based on CZT crystal and its use in school didactic experiments

M. Vanek 33

Comparison of commercial sorbents for ^{90}Sr determination in large-volume water samples

S. Zvachová, S. Dulanská, V. Silliková 34

Characterization of the biosorbent for the determination of barium

S. Zvachová, S. Dulanská. 35

SECTION II Radiation protection and safety operation of nuclear power plants 37

Radiation Calibration Chamber and NuEM LUCAS Detection System as part of the Radon Monitoring Program Montenegro

M. Babková 38

Present situation of groundwater pollution in NPP A1 Jaslovské Bohunice

J. Benko, M. Kostolanský, J. Plško, T. Kovács, I. Matušek 39

Emergency response and HERCA – WENRA Approach for a better cross-border coordination of protective actions

V. Drábová, M. Dubníčková 40

Citizen radiation monitoring networks in the Czech Republic - RAMESIS project

J. Helebrant, P. Kuča 41

Possibilities of the Construction of Concrete Shielding Structures Against the Effects of Ionizing Radiation

L. Hobst, L. Vítek. 42

Determination of potassium in environmental samples using detection of ^{40}K

M. Horník, J. Lesný, V. Adamcová, L. Káčeríková 43

Radiation protection of workplaces at Research Centre Řež

A. Kolros, J. Neužil 44

Configuration management at nuclear power plants

T. Kovalovský 45

Modernization of the Slovak Hydrometeorological Institute Radiation monitoring network

T. Melicherová 46

Correction of the heterogeneous weld of steam generator's cold collector on Unit 4 in Nuclear Power Plant Bohunice

B. Remenec, M. Moravanský 47

Protection against natural radionuclides in building materials, release of radioactive substances from workplaces and the possibility of their use for building materials

R. Šináglová 48

Radioactivity assessment in historical building in Kosice
E. Singovszká, A. Eštoková. 49
Radiation hormesis: fact or myth?
B. Šmajda. 50
SECTION III Protection against the effects of radon in buildings 51
Study of the relationship between radionuclide concentrations in the soil environment
A. Brisudová, M. Bulko, K. Holý 52
Radon indoor measurements in tufaceous buildings located in Naples and surroundings, Italy
P. Addonizio, G. Buccheri, A. Rinaldini 53
Time variability of radon activity concentration in waters of Považský Inovec
T. Eckertová, M. Müllerová, K. Holý 54
Development of continuous radon monitoring systems, for study of atmospheric processes
M. Helej, K. Holý, M. Bulko, M. Müllerová. 55
The results of the first use of RAMARN dosimeters are encouraging
P. Škrabálek 56
Monitoring of selected environmental variables in Banská Štiavnická mining area
K. Weis 57
SECTION IV Environmental engineering and lysimetric research 59
A simple and effective method to eliminate PAHs of oilfield wastewater
S. Chebbi, E. H. Balla, A. Allouache, A. A. Bouzidi, N. Aumar, L. Bouraine 60
WORKSHOP Practical applications of ecosystem monitoring 61
Evapotranspiration: model versus measurements
S. Reth, Ch. Heerdt, I. Matušek 62
Application of sewage sludge into the soils as sources of microelements: a laboratory lysimeter study
M. Horník, A. Jakubcová, V. Adamcová, A. Koprdová, K. Ondreičková, K. Hrčková, J. Gubiš 63
Weighable lysimeters – a perfect tool to observe phytoremediation processes in undisturbed soil columns
S. Reth, Ch. Heerdt, I. Matušek 64
Determination of actual evapotranspiration using water balance on lysimeters
A. Tall, B. Kandra, M. Gomboš, D. Pavelková, L. Balejčíková 65

PLENARY LECTURES

Radiation Protection in the Slovak Republic - history, present and monitoring of the radiation situation

Ing. Martina Dubníčková

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The presentation will include information on the activities of workers in the area of radiation protection and the activities of the radiation monitoring network in Slovakia. Monitoring the radiation situation in environmental samples, namely the food chain in connection with the new legislation on radiation protection in the Slovak Republic.

Keywords: Artificial radioactivity; radioactive substance; cesium; strontium; iodine; optimization; food chain; radiation protection; law.

Banská Štiavnica - the residence of the first technical university in the world and her current inheritors in the Slovak Republic

doc. RNDr. Jozef Kuruc, CSc.[1,2], RNDr. Svetlana Kurucová[3]

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The work briefly describes the history and development of mining and technologies associated with ore mining and processing of non-ferrous metals, including gold and silver in Banská Štiavnica and its surroundings. In 1737, the Chamber of Deputies issued a decree in Vienna, with an instruction of teaching at the Mining school - Bergschule - in Banská Štiavnica. The first professor of this school became an excellent mining expert Samuel Mikovíni.
On December 13, 1762, Maria Theresa Empress transformed the Mining School into the famous Imperial-Royal Mining Academy (Bergakademie Schemnitz), founded the first technological institute in the world. On July 13, 1763, the first Department of Chemistry and Metallurgy was founded in Banská Štiavnica. As the first professor, Maria Theresa appointed Nicolaus Jacquin of Leyden, one of the most prominent people in science in the second half of the 18th century. Other important scientists such as professors G. A. Scopoli and Anton L. Ruprecht worked at this department. There were many excellent technicians worked at the Mining Academy and in Banská Štiavnica, such as Matej Kornel Hell and his son Jozef Karol Hell.
The Mining academy in 1846 was renamed to the Mining and Forestry Academy. The definitive end came on April 24, 1919, after 157 years of existence in Banská Štiavnica.
A great number of mining, technical and cultural monuments has been preserved. On December 11, 1993, the city Banská Štiavnica was included in the UNESCO World Heritage List.

Keywords: Mining; education; water reservoirs; economic impact; historical aspects; UNESCO.

Ján Albrecht Music and Art Academy Banská Štiavnica – Seven Years of Existence

prof. PhDr. Zuzana Martináková, PhD., prof. PhDr. Egon Krák, ArtD.

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Ján Albrecht Music and Art Academy – Banská Štiavnica (JAMAA) is the only one private artistic university in Slovakia and the only one that provides studies not only in the field of classical music but also of jazz and historical informed performance. In the picturesque surroundings of Banská Štiavnica and the family way of teaching attract students not only from Slovakia, but also from around the world. During the seven-year existence, the bachelor and master study completed almost 40 students, of which one-third was other than Slovak nationality. JAMAA regularly organizes artistic, scientific and educational events with international participation and enables students and pedagogues traineeships and teachings abroad in frame of the Erasmus+ programme. It collaborates with professional domestic and foreign artists, ensembles and educational institutions. Rich artistic life also attracts citizens and tourists of Banská Štiavnica, whose interest in our institution is gradually increasing.

