UNIVERSITY OF AGRICULTURE IN KRAKOW

LSU
LOUISIANA STATE UNIVERSITY

Central and Eastern European Conference on Health and Environment

Environmental and health issues in fast changing economies

Krakow, June 10–14

CEECHE 2018

**Honorary Patronage of the President of the Republic of Poland
Andrzej Duda in the year of the Centenary of Regaining Independence 1918–2018**

PRESIDENT.PL

THE CENTENARY OF REGAINING INDEPENDENCE
1918 · 2018

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Conference Chairs

Prof. Stanislaw Gawronski - Poland, Warsaw University of Life Sciences

Prof. Slawo Lomnicki - USA, Louisiana State University

Rector Włodzimierz Sady

Ladies and Gentlemens,

It is my sincere pleasure to welcome you at the University of Agriculture in Krakow. We are greatly honoured to host this year's edition of the conference addressing the issues of health and environment at our university in the year when we celebrate 65 years of its independent activity.

This year discussion will focus on "Environmental and health problems in fast changing economies" which is a widening and continuation of our previous initiative, i.e. scientific conference which we called "Forum Green Smart City – the voice of science in smog control and whose third edition we hosted last year.

I am deeply grateful to Mr President Andrzej Duda for his honorary patronage over the conference and to the representatives of Polish and The United States Government, local self-government units, as well as agencies and economic entities for their presence and activity which is a part of the University of Agriculture strategy, since we not only strive to participate in but also solve some crucial problems familiar not only to Central and Eastern Poland but also the whole area of Central and Eastern Europe.

The challenges which scientists and practitioners will discuss over the next few days are global issues. According to the BBC news "One fourth of harmful sulphates in the United States results from burning fossil fuels by Chinese industries. In Los Angeles, high concentrations of nitrogen and carbon oxides originating from Asian producers are registered at least once a year". We must remember that we are talking about the distance of almost 12 000km in a straight line, which is even farther than from Lisbon to Beijing.

The other issues addressed during this year's discussion are of local character. Central and Eastern European Countries still grapple with the outcomes of environmental contamination caused by irrational economy, dominant in this part of the Old Continent for the 50 post-war years. It concerns not only the air, but also waters and reclamation of post military areas. Post industrial degradation of the environment poses another challenge.

We are meeting in Krakow, the city which, like other big metropolises faces ecological challenges. The situation is serious, if we consider the analyses showing that a two-week smog in November 2016 caused death of 29 people, whereas hospitalization of persons complaining of disorders associated with the air quality cost almost 7 hundred thousand zlotys, i.e. about 190 thousand dollars. Therefore we have to realize that in this case money is not the most important. The lives and health of future generations are at stake, including over 150 thousand students in Krakow.

I am glad that today's discussion will focus on increasing the awareness of the environment impact on human health and seeking possible actions which might affect the improvement of this civilization trap. As the University of Agriculture acting in synergy with politicians and economic entities we efficiently develop scientific methods aimed to improve this unfavourable situation. Let me mention the initiative of tree planting with active participation of Mr President of Krakow and municipal services.

Let me congratulate the organizers on their choice of the conference venue and selection of speakers. I wish you a nice stay at the University of Agriculture in Krakow and fruitful discussion.

Conference Welcome

Dear Participants,

It is our great pleasure to welcome you to the 2018 Central and Eastern European Conference on Health and the Environment (CEECHE) organized under a general theme “Environmental and Health Issues in Fast Changing Economies”. Indeed, Central and Eastern European Countries now face new challenges associated with the rapid economic development. Unfortunately, economic acceleration is often associated with undesirable environmental impacts, non-conforming to changing regulations and priorities driven by overall development.

Systemic transformations that took place in the early 90s revealed in significant environmental devastation from years of neglect and insufficient economies, which translated to compromised health on affected populations. The first CEECHE meeting, which was held in 2004 in Prague, was designed to provide scientific insight about how environmental contamination effects human health, approaches to assess environmental and human health risks, and remediation techniques to reduce exposure risks. The conference served as a form of scientific exchange by sharing the experience of scientists and regulators from the United States (US) with Central and Eastern European counterparts. From the beginning, the main goal was to foster international collaborations and increase the scientific exchange and interdisciplinary research. Indeed, recent meetings have resulted in many international projects and fruitful collaborations.

CEECHE meetings have always received great support from governmental institutions. The US Environmental Protection Agency (EPA) initially was a leader in establishing momentum, later the US National Institute of Environmental Health Sciences, particularly NIEHS Superfund Research Program (SRP) was critical for maintaining the conference existence and agenda. The NIEHS SRP support still remains strong and vital for the meeting. The prominence of the CEECHE meeting has grown over the years and the 2018 meeting gained the patronage of The President of The Republic of Poland Andrzej Duda.

Over CEECHE’s history, the environmental health problems have evolved, however the conference goal still remains the same: fostering the collaboration between the US and CEE scientists and providing training for young researchers, in recognition of their future role as the leaders in environmental health and science fields. Improvement of the environment quality and health protection not only requires highly skilled scientists and professionals but also active involvement of the policy decision makers and community members.

The 2018 CEECHE meeting is hosted for the first time in Poland. The host City, Kraków, is rich in culture and history, and the city where the first Polish University was established in 1364. It was in Kraków in 1491, where Copernicus received his first academic education. We hope that the historic location of this meeting, well known for its educational and collaborative assets will spur lively discussions, vigorous collaborations and create momentum for improving our future global environmental health.

Welcome to Kraków!

Stanislaw Gawroński
Slawo Lomnicki
Conference Chairs

Welcome Remarks for CEECHE

From Consul General Walter Braunohler

(June 11, 2018, 9:00 AM)

Distinguished guests, it is my great honor to welcome you all to the 2018 Central and Eastern European Conference on Health and the Environment.