Keywords: Ján Albrecht Music and Art Academy; Banská Štiavnica; Art Support Fund; Erasmus+ programme; Artistic and scientific activities; Artistic education; Musical art.

Roles, Activities And Practical Experiences of Control Chemical Laboratories Civil Protection of The Ministry of Interior Slovak Republic in The Field of Radiation Protection of Population

Ing. Peter Novotný, MVDr. Kristína Jaššová

Control and Chemical Laboratories for Civil Protection in Jasov, Slovak Republic
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The presentation consists of three parts. The first part describes the territorial scope of control chemical laboratories of civil protection in the Slovak Republic, which currently belong to the Crisis Management Section of the Ministry of the Interior Slovak Republic. It also outlines the basic legislation on dealing with emergencies with a radiological threat within the Ministry of the Interior. The lecture also describes the characteristics of control chemical laboratories of civil protection. In the second part the lecture describes the main tasks and procedures for performing radiation air monitoring in the sense of the annual plan. In tabular and graphical form, it shows the results of the measurements of the spatial dose gamma radiation equivalent in Košice and Prešov regions for the years 2013 to 2017 and the results of soil samples measurements for both regions. In the third part, the lecture informs in the picture about some radiation events, which were dealt with by the Radiation Laboratory in Jasov.

Keywords: Civil protection; Crisis Management Section.

Radiation Protection at Workplaces with Natural Sources of Ionizing Radiation in the Czech Republic

Ing. Hana Procházková

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In the Czech Republic, radiation protection in workplaces with natural sources of ionizing radiation is defined by Act No. 263/2016 Coll., The Atomic Act. This Act introduced some new concepts and requirements regarding radiation from radon at the workplace (§ 96 and 97 of the Atomic Act). Requirements consist of the notification of information to State Office for Nuclear Safety, measurements at the workplace, the informing of workers about the risk and the optimization of radiation protection. For details, Decree No. 422/2016 Coll., On Radiation Protection and the Security of Radionuclide Source, is set out in § 92 to 95.

Workplaces where increased radiation from radon can occur, it is considered, according to § 96

a) underground workplaces,
b) workplace which is collected, pumped or otherwise treated with water from underground source, in particular a pumping station, a spa facility, a bottling plant, a water treatment plant or a reservoir,
c) workplaces located in the underground or first floor of a building that meets the conditions set out in the Decree in § 92 and in Annex 25.

Act No. 263/2016 Coll., The Atomic Act, in § 93 and Decree No. 422/2016 Coll., On Radiation Protection and Security of the Radionuclide Source, in § 91 defined of the Workplace with the possibility of increased radiation from a natural source of radiation:

a) the deck of an aircraft over a height of 8 km,
b) workplace with naturally occurring radioactive materials.

Additional requirements are set out in Decree No. 422/2016 Coll. in § 88 to 90. In § 91 there are defined requirements for release of radioactive material from the workplace with naturally occurring radioactive materials.

Keywords: Radiation Protection; Radon; Naturally Occurring Radioactive Materials.

SECTION I
Radioenvironmental studies and peaceful use of nuclear energy

SECTION I

Imaging and quantification of microelements transport in plants using positron emission tomography

RNDr. Vanda Adamcová[1], Mgr. Klára Kuglerová[1],
doc. RNDr. Miroslav Horník, PhD.[1], doc. Dr. habil RNDr. Juraj Lesný, PhD.[1],
doc. Ing. Peter Kováč, PhD.[1], Mgr. Lenka Klčová, PhD.[2],
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The aim of the work was to evaluate the possibilities of the application of radioisotope ^{65}Zn representing the minor positron emitter in terms of its decay scheme (β^+ decay – 1.5 %) in the imaging and quantification of the uptake and transport of Zn in the plant tissues as an important microelement in plant nutrition under *in vivo* conditions and using a commercial 3D microPET system primarily developed for animal biological objects. As studied objects, the branches of wood plants, such as apricot (*Prunus armeniaca*) or sweet cherry (*Prunus avium*) and plants of Virginia mallow (*Sida hermaphrodite* L.) with the potential to use as energy crops or plants for phytoremediation methods were used. From the obtained results, it can be concluded that radioisotope ^{65}Zn can be applied in the imaging of the dynamics of Zn uptake and transport in the tissues of studied plants using a commercial 3D microPET systems, despite the fact that it is a practically non-typical positron emitter. The mentioned radioisotope has a relatively long half-life decay ($T_{1/2}$ = 243.9 d), which makes it possible to evaluate the uptake and distribution of Zn in the plant tissues practically within their whole life cycle, especially in one-year plant species. The obtained results in the form of 3D microPET records were supplemented by direct gammaspectrometric measurements of the distribution of applied radioisotope in the tissues of studied plants, as well as were compared with the autoradiographic records.

Keywords: ^{65}Zn; imaging; transport; plant tissues; positron emission tomography.

Acknowledgements
This work was supported by Slovak Research and Development Agency no. APVV-15-0098.

Application of radioanalytical methods for studying heavy metal transport in soybean plants

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Crops grown in metal polluted soil bear risk for contaminated food, therefore, identifying varieties that accumulate low amounts of toxic metal are of particular interest. Different morphological, physiological and genetic markers are used to identify the potential to accumulate the metal in tissues. Radioanalytical methods provide highly sensitive and precise tools to study not only accumulation rate but also the kinetics of metal uptake. Isotopes are used to determine and quantify the metals but also to visualize (imaging) their localization in individual plant parts. In our work we apply gamaspectrometry and autoradiography to monitor different soybean *(Glycine max L.)* varieties for metal uptake. The obtained data we complement with results of physiological, genetic as well as biochemical studies to provide a more complex knowledge on efficiencies of different tolerance mechanisms against metal toxicity in individual varieties.

Keywords: Radioanalytical methods; soybean; metal stress; isotopes; kinetics.

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SECTION I

Monitoring of radiocesium, signaficance of sampling

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The penetration of radionuclides into the environment occurs through falling on earth surface. Here radionuclides migrate which is resulting in contamination of rivers, soil but even plants and animals. In regard of timing relationship since Chernobyl disaster, in these days ^{137}Cs still persists in soil. It is still present in mushrooms and meat of wild boars. Contamination by ^{137}Cs exceeds allowed limit in surrounding states. Hence, its monitoring is very relevant. To get a precise data, it is necessary to pay an interest to sampling.

Keywords: Contamination; radiocesium; sampling.

Effect of pH on Sorption ^{85}Sr, ^{137}Cs and ^{60}Co on Chitosan, Activated Carbon and Composite Chitosan-Activated Carbon

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For the environment, the pollution of water resources by anthropogenic radionuclides is very dangerous. Such radionuclides include ^{239}Np, ^{239}Pu, ^{137}Cs, ^{60}Co, ^{99}Tc, ^{131}I, ^{89}Sr or ^{85}Sr. These are nuclear medicine products or nuclear plant products. Anthropogenic radionuclides were also produced by nuclear weapons tests. Suitable adsorbent materials capable of adsorbing radionuclides and heavy metals include carbon-based adsorbents or chitosan. This work studied the effect of pH on sorption of ^{85}Sr, ^{137}Cs and ^{60}Co on chitosan (CH 0.01g), activated carbon (C_A 0.01g) and chitosan activated carbon (CH-C_A 1: 1).
It was found that the sorption of all the radioisotopes under investigation for the materials concerned was that R% increased with the increasing pH of the solution. The percentage of sorption in depence on the used material, increased in order of CH 0.01g < C_A 0.01g < CH-C_A 1:1. The R% values were for CH-C_A 1:1 higher than 91% for ^{60}Co-sorption for composite material, 94% for ^{85}Sr-sorption for composite material and 64% for sorption of ^{137}Cs for composite material. CH-CA 1:1 exhibited buffering properties ranging from pH 4 to 8 where the pH values after sorption were in ranged from 6.0 to 6.5. The measurement error was less than 5%.

Keywords: Activated carbon; chitosan; adsorption; strontium; cobal; caesium.

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Lj. Matovic and A. Đukić et al. from the Laboratory of Materials Sciences, Vinča Institute of Nuclear Sciences, University of Belgrade, Belgrade, Serbia for cooperation in the preparation and characterization of carbon sorbents.

SECTION I

Determination of β-emitting radionuclides ^{107}Pd and ^{79}Se in radioactive waste

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A method of extraction chromatography with Ni Resin was used to separate ^{107}Pd in waste samples and a distillation method for separating ^{79}Se in radioactive waste samples.
Significant interfering radionuclides ^{137}Cs and ^{60}Co were removed by co-precipitation prior to separation. To remove ^{60}Co, a co-precipitation method with NH_4OH at pH 8 was used, and high selectivity of ammonium phosphomolybdate $(NH_4)_3PMo_{12}O_{40}$ was used to remove ^{137}Cs. Co-precipitation removed up to (85 - 90) % ^{137}Cs and (90 - 92) % ^{60}Co. Distillation of ^{79}Se was carried out in a medium of 50 cm^3 6.5 $mol \cdot dm^{-3}$ HCl and 14 cm^3 18.31 $mol \cdot dm^{-3}$ HBr. Selenium was precipitated from the solution with 2 cm^3 15 % $TiCl_3$ and 2 g $NH_2OH \cdot HCl$. The chemical yields were determined gravimetrically in the range (72 – 88) %. Sorption of Pd^{2+} on the Ni Resin was carried out in HCl with concentration 1 $mol \cdot dm^3$ to form a yellow precipitate of $Pd(DMGH)_2$. The elution of Pd^{2+} was carried out with 50 cm^3 8 $mol \cdot dm^{-3}$ HNO_3. The yields of ^{107}Pd were determined by atomic absorption spectrometry and were in the range of (47 - 75) %. The activities of ^{79}Se and ^{107}Pd were determined by liquid scintillation spectrometry by Tri Carb 3100 TR in the energy window (0 - 80) keV and all activities were less than the MDA. The lowest MDA for ^{79}Se was 0.003 $Bq \cdot cm^{-3}$ and for ^{107}Pd was MDA less than 0.008 $Bq \cdot cm^{-3}$. These separation methods can be used to declare ^{79}Se and ^{107}Pd activities before storage in the National Radwaste Repository in the Slovak Republic.

Keywords: ^{107}Pd; ^{79}Se; distillation; extraction chromatography.

Determination of ^{137}Cs using fly ash and carbon microfibers

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The growing fly ash production is causing environmental problems associated with technological and economic influences in the world, since the hazardous properties of fly ash result primarily from the presence of the volatile toxic metals in fly ash. Cellulose is a promising precursor for the production of carbon fibers; the cellulosic fibers have a well-ordered crystalline structure and pyrolysis forms a strong fibrous carbonaceous material. Cellulosic precursors have high thermal conductivity, high purity and mechanical flexibility. The recent accident at Fukushima NPP has drawn attention to environmental contamination. The aim of the work was to compare the results of the modified fly ash and carbon microfibers for the concentration ^{137}Cs. In this paper the results from the testing of the possibility of sorption of Cs on the modified ash and carbon fibre wee compared. Results of measurements on both impregnated sorbents confirmed the possibility of sorption of ^{137}Cs for the use of both materials for the concentration of ^{137}Cs in real samples.

Keywords: Concentration; fly ash; carbon fiber; ^{137}Cs.

Acknowledgements
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SECTION I

Possibilities of decreasing azoxystrobin residues after high doses of ionizing radiation

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Fungicide azoxystrobin toxicity was monitored by means of a 96-h biotest with *Artemia franciscana* nauplius stages after exposure to solutions with concentrations of 0.25 and 0.5 $mg.l^{-1}$ irradiated with ^{60}Co gamma radiation with doses of 1 and 10 kGy. The effects of ionization radiation on azoxystrobin toxicity were mainly manifested by a statistically significant reduction of lethality after 48-, 72-, and 96-h exposure. The observed effect of gamma ionizing radiation on azoxystrobin toxicity suggest that this approach can be applied as an alternative for a reduction of azoxystrobin residua in food.

Keywords: *Artemia franciscana*; gamma radiation; pesticide.

Sequential radionuclides determination in bones of wild animals

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The work was focused on the sequential determination of radionuclides – ^{90}Sr, ^{210}Pb and ^{226}Ra in bones of wild animals using the AnaLig® Sr-01 Resin. Based on the metabolic similarity of selected radionuclides with calcium, the target matrix was selected – the bones in which the radionuclides are deposited, replaced with calcium, and irradiate the organism for a long time. Chemical yield of lead was monitored by addition of the Pb^{2+} carrier and measured by AAS from PERKIN-ELMER. Radionuclides ^{85}Sr and ^{133}Ba were used to determine the radiochemical yields by measurement on the HPGe detector. Firstly, was eluated ^{210}Pb with 9 $mol \cdot dm^{-3}$ HCl followed by ^{90}Sr with Na_2H_2EDTA pH 6 and ^{226}Ra with Na_2H_2EDTA at pH 9 from AnaLig® Sr-01 Resin. The ^{90}Sr and ^{210}Pb activity masses were determined after the increase in their daughter products: ^{90}Sr (^{90}Y) and ^{210}Pb (^{210}Bi) to the TRI CARB 3100 TR. The mass activity of ^{226}Ra was determined on a 576A Alphaspectrometer with ULTRA™ AlphaDetector 600.