As the U.S. Consul General here in Krakow for almost 3 years, I am have seen great cooperation between the United States, Poland, and the surrounding Central European countries on many fronts. Security, trade, and strong people-to-people programs that are helping to make all of our countries better.

The scientists in this room fully understand the value of collaboration. By working together, we accomplish much more than we can separately, especially when addressing complex, difficult environmental challenges.

One of the reasons Krakow was selected as the venue for this year's conference is the work the city and various non-governmental groups are doing to address air-pollution.

Indeed, over my three winters in Krakow, there have been some terrible, smoggy days here in this beautiful city.

But I am heartened to see government and non-governmental entities attack the problem head on. In the 1990's, the United States helped fund the first air quality monitors in Krakow to gauge the extent of the problem. Since that time, NGO's, the government, and even private industry have worked together to improve air quality in Krakow. Thousands of heating systems have been updated. There have been large education campaigns to dissuade the burning of garbage and other harmful pollutants. And, on September 1, 2019, the city will implement an ordinance that bans fossil fuel burning for home heating in the city altogether.

At the same time, Krakow's innovation sector, which is one of the strongest of any city in the world, has taken on the challenge as well. In 2015, a young group of organizers, with whom the consulate has been privileged to work with from the beginning, established the Smogathon, a competition that brings together innovators from around the world to showcase the best technological solutions to fight smog. This year, Smogathon held its first-ever semi-finals in the United States and I am proud to say that an American startup was the winner of the Smogathon competition in Krakow.

Another company that was featured in a past Smogathon is Krakow's own Airly. This company has created an inexpensive, high-quality air monitoring system that brings real-time information about air quality affecting millions of Poles around the country.

Together, these collaborative efforts between government, industry, and activists – and even between Americans and Poles – have resulted in significant improvements in Krakow's air quality over the last two years. Although there is more to do, Krakow's example shows us that there is a way forward if we work together.

Once again, I want to thank the organizers of this event for giving me this opportunity to address all of you. I wish you all much success in the work you are doing together to help find solutions for our environmental challenges.

History

Clean environment is one of the critical components to achieve a healthy population. Unfortunately, locations, with no environmental impact due to human activities are hard to find. The exposure risk to various pollutants affects adults, children or even unborn. Due to their size, physiology, and behavior, children are more vulnerable than adults to environmental hazards. In the most recent report, World Health Organization estimates that more than 1 in 4 deaths of children under 5 years of age are attributable to unhealthy environment. Every year, environmental risks take the lives of 1.7 million children under 5. Chronic exposure to pollutants will result in unpredictable health problems of future generations as the toxicity of many pollutants is not well understood and estimated, leaving a large uncertainty on the health risk assessment. Similarly, the pollutants fate and the products of their environmental transformation are often unknown. Environmental health issues are particularly magnified in countries with fast developing economies. Central and Eastern European (CEE) countries grapple with 2 overlaying problems: legacy contaminations from past communist era and increasing pollution associated with recent fast economic growth. Problems associated with aquatic contamination with metals, pesticides, elevated mineralization and many others have been reported. Unresolved radiation contamination, flame retardants and Baltic aquifer contamination are only few examples of regional environmental problems.

The first Biennial Central and Eastern European Environmental Health Conference was held in 2004 in Prague (http://www.fi.muni.cz/ceehc) and emphasized the need for the education and training of young scientists. With the following meetings in 2006 (Bratislava), 2008 (Cluj-Napoca), 2014 (Cluj-Napoca) and 2016 (Prague) the conference successfully contributed to development of many co-operations and trained many young researchers 3. The main goal of past and current conferences is creating a platform to share the experience and provide guidance to the scientists from CEE countries on how to evaluate the environmental health risks, decrease the pollution and remediate environment. With this intent, we are inviting leading scientists from US and EU and their counterparts in CEE countries to participate in this forum for advancement of the environmental health field with the hope to create a “breeding environment” for future collaborations. Vast experience of US and Western European scientist in battling pollution, in environmental remediation and connecting health effects to the environmental factors will advance the environmental and environmental health fields within the CEE region, gradually decrease the pollution and decrease observed environmental health impacts on populations.

Central and Eastern European Conference on Health and the Environment
Krakow 2018
June 10-14

CEECHE 2018

SUNDAY, June 10

- WORKSHOP REGISTRATION
- Workshop Opening
- Breakup SESSION 1
- Breakup Session 2
- Coffee Break
- LUNCH BREAK
- Joint Sessions
- REGISTRATION STARTS
- WELCOME RECEPTION

MONDAY, June 11

Session Chairs: S. Gawronski, S. Lomnicki

Opening Remarks by Distinguished Representatives

Coffee Break

Press Conf. — Short Plenary: A. Konieczny - The role of forests and their impact on people's health

35+5 PL-1

W. Suk
Advancing Science in Rapidly Changing Environments

35+5 PL-2

E. Konduracka
Environmental Pollution and Civilization Disorders

Coffee Break

Chairs Konduracka/Cormier		Chairs Surmacz-G/Carpenter	
A1 Keynote	25+5	B1 Keynote	25+5
S. Lomnicki		D. Carpenter	
A2	15+5	B2	15+5
A. Ghimire		S. Al-Abed	
A3	15+5	B3	15+5
M. Petriello		Y. Ueda	

LUNCH BREAK

A4	15+5	B4	15+5
G. Nersisyan		J. Surmacz-Górska	
A5	15+5	B5	15+5
A. Paldy		M. Torborek	
A6	15+5	B6	15+5
L. Draghia		C. Vélez-Vega	
A7	15+5	B7	15+5
PANEL DISCUSSION		PANEL DISCUSSION	