Keywords: Sequential determination; AnaLig® Sr-01; ^{90}Sr; ^{210}Pb; ^{226}Ra; bones of wild animals.

SECTION I

Phycoremediation as a potential method for the decontamination of wastewater using green microalgae *Chlorella vulgaris* and *Scenedesmus obliquus*

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The presence of radionuclides in the environment is a global problem that is currently addressed by various methods of chemical decontamination that can be harmful to the environment. For this reason, bioremediation takes place, using organisms and microorganisms to reduce and eliminate contaminants from the environment.
The experiments were followed by the bioremediation ability of *Chlorella vulgaris* and *Scenedesmus obliquus* in contaminated aqueous solutions containing ^{137}Cs and ^{60}Co. An important parameter to determine the effectiveness of bioremediation was to monitor the decrease in activity in contaminated solutions in a medium with different pH values. The microalgae were cultured under light mode at 12 h./12 h. light / dark at room temperature. Bürker chamber was used to determine the sorption capacity of microalgae.

Keywords: Bioremediation; microalgae; radionuclides; *Chlorella vulgaris; Scenedesmus obliquus.*

Basic parameters of gamma spectrometry system based on CZT crystal and its use in school didactic experiments

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The paper deals with the basic characteristics of the gamma spectrometric system designed for school experiments, with a detector based on CZT (cadmium-zinc-telluride) semiconductor crystal. Spectrometer RadAngel for Schools^{TM} (RA4S^{TM}) from manufacturer Kromek Group plc. is equipped with a 5x5x5 mm CZT detector, compact design (90 mm x 55 mm x 25 mm), small weight (135 g), integrated electronics with USB connection to PC and basic spectrometric software. The manufacturer declares an energy resolution of <3.5% FWHM for 662 keV and energy range of 40 - 1500 keV with spectrum size of 4096 channels. Due to the absence of detector efficiency data, we focused on the determination of the peak efficiency (full energy peak efficiency) for the declared energy range and determination of energy resolution (FWHM) as a function of peak energy. The results show that RA4S exceeds manufacturer's declared values in several parameters. In the paper we present the sample spectra measured using the KCl sample as well as the spectrum of calibration standard in the Marinelli beaker geometry used for energy, FWHM and efficiency calibration. Peak efficiency values are relatively low, which is agreement with expectations due to the small effective volume of the detector. Finally, there are several suggestions for school experiments using the features of the device described.

Keywords: CZT detector; gama spectrometry; RA4S^{TM}; RadAngel for Schools^{TM}; FEP efficiency; energy resolution.

Acknowledgements
This work was partially supported by Cultural and Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic for the project KEGA No. 021TU Z-4/2017 and project KEGA No. 012TU Z-4/2017.

SECTION I

Comparison of commercial sorbents for ^{90}Sr determination in large-volume water samples

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The aim of this thesis was to compare the methods for the concentration of ^{90}Sr from large volumes of waters in terms of yield, time. To compare the methods used three commercially available methods using 3M Bioanalytical Technologies - 3M EmporeTM Rad Disks STRONTIUM, AnaLig® Sr-01 from IBC Advanced Technologies and Sr® Resin manufactured by Eichrom Technologies. In the work two types of real samples of water (concentrate and low volume sample for rapid analysis) were used to select a suitable separation method. Radiochemical yield was monitored using ^{85}Sr tracing radionuclide and ^{85}Sr was measured on HPGe detector. The work suggests that the most appropriate method for determining ^{90}Sr is the use of a commercially available product AnaLig® Sr-01 from IBC Advanced Technologies.

Keywords: Large-volume; determination; strontium.

Characterization of the biosorbent for the determination of barium

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Nowadays, the widely used sorption methods are which use organic ion exchangers and inorganic sorbents. Regardless of the fact that the inorganic sorbents are highly selective for the determined ions and highly resistant to radiation, their use is restricted by technological parameters of these materials. In recent years use of biosorbents comes to the fore, among which we can include the compounds based on natural materials. Fungi have in their structure a number of functional groups and have high sorption capacity. To increase the sorption capacity of natural materials - mushrooms, it needed a suitable modification. The work was focused on the preparation of biosorbent with a future aim to characterize its sorption properties for determination of anthropogenic radionuclides. The main characteristics of the sorption properties of the composite biosorbent prepared from the fungus- Fomes fomentarius.

Keywords: Biosorbent; fungus; barium.

SECTION I

SECTION II
Radiation protection and safety operation of nuclear power plants

SECTION II

Radiation Calibration Chamber and NuEM LUCAS Detection System as part of the Radon Monitoring Program Montenegro

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The radon calibration chamber, along with the NuEM LUCAS comprehensive detection system, is a complex of devices designed for the gradual introduction of a radon monitoring program in the Republic of Montenegro. The detection system is designed to determine the volume activity of radon isotopes (^{222}Rn, ^{220}Rn) in atmospheric, soil air and water samples. This system meets the requirements of the International Atomic Energy Agency for Radon Monitoring in Montenegro. The radon chamber as well as the NuEM LUCAS detection system was manufactured and supplied by NUVIA a.s.. The radon chamber serves mainly for applied research in the area of radon dynamics and its products in the air for routine control of the reliability of the used measuring technique and for the standardization of the RVA (radon volume activity) and ERVA (equivalent radon volume activity).

Keywords: The radon calibration chamber; radon monitoring program.

Present situation of groundwater pollution in NPP A1 Jaslovské Bohunice

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Nuclear Power Plant (NPP) A1 was shut down in 1977. Pollution of the geological environment in the NPP A1 is present as a result of accidents at the power plant (1976, 1977) and subsequent handling of radioactively contaminated residua. Groundwater of the NPP A1 are long-term contaminated with tritium ^{3}H, which, unlike the other radionuclides considered, is transported as part of the water molecule in groundwater. In addition to the tritium, other, less migrating nuclides ^{60}Co, ^{137}Cs, ^{90}Sr, ^{40}K, and alfanuclides were found in the past. The threat of groundwater outside the industrial area by these radionuclides is excluded from modeling calculations and long-term regular monitoring results. These results were confirmed by lysimeter experiments with radioactive contaminated soil of A-1. In the area of the main sources of groundwater contamination, therefore, since 2000 the continuous remediation pumping of groundwater from the N-3 borehole has been in operation. The pumping significantly affects the situation in the area. The legislation required the implementation of the Risk Analysis in 2011 and its update in 2017. The aim was to assess whether the current state of groundwater pollution and the geological environment represents the environmental and health risk for NPP A1 and the environment, also to establish and update the criteria under which it was possible to end the remediation of groundwater.
The contribution presents the results and conclusions of the Risk Analysis in relation to groundwater pollution status in 2017.