Coffee Break

Chairs Gurzau/Vangrunsveld		Chairs Astel/Henry	
C1 Keynote	25+5	D1 Keynote	25+5
J. Vangronsveld		A. Astel	
C2	15+5	D2	15+5
V. Pidlisnyuk		S. Kolarevic	
C3	15+5	D3	15+5
I. Gruss		S. Cociu	
C4	15+5	D4	15+5
Y. Chayka		K. Krakowian	
C5	15+5	D5	15+5
D. Nebeská		M. Rejek	
C6	15+5	D6	15+5
T. Stefanovska		H. Henry	
C7	15+5	D7	15+5
PANEL DISCUSSION		PANEL DISCUSSION	

TUESDAY, June 12

Session Chairs: S. Małek/B. Suk SP-2

W. Maliszewski: Rocket Fuel Oxidizer: Polish Method of Disposal

35+5 PL-3

S. Cormier
A New Class of Environmental Pollutant Increases Morbidity and Mortality from Influenza Virus Infection

Coffee Break

35+5 PL-4

B. Hennig
Healthful Nutrition as a Modifier of Pollutant-Induced Inflammatory Diseases: Implications in Atherosclerosis

Coffee Break

POSTER SESSION

LUNCH BREAK
Lunch will be prepared for take away to accommodate sightseeing

TOURIST PROGRAM

Student organized dinner

WEDNESDAY, June 13

Session Chairs: F. Gambus/K. Pennell

35+5 PL-5

S. Romanko
The climate change impacts, climate strategies and alternative energy perspectives in the cities of Eastern Europe

Coffee Break

35+5 PL-6

A. Baker
Agromining: Farming for Metals and the Valorization of Metal-Contaminated Lands and Wastes

Coffee Break

Chairs Grochowalski/Lomnicki		Chairs Ostrega/McKernan	
E1 Keynote	25+5	F1 Keynote	25+5
A. Grochowalski		A. Ostrega	
E2	15+5	F2	15+5
S. Al-Abed		I. Kovalchuk	
E3	15+5	F3	15+5
A. Gutierrez		S. Klimov	
E4	15+5	F4	15+5
S. Chow		K. Ciarkowska	
E5	15+5	F5	15+5
V. Bencko		E. Oleńska	
E6	15+5	F6	15+5
J. McKernan		R. Maier	
E7	15+5	F7	15+5
PANEL DISCUSSION		PANEL DISCUSSION	

LUNCH BREAK

Chairs: Gawronski/Lin		Chairs Bubak/Vélez-Vega	
G1 Keynote	25+5	H1 Keynote	25+5
S. Lin		A. Bubak	
G2	15+5	H2	15+5
K. Pennell		S. Andrusaityte	
G3	15+5	H3	15+5
M. Roghani		T. Hana	
G4	15+5	H4	15+5
Y. Lu		E. Baltrėnaitė	

Coffee Break

G5	15+5	H5	15+5
Z. Lin		M. Bloom	
G6	15+5	H6	15+5
D. Iunac		O. Sergeyev	
G7	15+5	H7	15+5
W. Lawrence		A. Gruszecka-Kosowska	
G8	15+5	H8	15+5
S. Gawronski		P. Rudnai	
G9	15+5	H9	15+5
PANEL DISCUSSION		PANEL DISCUSSION	

Future environmental health careers – A panel for young researchers Kepka/Madeen

GALA DINNER

THURSDAY, June 14

Chairs Stasch/Al-Abed		Chairs Baker/Reams	
I1 Keynote	25+5	J1 Keynote	25+5
A. Stasch		M. Reams	
I2	15+5	J2	15+5
M. Malinowski		J. Irving	
I3	15+5	J3	15+5
M. Gliniak		J. Babjakova	
I4	15+5	J4	15+5
M. Jewiarz		A. Hambartsumyan	
I5	15+5	J5	15+5
H. Latala		O. Khan	
I6	15+5	J6	15+5
S. Femielec		PANEL DISCUSSION	
I7	15+5		
J. Dobrowolski			

Coffee Break

PL-7 Session Chairs Henry/Malek

R. Zimmerman

Analysis of the Toxicity of Combustion Aerosol: Chemical Composition of Different Combustion-Emissions and their Molecular Biological Effects on Air/Liquid-Interface Exposed Lung Cells

Closing Remarks

Organizers

- Faculty of Agriculture And Economics, Department of Agricultural and Environmental Chemistry
- Faculty of Forestry, Institute of Forest Ecology and Silviculture; Department of Forest Ecology and Reclamation
- Louisiana State Univesity

MONDAY - June 11, 2018

9:00-12:00: OPENING SESSION – Main Hall

CO-CHAIRS: Stanislaw Gawroński, Warsaw University of Life Sciences (Poland) and Slawomir Lomnicki, Louisiana State University (USA)

Opening Remarks by Distinguished Representatives

The role of forests and their impact on people's health
Short plenary presentation - wykład dr inż. Andrzej Konieczny

Plenary Presentation- Main Hall

Advancing Science in Rapidly Changing Environments
W. Suk, *Director, Superfund Research Program, NIEHS/NIH, Research Triangle Park, NC, USA*

Plenary Presentation – Main Hall
Environmental Pollution and Civilization Disorders
E. Konduracka, Jagiellonian University School of Medicine and John Paul II Hospital, Poland

12:10-15:40 PARALLEL SESSIONS A and B

(with Lunch Break 13:20-14:10)

SESSION A: Chemistry, health risks and solutions for atmospheric air pollution
CO-CHAIRS: *Ewa Konduracka, Jagiellonian University (Poland) and Stephania Cormier,* LOUISIANA *State University (USA)*

SESSION B: Topics of growing awareness related to environmental health
CO-CHAIRS: DAVID CARPENTER, UNIVERSITY AT ALBANY (USA) AND JOANNA SURMACZ-GÓRSKA, SILESIAN UNIVERSITY OF TECHNOLOGY (POLAND)

TIME	MAIN HALL	ROOM 033
12.10	A1 KEYNOTE. PM Air Pollution – Are EPFRs (Environmentally Persistent Free Radicals) a marker of PM's health impacts? (S. Lomnicki)	B1 KEYNOTE. Electromagnetic fields and human health (D. Carpenter)
12.40	A2. Fate of selected pollutants of concern: Surface and Environmentally Persistent Free Radicals (EPFRs) assisted oxidation (A. Ghimire)	B2. Rapid method to quantify carbon nanotubes (CNTs) in environmental media (S. Al-Abed)
13.00	A3. Dioxin-like PCB 126 increases systemic inflammation and accelerates atherosclerosis in lean LDL receptor deficient mice (M. Petriello)	B3. Agricultural Field Measurement of Radioactive Cesium in Fukushima (Y. Ueda)
	LUNCH	
14.20	A4. A Study of tree species phytofiltration properties in the green infrastructure of the city of Yerevan (Armenia) (G. Nersisyan)	B4. Occurrence and removal of selected pharmaceuticals from the aquatic environment (J. Surmacz- Górska)
14.40	A5. Health impact of suspended particulate matter in some Hungarian cities assessed by Airq+ (A. Paldy)	B5. Physical activity attenuates alterations of the gut-brain axis and brain metastasis formation induced by PCBs (M. Toborek)
15.00	A6. Aristolochic acid I and Balkan Endemic Nephropathy etiology: a potential exposure pathway through soil (L. Draghia)	B6. Impact of Hurricanes Irma and Maria on Puerto Rico Maternal and Child Environmental Health Health Research Programs (C. Vélez-Vega)
15.20	Panel Discussion	Panel Discussion

15:50 – 18:20 PARALLEL SESSIONS C and D

SESSION C: Environmental issues and local population exposures at former military sites in Central and Eastern European countries

CO-CHAIRS: EUGEN GURZAU, ENVIRONMENTAL HEALTH CENTER (ROMANIA) AND JACO VANGRONSVELD, HASSELT UNIVERSITY (BELGIUM)

SESSION D: Coastal and aquifer pollution

CO-CHAIRS: HEATHER HENRY, NATIONAL INSTITUTES OF ENVIRONMENTAL HEALTH SCIENCES (USA) AND ALEKSANDER ASTEL, POMERANIAN UNIVERSITY (POLAND)

TIME	MAIN HALL	ROOM 033
15.50	C1 KEYNOTE. The impacts of soil contamination on tree rhizosphere bacterial communities in a forest on an old military site (J. Vangronsveld)	D1 KEYNOTE. Sustainable Development of Several Coastal Lakes in The Southern Baltic Area (A. Astel)
16.20	C2. Impact of military territories to the environment and place of phytotechnology with miscanthus biomass production (V. Pidlisnyuk)	D2. Identification of hotspots of genotoxicological and faecal pollution along the Danube and Sava rivers – the whole river surveys (S. Kolarevic)
16.40	C3. Environmental risk assessment of heavy metal contamination at military sites in Ukraine: avoidance and reproduction test with Collembola (I. Gruss)	D3. Evaluation of drinking water quality and health state of population in Chisinau Municipality (S. Cociu)
17.00	C4. Actual Questions of Population Health Risk Assessment Of Former Military Sites In Czech Republic (Cr) And Ukraine (Ua) (Y. Chayka)	D4. The effect of spruce dying and air pollution on water quality on the example of springs within the Skrzyczne range area (K. Krakowian)
17.20	C5. Growing miscanthus x giganteus in post-military soil and soils contaminated by petroleum hydrocarbons: remediation and biomass production (D. Nebeská)	D5. Photocatalytic removal of sertraline from water over titania/chitosan hybrid materials (M. Rejek)
17.40	C6. The composition of nematode community associated with niscanthus x giganteus grown at dolyna militarty contaminated site (T. Stefanovska)	D6. Innovation in Coastal and Aquifer Remediation and Monitoring (H. Henry)
18.00	Panel Discussion	Panel Discussion

TUESDAY - June 12, 2018

9:00-11:10 PLENARY SESSION – Main Hall

CO-CHAIRS: Stanisław Małek, **University of Agriculture in** Kraków (Poland) and William Suk, National Institute of Environmental Health Sciences (USA)

Short Plenary Presentation – Main Hall
Rocket Fuel Oxidizer: Polish Method of Disposal
W. Maliszewski

Plenary Presentation – Main Hall
A New Class of Environmental Pollutant Increases Morbidity and Mortality from Influenza Virus Infection
S. Cormier, Louisiana State University, USA

Plenary Presentation – Main Hall
Healthful Nutrition as a Modifier of Pollutant-Induced Inflammatory Diseases: Implications in Atherosclerosis
B. Hennig, University of Kentucky, USA

11:20-13:20 POSTER SESSION - Hall

Packaged lunches provided for sightseeing at the conclusion of the poster session

18:30 DINNER for students and post-doctoral scholars (Club Arka)

WEDNESDAY - June 13, 2018

9:00-11:00: PLENARY SESSION – Main Hall

CO-CHAIRS: Florian **Gambuś, University of Agriculture in** Kraków (Poland) and Kelly G. Pennell, University of Kentucky (USA)

Plenary Presentation – Main Hall

Climate Change Impacts, Climate Strategies and Alternative Energy Perspectives in the Cities of Eastern Europe

S. Romanko, Vasyl Stefanyk Precarpathian National University, Ukraine

Plenary Presentation – Main Hall

Agromining: Farming for Metals and the Valorization of Metal-Contaminated Lands and Wastes

A. Baker, Laboratoire Sols et Environnement and LABEX Ressources21, ENSAIA/INRA, Université de Lorraine, France

11:00-13:30: PARALLEL SESSIONS E and F

SESSION E: Chemistry, fate, transport, and health effects of persistent halogenated contaminants