Keywords: Risk analysis; nuclear power plant A-1 Jaslovské Bohunice; groundwater; monitoring.

SECTION II

Emergency response and HERCA – WENRA Approach for a better cross-border coordination of protective actions

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The Slovak Republic is a country with large industrial and residential agglomerations which are concentrated on a relatively small territory. Despite the built-in safety and security system, there is a number of potential sources of emergency situations that may occur when performing activities using a source of ionizing radiation, due to the illegal use of a source of ionizing radiation, a terrorist act, the illicit use of a source of ionizing radiation or a radiological emergency originating outside the territory of the Slovak Republic. These situations require rapid adoption of urgent protective measures to mitigate serious adverse effects on human health and safety, quality of life, property, the environment, or mitigation of the hazard, which could also cause serious adverse consequences.

In order to detect and deal with emergency situations and to protect the individual, society and the environment from uncontrolled leakage of radioactive substances in any circumstances, a response plan for the emergency situation is established in the Slovak Republic. In order to avert or reduce irradiation, the Slovak republic adopted a response plan which follows the guidelines of the International Atomic Energy Agency. First and foremost it is prompt classification of an emergency, the emergency planning zones, intervention levels and operational intervention levels. In Europe, several initiatives have been in place over the years to try to harmonize procedures and general criteria for taking urgent protective actions. One of them is HERCA - WENRA's approach to cross - border coordination of protective actions.

Keywords: Emergency response; HERCA – WENRA Approach; protective actions.

Citizen radiation monitoring networks in the Czech Republic - RAMESIS project

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The presentation describes the current state of the RAMESIS project (ID: VI20152019028, Radiation Monitoring Network for institutions and schools to assure early awareness and enhancing safety of citizens), a project of security research of the Ministry of the Interior of the Czech Republic, solved by SÚRO in cooperation with CTU UTEF and NUVIA a.s. focused on supporting creation and operation of a citizen network to monitor the gamma dose rates in the Czech Republic.

Within the project, simple and affordable detectors for continuous stationary measurements are created, designed especially for schools and other institutions, and detectors for mobile monitoring are acquired, detectors of both types are provided free of charge to the people interested in the measurements.

In order to receive, process and present the measurement results, a central RAMESIS application is being developed. The application provides:

- bidirectional communication with stationary detectors and continuous automatic acquisition of the measured values, as well as receiving the results of the mobile measurements by file upload using a web interface
- processing and storing measurement results in the RAMESIS central database
- presentation of the store data in the form of maps, graphs and tables on the RAMESIS website
- export and transfer of data to other similar systems at national and international level
- easy addition of modules to receive data from other sources

Along with the central application an information portal is also continually being created for the presentation of information about the RAMESIS project, used detectors and their parameters and control, principles and methods of measurement etc., as well as general information on radiation protection and radiation monitoring.

The project also includes development of tools for the local presentation of mobile measurement results on the user's PC / laptop using open-source software tools and freely available background map data like OpenStreetMap.

Keywords: RAMESIS; citizen networks; Safecast; OpenStreetMap; radiation monitoring; public; detectors.

SECTION II

Possibilities of the Construction of Concrete Shielding Structures Against the Effects of Ionizing Radiation

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Shielding structures are part of all newly constructed or renovated irradiation facilities with sources of ionizing radiation such as linear accelerators or sources of gamma radiation used both in defectoscopy in engineering, and in diagnosis and therapy in healthcare. Shielding structures are also an important part of nuclear power plants the construction of which is planned in the near future.
Economically, the most advantageous material for shielding structures is ordinary concrete made from local resources. This solution, however, can only be used in greenfield development. Most often, however, we face the requirement on the design of built-ins or additions to the existing structures, where the designer is limited by the dimensions of the structure. In this case it is necessary to choose a more "effective" shielding material such as "heavy concrete", or additional shielding of the structure by steel plates. But these solutions are economically very costly.
During the construction itself, it is necessary to guarantee that the shielding materials used have the properties considered in the calculation. In practice, continuous monitoring at construction sites proved useful, where the bulk density of concrete is checked both in truck mixers, and during placement and compacting in the formwork. This monitoring is performed by both domestic and foreign radiation densimeters.

Keywords: Shielding structures; ionizing radiation; heavy concretes.

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Determination of potassium in environmental samples using detection of ^{40}K

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Potassium is a radioactive biogenous element. Its amount in earth crust represents approximately 2.1 weight %, which refers to the ninth highest concentration of elements in the litosphere. The presence of the mentioned alkali metal in the environment, considering its chemical and physical properties, belongs to the basic requirements for life in Earth. In addition to 25 isotopes, another 4 nuclear isomers of potassium are known. Because of its long halflife ($1.248.10^9$ years), ^{40}K is one of most abundant radionuclides in nature, even though its concentration in potassium is very low (0.0119 %). The presence of ^{40}K in potassium enables the determination of this element by measuring of its radioactivity. The work encompasses the determination of potassium in synthetic fertilizers and in the soil samples by scintillation γ-spectrometry using the detection assembly consisting of the well type detector 76BP76/3 NaI(Tl) made by Envinet (Czech Republic) operated by the data evaluation program ScintiVision-32 (product of Ortec, USA) and of the lead shielding made by Envinet (Czech Republic). The work involves information concerning the estimation of detection efficiency, estimation of ^{40}K γ-photons-self-absorption in the samples as well as estimation of the necessitated measurement-time for required relative standard deviation.

Keywords: Potassium; ^{40}K; γ-spectrometry.

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SECTION II

Radiation protection of workplaces at Research Centre Řež

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Research Centre Řež (RCR) is a research organization focused on research, development and innovation in the energy sector, primarily nuclear energy, reactors physics, chemistry and materials. RCR currently operates ten radiation workplaces of the II, III and IV category. From the point of view of the way in which ionizing radiation sources are handled these workplaces are rather different. Therefore a differential approach is required to ensure the radiation protection requirements. The radiation protection in RCR is organized into three separate infrastructures, each with an own radiation protection officer. The "SUSEN" infrastructure includes eight workplaces of the II and III category in which are handled unsealed and sealed radionuclide sources of simple and significant sources category and a particle accelerator of a model 14 MeV D-T neutron generator. Five of radiation workplaces of this infrastructure were newly established within the SUStainable ENergy Project (SUSEN) in the end of 2016, especially for the material research purpose. Two other workplaces are planned to be established this year. The "REACTORS" infrastructure includes two workplaces of the IV category with LVR-15 and LR-0 research reactors. Both reactors were operated by UJV Řež company until 2012. The "PFW PILSEN" infrastructure includes a newly built workplace of the II category with a 0.8 MW radiation generator, established in 2018. The common problem of radiation protection related to the operation of these RCR workplaces is the modernization of documentation for approved activities under the new Atomic Act and the provision of uniform approaches in the field of radiation protection, training of workers and safe management of radiation sources.