CO-CHAIRS: Adam Grochowalski, Cracow University of Technology *(Poland) and Slawo Lomnicki,* LOUISIANA *State University (USA)*

SESSION F: Environmental and health impacts of minerals/metals and mining activities

CO-CHAIRS: JOHN MCKERNAN, ENVIRONMENTAL PROTECTION AGENCY USA) AND ANNA Ostręga (POLAND)

TIME	MAIN HALL	ROOM 033
11.10	E1 KEYNOTE. Copper salts as catalyst substances responsible for formation of dioxins and other halogenated compounds during burn process in fireplaces and heating stoves (A. GROCHOWALSKI)	F1 KEYNOTE. Revitalization of post-mining areas for sustainable tourism (A. Ostręga)
11.30	E2. New developments in the synthesis and use of reactive activated carbon impregnated with iron nanoparticles for remediation of persistence organic pollutants in contaminated sediments and water (S. Al-Abed)	F2. Heavy metals and lipids in the tissue and bee production at traditional and organic bee-keeping conditions and the ways of their levels' correction (I. Kovalchuk)
11.50	E3. Development of magnetic nano-composite materials as reusable adsorbents for chlorinated organics in contaminated water (A. Gutierrez)	F3. Limiting horizontal water filtration using drainage screen modules to reduce the hydraulic interaction of artificial objects and the natural environment (S. Klimov)
12.10	E4. Biogeochemical characterization of a dual-pathway microbial remediation strategy for chlorobenzenes at the anaerobic-aerobic groundwater interface (S. Chow)	F4. Risk assessment of ZN-PB ores mining and usefulness of native plant communities in decreasing its impact on affected areas (K. Ciarkowska)
12.30	E5. Adverse human health effects including congenital malformations related to the use of agent orange (V. Bencko)	F5. Rhizobia as the microorganisms potentially improving the growth of legumes in heavy metal polluted areas (E. Oleńska)
12.50	E6. Identification of an Immobilization Technology for Per- and Polyfluoroalkyl Substances (PFAS) Contamination in Soil and Sediments (J. McKernan)	F6. Soil microbiome dynamics during revegetation of pyritic mine tailings: understanding microbial bioindicators of soil acidification (R. Maier)
13.10	Panel Discussion	Panel Discussion

13:30 – 14:30 LUNCH

14:30 – 17:50 Parallel Sessions G and H

	SESSION G: Exposure science and risk reduction approaches for indoor pollution CO-CHAIRS: Stanislaw Gawroński, Warsaw University of Life Sciences (Poland) AND SHAO LIN, UNIVERSITY OF ALBANY (USA)	**SESSION H: Environmental risk assessment and epidemiology** CO-CHAIRS: Anicenta Bubak, Cenia-Ekspertyz (POLAND) AND Carmen Vélez-Vega, UNIVERSITY OF PUERTO RICO (USA)
TIME	MAIN HALL	ROOM 033
14.40	G1 KEYNOTE. Assess school environmental effects on children's health and performance and evaluate environmental policies' impacts (S. Lin)	H1 KEYNOTE. Bioavailable forms of metals and Human Health Risk Assessment (A. Bubak)
15.00	G2. Fate and transport processes for assessing in-building CVOC concentrations from subsurface sources (K. Pennell)	H2. Surrounding Greenness, air pollution and general health in preschool children (S. Andrusaityte)
15.20	G3. Sewer systems and volatile organic compounds: indoor air considerations for buildings near contaminated groundwater plumes (M. Roghani)	H3. Lung cancer in black coal miners in the Czech Republic, 1992-2015 (T. Hana)
15.40	G4. Assessing the association between home indoor environment and respiratory health among school age children in Romania (Y. Lu)	H4. Dynamic approach to transfer of potentially toxic elements in the soil-plant system (E. Baltrėnaitė)
16.10	G5. Indoor environment and respiratory health in Romanian primary school children (Z. Lin)	H5. Gestational phthalate exposure and intrauterine growth restriction (M. Bloom)
16.30	G6. Study conditions and air pollution in pre-university institutions (D. Iunac)	H6. Peripubertal serum dioxins and subsequent adult semen quality and sperm methylome in the prospective Russian children's study (O. Sergeyev)
16.50	G7. Dietary Factors May Decrease the Effects of Environmental Hazards on Asthma and Allergy in Children (W. Lawrence)	H7. Heavy metals in water and risk assessment: A case study of the Czarna Przemsza River source in Zawiercie, Poland (A. Gruszecka-Kosowska)
17.10	G8. Plant as remedy for improving indoor air quality (S. Gawroński)	H8. Relationships between air pollution level of PM10 and health status of 8-10 years old children – Results from the Hungarian National Children's Respiratory Surveys (2005-2017) (P. Rudnai)
17.30	Panel Discussion	Panel Discussion

17:50 – 18:40

A Panel for students, post-docs and young researchers: Future environmental health careers

CO-CHAIRS: Kepka, University of Agriculture in Kraków (Poland) AND ERIN MADEEN, JOHNS HOPKINS UNIVERSITY, (USA)

19:30 CEECHE 2018 Gala Dinner

Located in the lower level of the *Kraków Cloth Hall in the Old Town Main Square (Rynek Główny)*

THURSDAY - June 14, 2018

9:00-11:30: PARALLEL SESSIONS I and J

SESSION I: Environmental and health benefits of renewable energy sources

CO-CHAIRS: *Souhail Al-Abed,* ENVIRONMENTAL PROTECTION AGENCY *(USA)*
and Antoni Stasch, European Business Club Association *(Poland)*

SESSION J: Social, political and economic impacts and considerations related to environmental stressors

CO-CHAIRS: ALAN BAKER Laboratoire Sols et Environnement and LABEX Ressources21, ENSAIA/INRA, Université de Lorraine, (France) AND MARGARET REAMS, LOUISIANA STATE UNIVERSITY USA)