Keywords: Radiation protection; atomic act; significant source; radiation generator; particle accelerator; research reactor; LVR-15; LR-0; SUSEN.

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Configuration management at nuclear power plants

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Configuration management (CM) is a system engineering process is to provide a disciplined approach to the control of the physical configuration, design requirements, and facility Configuration information (FCI) such that station operators have high confidence that structures, systems, and components are fully functional and support safe, reliable plant operation. This process ensures that a plant is operated, maintained, and modified in a manner that maintains the physical plant, design requirements, and FCI consistent with each other. In turn, this ensures the physical configuration of the plant is maintained in accordance with the design basis, licensing basis information, regulatory requirements, and permits for operation. The configuration management process provides a readily available, accurate source of design basis and licensing basis information through information management processes and content management process which describe the following presentation aimed on the CM process experiences a evolution steps on nuclear power plants in Czech Republic. The information management is closely connected to building functional design knowledge management.

Keywords: Configuration management.

SECTION II

Modernization of the Slovak Hydrometeorological Institute Radiation monitoring network

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Radiation monitoring SHMÚ has a long tradition. Its beginnings go back to 1962, when the institute was entrusted with its operation due to the need to monitor the contamination of the atmosphere by nuclear weapons testing. Several changes have taken place during its operation. One of the most important in recent years is the total exchange of measuring technology and the creation of new information system. The aim of modernization is 30 pieces of gamma probes located at meteorological stations. The data will be collected in a new information system and provided to data exchange partners: the European Commission, the Radiation Warning Center in Vienna, the Meteorological Service in Budapest, the State Office for Nuclear Safety of the Czech Republic and the Nuclear Regulatory Authority of the Slovak Republic. Currently, the role of monitoring is mainly to provide an early warning system for radiation.

Keywords: Radiation monitoring; early warning system for radiation.

Correction of the heterogeneous weld of steam generator's cold collector on Unit 4 in Nuclear Power Plant Bohunice

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The topic of the paper is the realization of the cold collector heterogenous weld correction of the DN 1100 pipe line connection of steam generator PGV-213 on Unit 4 of NPP Bohunice from the radiation protection point of view. The correction consisted of the complete removal of the original weld and completely new heterogenous weld was made. Measures have been taken to minimize the collective effective dose and the maximum individual effective doses in accordance with the principle of optimization in radiation protection. The collective effective dose was 91.5 man mSv, maximum single personal effective dose was 0.632 mSv, average individual cumulative effective dose was 0.726 mSv, a maximum cumulative personal effective dose was 3.921 mSv, and the number of persons working on the specified radiation work permit was 126.

Keywords: DN 1100; cold collector of steam generator.

SECTION II

Protection against natural radionuclides in building materials, release of radioactive substances from workplaces and the possibility of their use for building materials

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In the Czech Republic, manufacturers and importers of building materials have obligations relating to protection against natural radionuclides in building materials. Manufacturers and importers of building materials are required to ensure systematic measurement and evaluation of the content of natural radionuclides in building material and to keep the prescribed data including the results of measurements of the content of natural radionuclides in the manufactured building material. These data must be communicated to the State Office for Nuclear Safety. The criterion for evaluating the measurement results is the value of the mass activity index. If the value of the activity index 1 is not exceeded, the building material can be supplied to the Czech market without restrictions. If the value of the weight index is greater than 1, the effective dose of a representative person from external gamma irradiation should be calculated when using a residential or residential building constructed from this building material. If this dose exceeds the reference level of 1 mSv/year, it is possible to supply this building material only with the permission of the State Office for Nuclear Safety.

Keywords: Building Materials; Natural Radionuclides; Radiation Protection.

Radioactivity assessment in historical building in Kosice

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It is generally known that some of the building materials are naturally more radioactive than others. However, all building materials and products from which natural raw materials originate contain various natural radionuclides uranium (^{238}U), thorium (^{232}Th) and radium (^{226}Ra). These radionuclides are sources of natural radioactivity in the indoor environment of buildings. The monitoring of the concentration of radioactive elements in building materials as well as the levels of radioactivity emitted by these materials in order to assess the radiation risks to human health is very important because most of the population spends about 80% of their time inside buildings. The purpose of this contribution is to evaluate the natural radioactivity in samples taken in historical building in Košice.

Keywords: Radioactivity; building materials; radiological parameters.

Acknowledgements
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SECTION II

Radiation hormesis: fact or myth?

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The idea about the equivalency or differences in mechanisms of action of low to very low doses, or dose rates of noxious environmental factors vs high doses/dose rates belongs for long time to the controversial questions in ecophysiology, incl. radioecology. Numerous observations of stimulatory actions of otherwise noxious environmental factors, as heavy metals, poisons, UV- and ionizing radiation, heat shock, starvation, etc. are documented since the 19th century. These phenomena were overall denoted as "hormesis". The opinions on the effects of low dose rates of ionizing radiation of natural or artificial origin are changed in broad range since the discovery of x-rays up to present time, from uncritical acceptance of the conception of its beneficial effects to the total denial of this alternative. The arguments pro and contra, however, were based often not on objective scientific knowledge, but rooted in conjecturally political, economical and ideological approaches. In present time, the so called "linear no-threshold" model is prevailing in most of theoretical works and practical applications on the field of radioecology and environmental protection, as well. This model do not admit any beneficial effects of low radiation doses. It grants on one side, that no potential danger corresponding to given level of the noxious factor will be underestimated, but, on other side, do not considers the inherited defensive and adaptive capabilities of living organisms, including humans, to adapt to often extremely conditions (e.g. survival at high or low temperatures, at the lack of oxygen, in dehydration, at high salinity, etc.), acquired during the long-lasting evolution.
The aim of our contribution was to evaluate the current state of scientific discussion on the radiation hormesis, to point out the possible mechanisms of the positive effects of low doses of radiation on the living organisms and to discuss some challenges in uncritical and mechanistic use of the TNT-model in radiation safety.

Keywords: Low doses; radiation hormesis; the LNT-model.