TIME	MAIN HALL	ROOM 033
9.10	I1 KEYNOTE. Environmental pollution - A threat of the Earth's life and a killer of 9 million human beings a year (A. Stasch)	J1 KEYNOTE. Applying resilience theory to community engagement with residents facing cumulative environmental exposure risks: lessons from Louisiana's industrial corridor (M. Reams)
9.30	I2. Ecological evaluation of the production of alternative fuel from waste (M. Malinowski)	J2. Community Resilience and Critical Transformations: The Case of St. Gabriel, Louisiana (J. Irving)
9.50	I3. Impact of ozone pretreatment on the biometallurgical properties of toxic wastes (M. Gliniak)	J3. Behavioral and psychosocial risk factors in high school students – results from the Y.A.B.S. study (J. Babjakova)
10.10	I4. Analysis of the biochar production from waste biomass—process influence on quality parameters (M. Jewiarz)	J4. Implementation of "Intended Nationally Determined Contributions" of the Republic of Armenia in rural communities (A. Hambartsumyan)
10.30	I5. Energy management in crops under cover during storage heat in the accumulators: energy and ecological effects (H. Latala)	J5. Anthropocene and the Contemporary Environmental Situation (O. Khan)
10.50	I6. Gasification of waste and biomass-energetic and environmental effects (S. Famielec)	Panel Discussion
11.10	I7. Polish concept and 46 years research and training on primary prevention of environmental risk factors (e.g. cancer prevention, sustainable development focused on better environmental health in industrial and recreational areas) (J. Dobrowolski)	

11:40-13:00: CLOSING SESSION – Main Hall

CO-CHAIRS: Heather Henry, National Institute of Environmental Health Sciences (USA) and S. Małek, University of Agriculture (Poland)

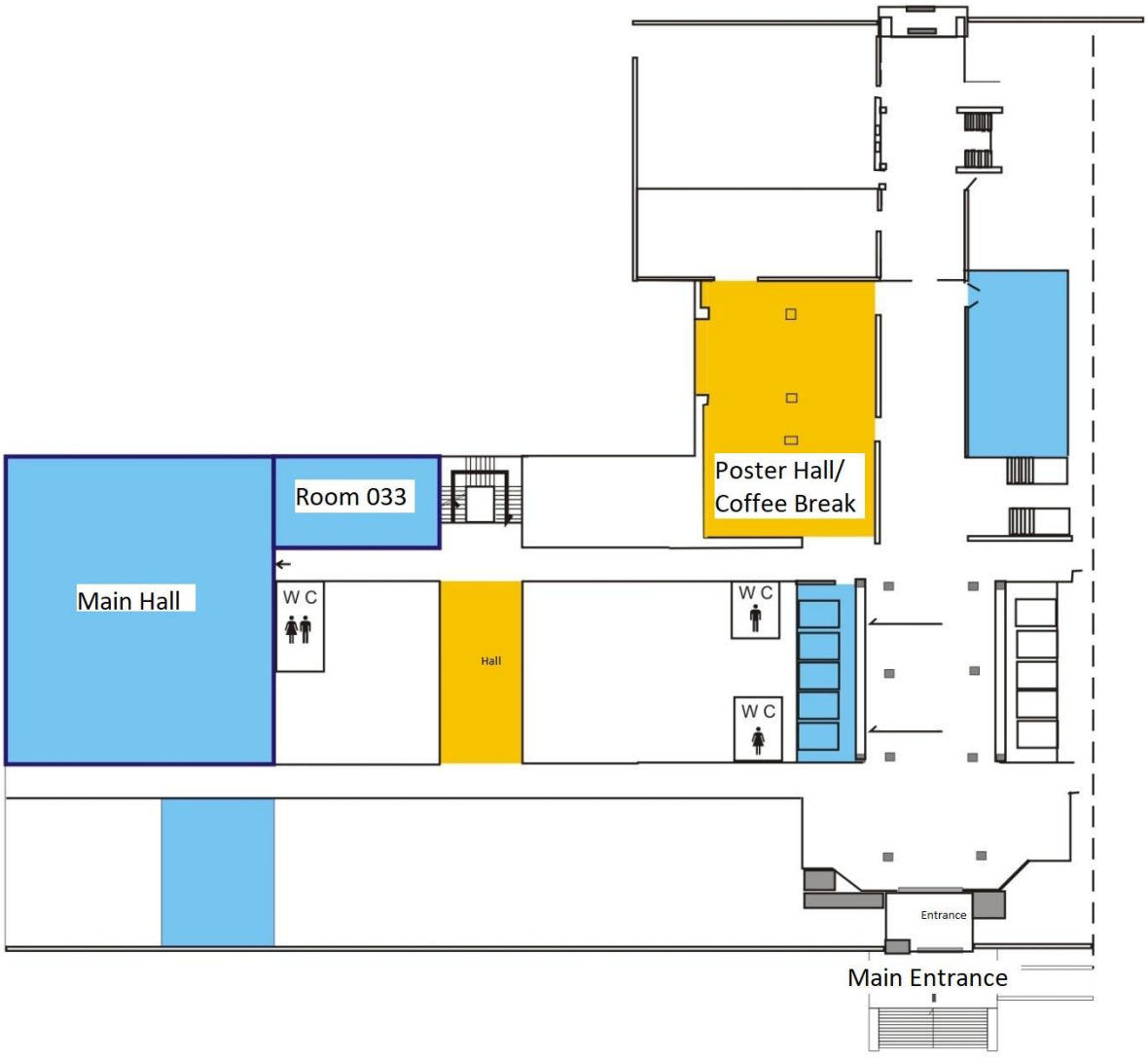
Plenary Presentation - Main Hall

Analysis of the Toxicity of Combustion Aerosol: Chemical Composition of Different Combustion-Emissions and their Molecular Biological Effects on Air/Liquid-Interface Exposed Lung Cells