SECTION III
Protection against the effects of radon in buildings

SECTION III

Study of the relationship between radionuclide concentrations in the soil environment

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Natural radioactivity is mainly characterized by a small number of primordial radionuclides, among which the most relevant ones are ^{40}K and the members of the natural radioactive families of ^{238}U and ^{232}Th. Based on their concentrations in the soil, it is possible to calculate the gamma dose rate at 1 m above the ground, and also to estimate the exhalation rate of ^{222}Rn from the soil. An increased concentration of ^{226}Ra is also considered to be the precursor of increased ^{222}Rn concentrations in houses.
In order to study the relationships between terrestrial radionuclides ^{40}K, ^{232}Th, ^{226}Ra and ^{222}Rn, and to test different approaches of determining the ^{222}Rn exhalation rate from the soil, the Mochovce area proved to be especially suitable since it is radiologically well documented. The correlations between ^{40}K, ^{232}Th, ^{226}Ra were high for the entire area of interest. After dividing the area into four quadrants, a high correlation was found in three quadrants; the remaining quadrant exhibited a markedly low correlation between the radionuclides due to the complexity of the geological subsoil and the soil cover. The correlations between ^{222}Rn and ^{226}Ra for the whole area as well as for the individual quadrants were unexpectedly low; moreover, in one of the quadrants, the relationship between ^{222}Rn and ^{226}Ra was observed to be decreasing. This rather surprising outcome may be caused by spatially varying soil parameters (such as porosity, emanation coefficient and water content) affecting the concentration of ^{222}Rn in the soil air.

Keywords: Terrestrial radionuclides; radon; soil; correlations.

Radon indoor measurements in tufaceous buildings located in Naples and surroundings, Italy

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This study is focused on radon indoor measurements that INAIL (National Institute for Insurance against Work Injuries) carried out in buildings located in Naples and surroundings (Campania, Italy), where Rn concentration is affected both by geology and by construction materials (mainly tuff).
Campania is the second Region of Italy as for population (and more than 50% of its 6 million of inhabitants are concentrated in the Province of Naples). Volcanism is there connected to the presence of a large volcanic complex, related to a mantle anomaly.
INAIL focuses on research activity for evaluation and management of health risk at workplaces, due to indoor radon exposure, taking into account of active laws. Starting from knowledge about geology of Campania Region, the aim of this research is the assessment of risk in workplaces due to Rn presence.
During the measurement campaign, in order to estimate risk from radon in Naples and surroundings (where shops are often located underground or at ground floor), INAIL is currently using an active device Alphaguard PQ2000 Pro and is also informing workers about radon risk and about possible solutions for risk reduction.
Results will allow to realize Radon Potential Maps (RPM), which can help Italian Institutions to identify areas with high levels of radon, to realize an effective territorial plan and to assess the health risk, according to the Directive EURATOM 2013/59.

Keywords: Radon; risk assessment; volcanism; territorial planning.

SECTION III

Time variability of radon activity concentration in waters of Považský Inovec

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Radon concentration in waters is not constant and can exhibit a significant variability in longer time horizon. In this contribution, we deal with long-term monitoring of changes in radon activity concentration (RAC) in five selected springs of Považský Inovec Mountains, depending on meteorological conditions affecting their temperature and yield, and also the type of subsoil. First sampling of water was carried out in March 2015, although methodical monitoring of RAC took place during two years since September 2015. Waters of these springs contain greater concentration of ^{222}Rn and were situated on the subsoil with larger content of ^{226}Ra in the rocks. A negative correlation was observed between spring temperature and RAC; in contrast, a positive correlation was found between spring yield and RAC in waters. Higher values of RAC during the monitoring period were found in winter months and even in early spring. The highest value of RAC was measured in Dastínska kyselka spring (with the average of 201 Bq/l) with RAC ranging from 176 to 225 Bq/l.

Keywords: Radon; activity concentration; flow; subsoil; temperature; variations.

Development of continuous radon monitoring systems, for study of atmospheric processes

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Radionuclides in nature are natural and anthropogenic. From all of the radioactive isotopes in atmosphere, ^{222}Rn is the most important, but there is not enough data from continuous measurement, that would be usefull for testing exhalation rate from soil, calculating equivalent mixing height and other applications. For continuos measurements of ^{222}Rn on KJFB UK we use large scintilation chamber with active volume 4,5l and for simultaneous control of data we use scintilating chamber with active volume of 1l. However these monitoring systems have insufficient efficiency, that is why new monitoring systems are being developed. One of them is detection system based on two filter method. System uses two filters, one placed on the enter and second on the exit from accumulation chamber. Second filter is measured on semiconductor detector. Second detection system is based on the same method but scintilating detector was used. Next we designed new detector with high efficiency, based on electrostatic collection of radon short lived decay products.

Keywords: Continuous monitoring; radon; equivalent mixing height; two filter method.

SECTION III

The results of the first use of RAMARN dosimeters are encouraging

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Seven alpha RAMARN dosimeters were used to determine the OAR in five new and two reconstructed family houses located in exposed areas in Banská Štiavnica and its surroundings. The reference level 300 Bq/m^3 was not exceeded in none of the examined households. However, exposure scenarios on 3 objects should be analyzed and potentially optimized to reduce the OAR below 100 Bq/m^3. Users of the two houses most burdened with radon are not interested in the optimization of the risk of lung cancer, despite having been informed about the dangers.

Keywords: Radon; Existing exposition situation; Indoor Rn activity; Risk optimization.

Monitoring of selected environmental variables in Banská Štiavnická mining area

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Mining landscape is a specific type of landscape, that is significantly and in the long-term influenced by human activity. Already primarily from the point of view of the specific geological and tectonic conditions of its origin, it is an environment with multiple risk factors influencing living systems. The effects of some factors of the natural environment are significantly increased by mining or construction activities, respectively, these effects are partially or significantly eliminated. Radioactivity as a natural property of the rock environment is certainly the most risky factor in terms of effects, although its effects do not occur immediately. But there are many other factors that are conditioned by the geological environment and mining activity, but their effects are as necessity, resp. are positively influencing the presence of life and its quality.
The article is an example of research and monitoring of selected environmental factors that either directly or indirectly, positively or negatively contribute to the creation of specific environment conditions significantly affected by mining activities in the past. The varied composition of these variables determines or eliminates not only the presence but also some basic life manifestations of certain animal species or living organisms in general.

Keywords: Mining; environment; life; health; monitoring.