R. Zimmermann, Joint Mass Spectrometry Centre, Rostock University (Analyt. Chem.) & Helmholtz Zentrum München, Germany

Closing Remarks

CONFERENCE VENUE



Plenary Session

Advancing Science in Rapidly Changing Environments

William A. Suk

Director, Superfund Research Program, NIEHS/NIH, Research Triangle Park, NC, USA

Finding innovative science-based solutions to environmental health issues is critical given the potential impacts associated with rapidly changing environments. It is reported that pollution is linked to 1 in 6 deaths worldwide, or 9 million premature deaths in 2015. In addition, it is estimated that the economic costs associated with pollution management exceeds $4.6 trillion USD each year. Despite these staggering findings, the future may yield greater environmental issues resulting from the demands of growing economies and the increasing magnitude of natural disasters. For example, growing economies may bring about the introduction of new chemical products with unknown toxic properties as well as expansion of mining, agriculture, electronic waste generation, etc. Furthermore, natural disasters of increasingly greater magnitude are on the rise, creating major challenges for environmental health. The impacts of these on activities on human health could be detrimental; however, traditional toxicological approaches require considerable resources, infrastructure, and time – luxuries that may not be practical in these scenarios. Hence, there is a need to advance new approaches to meet the demands for these rapidly changing environments. Addressing these complex challenges requires an integrated, multidisciplinary approach including toxicology, engineering, nutrition, and community engagement. The NIEHS Superfund Research Program (SRP) has championed this type of research since its inception. One of the key mandates of the NIEHS Superfund Research Program (SRP) is to develop advanced techniques for the detection, assessment, and evaluation of the effects on human health of hazardous substances. By combining multidisciplinary expertise, many of SRP grantees have been successful in creating cutting edge rapid screening tools for environmental assessment and toxicity testing. As biological knowledge continues to evolve, SRP researchers are also developing better computational models that integrate in vitro, in vivo, and in silico data. As we move forward, these new approaches can improve what we know about how complex real-world exposures lead to disease – and how to prevent exposures and reduce the uncertainty of risk posed by hazardous substances.

Environmental Pollution and Civilization Disorders

Ewa Konduracka

Jagiellonian University School of Medicine and John Paul II Hospital

Environmental pollution is reaching worrying proportions worldwide. Although the exact contribution of environmental factors to the development of death and diseases cannot be precisely determined, the World Health Organization (WHO) has estimated that 13 million deaths annually are attributable to environmental causes. The link between pollution and health is like chain reaction from sources to health effects.

Several conditions are needed for the development of health effects :appropriate time of exopsure-often relatively long periods , or repeated occasions, human individual vulnerability, human behavioures, lifestyle, coexistent disorders. Some epidemiological issues should be emphasise at this moment. The number of potential pollutants is countless and most of them was not evaluated in term of their toxicity and health risks. Pollutants rarely occur in isolation; more typically they exist in combination, so we are usually exposed to mixes of pollutants, often derived from different sources, some of which may have additive or synergistic effects. Health outcomes may be more or less specific to exposures to particular pollutants. Individual exposures can give rise to a range of different health effects. Many acute effects are almost immediate, and have latencies typically of no more than a few minutes to a few days , whereas chronic effects can have latencies of several years—up to 20 years or more. Although the development of diseases is multifactorial, the contribution of environmental pollution to the burden of disease is well documented. In fact , there are only few diseases that are not affected by pollution. Pollution affects: lungs, heart and vessels, brain, immune system, fetus, mortality, endocrine system.

A New Class of Environmental Pollutant Increases Morbidity and Mortality from Influenza Virus Infection

Stephania Cormier, Vivek Patel and Jeffrey Harding

Louisianan State University

While exposure to elevated levels of airborne PM pollution has been associated with adverse health outcomes such as asthma and chronic obstructive pulmonary disease, several recent epidemiological studies have also recognized an association between exposure to elevated levels of PM and decreased resistance to respiratory tract viral infections. Our previous studies demonstrated combustion derived PM containing environmentally persistent free radicals (EPFRs) induced immunosuppression allowing for enhanced influenza disease severity and mortality in neonatal mice. Current studies were aimed at understanding the mechanism of this immunosuppression.

C57Bl/6 mice were acutely exposed to a EPFRs, and infected with influenza virus. Weight loss, survival, pulmonary viral load, and pulmonary adaptive immune responses were analyzed. To understand the role of genetic susceptibility in severity, we also characterized disease severity in recombinant inbred mouse lines and sex as a variable was analyzed.

Mice exposed to EPFRs had significantly enhanced morbidity and decreased survival following influenza infection. Increased oxidative stress was also observed in the lungs of these mice. Reduction of oxidative stress attenuated these effects. A significant increase in pulmonary regulatory T cells (Tregs) and the immunosuppressive cytokine, IL10, was observed in CDPM exposed and influenza infected mice, which peaked at 10 days post exposure compared to air exposed and Flu infected mice. This coincided with decreased T helper 1(Th1) and cytotoxic T cell (Tc1) responses that play an important role in protecting against Flu infection. Using mice deficient in Tregs or by administration of recombinant IL10 to the airways, we were able to demonstrate the role of these cells, and their effector cytokine, in enhance influenza severity following influenza infection.

Individual differences in human and mouse responses to air pollutants suggest that some subpopulations are at increased risk to detrimental health effects following exposure. Our data further demonstrated that EPFR exposure induced transient activation of the aryl hydrocarbon receptor (AHR) resulting in transient activation of AHR-dependent ILC3 and IL22 responses in the lungs. IL22, which is important in epithelial repair and resolution of inflammation following influenza infection, remained at baseline even following infection. Cyp1a1 expression (as a readout for AHR activation) was found to vary widely depending on the mouse strain following exposure to PM demonstrating a heritability in gene expression traits and disease severity.