SECTION III

SECTION IV
Environmental engineering and lysimetric research

SECTION IV

A simple and effective method to eliminate PAHs of oilfield wastewater

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Induced air flotation (IAF) was used to recover the total polycyclic aromatic hydrocarbons (PAH_{tot}) from produced water (PW), a real oilfield effluent, sampled from the hydrocarbon storage tanks, SONATRACH of Bejaia. Tween 80 was used as a collector at a test concentration of 0.5% (V:V) and ethanol was used as a frother at a test dosage of 0.5 mL/L of PW. The natural presence of NaCl at greater concentrations may improve the removal efficiency of PAH_{tot} from PW by IAF. It was found that the conditioning step before initiating the flotation process is important for the PAH_{tot} recovery. A PAH_{tot} recovery of 93.67% was achieved at 30 min of conditioning and 20 min of flotation. It was also found that in presence of Tween 80 during the conditioning step, PAH_{tot} have tendency to reach the water surface. It was disclosed that addition of ethanol in PW during the conditioning has reduced both the conditioning time from 30 min to 10 min and the flotation time from 20 min to 12 min, which is beneficial from an economic standpoint. The effect of ethanol on the flotation kinetics of PAH_{tot} was explained well by Higuchi model.

Keywords: Waste water; polycyclic aromatic hydrocarbons; induced air flotation; Tween 80; kinetics; environment.

WORKSHOP

Practical applications of ecosystem monitoring

WORKSHOP

Evapotranspiration: model versus measurements

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Evapotranspiration is one of the most needed information in environmental research, and one of the most discussed. The calculation of the evapotranspiration using climate data measured by a (standard) climate station is stand of the art. Calculations normally used the equations of Penman-Monteith, Haude or Turc, with all the known limitations of each method. Further on eddy covariance is a common method. Often the calculated rates are not in line with the real scenarios at the place, because of the requirements postulated by the different methods – e.g. homogeneous surface structure- are not given.
Real measurements of the evapotranspiration need the use of large lysimeters which are time and money consuming. The new Ready-to-go Lysimeter is a small lysimeter station for soil columns with an area of up to 0.5 m² and a length of up to 1 m. The Ready-to-go lysimeter is suitable both for disturbed soil (filled by hand) and for undisturbed soil monoliths when using the patented UGT excavation technology.
The Ready-to-go Lysimeter is the ideal supplement to an existing weather/climate station for directly calculating evaporation and the recalibration of the mentioned above calculation methods for the exanimate area.

Keywords: Evapotranspiration; model; lysimeter; climate.

Application of sewage sludge into the soils as sources of microelements: a laboratory lysimeter study

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The aim of the work was to characterize the samples of sewage sludge (SS) originated from the Wastewater Treatment Plant Piešťany (TAVOS, Inc. Trnava) in terms of their potential application into the soils using a laboratory lysimeter system. Within the physico-chemical characterization of SS, the samples were analysed in terms of the values of pH, cation exchange capacity (*CEC*), total organic carbon (*TOC*), water holding capacity (*WHC*), as well as the presence of heavy metals. It was found that SS contained significant amounts of microelements Zn (1 269 mg/g dry wt.) and Cu (224 mg/g dry wt.). Laboratory lysimeter experiments involving the application of SS into the top layer of agriculturally used soil (0 – 10 cm) forming a part of a 40 cm soil column, in which seedlings of tobacco plants (*Nicotiana tabacum* L.) were cultivated, showed that in case of the SS application in the highest, legislatively permitted amounts (15 t/ha), into the soil eluate 0.07% Cu and 0.11% Zn were released and in tobacco plants 0.05% Cu and 0.13% Zn were accumulated from the total amount of Cu and Zn originated from the application of SS at the beginning of the experiment (Cu – 23.5 mg and Zn – 133 mg). At the application of SS in the amount of 30 t/ha, thus in the amount 2-times exceeding legislatively given limits, into the soil eluate 0.04% Cu and 0.02% Zn were released and in tobacco plants 0.09% Cu and 0.16% Zn were accumulated from the applied amount of SS (Cu – 47.0 mg and Zn – 267 mg).

Keywords: Sewage sludge; microelements; soil; plants; lysimetry.

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Weighable lysimeters – a perfect tool to observe phytoremediation processes in undisturbed soil columns

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Phytoremediation is one of the techniques used for remediation of contaminated sites. For the validation of its effectiveness it is necessary to monitor short and long-time changes in plants, soil and water. A variety of permits may be required when using phytoremediation at a site. Cities or states may have restrictions about using invasive or genetically modified plant species. It should be defined the fate and transport of the contaminants of concern including the effects on the food chain. And it should be clear how contaminated materials are disposed when remediation will be complete, and the site will be closed. While many laboratory studies of phytoremediation potential have been conducted, application of this technology in field studies is limited. Lysimeters are one of the state of the art technology for field studies under well controlled conditions.

In detail the advantages of lysimeter stations are: a) the undisturbed soil columns has no contact to the surrounding soil. Contaminants which are added as a treatment, cannot spread in the surrounding soil. b) The effects on the environment through the growth of genetically modified plants or invasive species, which are used for phytoremediation, can be minimized. c) The flexible lysimeter design, the facilities and the additional electronic measuring devices allow the investigation of various environmental questions. d) The container unit of a lysimeter consists of Polyethene PE-HD, which is water tight, impermeable for contaminants and has low chemical reaction. The disposal is cheaper and easier than that of concrete. e) With the "lysimeter soil retriever" technique it is possible to recover the undisturbed soil columns and bring it to a laboratory for further investigations.

To conclude, lysimeter can not only be used to monitor water balances, but also for monitoring the movement of hazardous substances in plants, soil and water. Lysimeter are a perfect tool to understand the complex processes of phytoremediation and facilitate the development of phytoremediation strategies.

Keywords: Lysimeter; phytoremediation.

Determination of actual evapotranspiration using water balance on lysimeters

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Weighing lysimeters represent a valuable tool for studying the water balance in the soil-groundwater-plant-atmosphere-atmosphere system. By accurately measuring the mass of the soil monolith per unit of time, it is possible to capture the change in water content in the soil - one of the basic elements of the water balance. The lysimeters in the lysimeter station in Petrovce nad Laborcom in the east of Slovakia are equipped with a groundwater level control system. This system makes it possible to precisely quantify water flows at the lower boundary of the unsaturated zone of the soil. For known precipitations, actual evapotranspiration (ETa) is the only unknown element in the water balance equation - and thus it can easily be calculated. This paper deals with the quantification and analysis of individual members of the water balance of the soil-groundwater-plant-atmosphere-atmosphere system. Due to the meteorological data from nearby meteo station, the reference evapotranspiration values were calculated and then mutualy compared with the ETa values obtained from the lysimeters.

Keywords: Weighing lysimeter; water balance; evapotranspiration.

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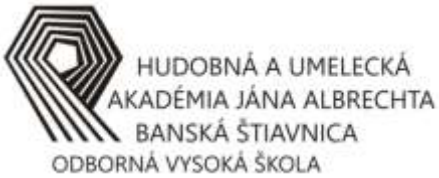

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