Conclusion: Exposure to EPFRs increases influenza virus disease severity and mortality. Immunosuppression following exposure to EPFRs was important in enhanced disease and inhibiting oxidative stress or airway epithelial injury during exposure improved outcome. AHR responses following exposure to EPFRs varied considerably among mouse strains suggesting the existence of genetic subpopulations are at increased risk to detrimental effects following exposure. Improved monitoring for specific components of PM including free radical species and/or development of efficient filtration systems will reduce morbidity and improve survival during such exposures.

Healthful Nutrition as a Modifier of Pollutant-Induced Inflammatory Diseases: Implications in Atherosclerosis

Bernhard Hennig , Michael C Petriello

University of Kentucky

There is strong evidence that environmental pollutants and related chemical stressors can contribute to the pathology of inflammatory diseases, such as atherosclerosis and other cardiovascular diseases (CDVs). Furthermore, nutritional components with anti-oxidant and anti-inflammatory properties are known to lesson or buffer disease risks linked to environmental exposure. Atherosclerosis and other CVDs are defined as inflammatory diseases, which suggests that multifactorial interactions linked to exacerbated disease pathology include pro-inflammatory chemical and non-chemical stressor. Many pollutants or chemical stressors with pro-oxidant and pro-inflammatory properties include persistent organic pollutants that have an affinity for the aryl hydrocarbon receptor (AhR). AhR ligands lead to induction of P450s and free radical formation, followed by inflammation. For example, dioxin-like PCBs can increase endothelial cell dysfunction and activation (e.g., increased adhesion molecule expression and cytokine production). Recent data suggest that genetic and lifestyle factors are independently associated with susceptibility to CVD. Thus, potential biological interactions between chemical and non-chemical stressors and buffers will determine disease outcome. Non-chemical stressor/buffers can often be controlled by an individual and include diet and/or nutritional quality and physical activity (sedentary vs. active lifestyles). Our data suggest that nutrition, or the type of diet we eat, can modulate environmental insults. For example, fats/oils high in omega-6 fatty acids can act as pro-oxidative and pro-inflammatory stressors. Adhesion molecule (VCAM-1) expression was negligible in mice fed an olive-oil–enriched diet, whereas, corn-oil–fed mice exhibited elevated VCAM-1 expression. In corn-oil–fed mice, PCB treatment further increased VCAM-1 staining in aortic tissues. In contrast, foods rich in omega-3 fatty acids and plant-derived polyphenols can act as non-chemical buffers. For example, supplementation with green tea extract leads to increased antioxidant protein expression in the presence of PCB 126. Many pollutants and pro-atherosclerotic nutrients/diets can activate NF-kB signaling leading to increased oxidative stress and inflammation, and many anti-inflammatory nutrients can decrease inflammation by activating Nrf2 signaling. Our data, including metabolic profiling, suggest that the pathology of PCB-mediated inflammatory diseases is complex and may involve disturbances in the gut microbiota, liver and vascular tissues. Of special interest are approaches of prevention/intervention to lower disease outcome linked to complex interactions of chemical stressors to modify CVD disease outcome. (supported in part by NIEHS/NIH grant P42ES007380)

Climate Change Impacts, Climate Strategies and Alternative Energy Perspectives in the Cities of Eastern Europe

Svitlana Romanko, Vasyl Stefanyk Precarpathian National University

Eastern Europe and Central Asia countries have had a negative prerequisites for public health awareness, connected to the climate change impacts. Given the Soviet tradition of extensive nature use, the system of monitoring of climate change impacts in the cities was inappropriately insufficient. No country from 12 countries of the region has not adopted the Law On Climate. Citizens are not informed of main climate impacts in the cities - heat and cold waves and others.

Sometimes local climate policies are formed by the specific Climate Strategies and/or Action Plans development in the cities. These strategies are mostly focused on local adaptation to climate change impacts and can be significantly resulted. The state regulation at the same time assets the framework, often not accompanied by effective mechanism of implementation.

Resolution of the Cabinet of Ministers of Ukraine № 932-r, adopted on December 7, 2016 ""On Approval of the Concept of Implementation of State Climate Change Policy for the Period until 2030» provides general provisions of the Paris Agreement implementation and gives a whole new perspective for reducing greenhouse gas emissions, adaptation to the effects of climate change and, consequently, a gradual just transition to a low-carbon scenario of the country's development.

Low Carbon Development Action Plan of Ukraine (2017) created the catalog of national policies and measures on low carbon development. Other countries of the region are on the same level of climate policy development, except Belarus. Yet any of the regional countries adopted the Law on Climate.

State monitoring systems in a majority of regional cities still lack the technology and capacity to monitor the air pollution in the cities and GHG emissions as it’s not a priority. A package of regulations on the establishment of a system for monitoring, reporting and verification of GHGs in Ukraine drafted and discussed on the open public events. In other countries, e.g.Kazakhstan, its not possible to adopt such a legislation at all, as 80% of their economy based on fossil fuels.

The main goals of the climate policy in the cities of the region should be defined as :

- reduction of the emissions of greenhouse gases to meet commitments under international climate change agreements in 2030;

- joining the Covenant of Mayors EU initiative to increase energy efficiency of cities at least 40% by 2030, energy supply from renewable sources of energy to 18% by 2020;

- development and adoption of Climate Strategies in the cities and the State Program ""Protection and Counteraction to Climate Change for 2018-2030"";

- implementation of measures in the energy, transport, and environmental sectors;

- carbon tax as an additional financial burden

- system of public early warning system of climate impacts.

Agromining: Farming for Metals and the Valorization of Metal-Contaminated Lands and Wastes

Alan J M Baker, JL Morel, G.Echevarria, A.Van der Ent

Laboratoire Sols et Environnement and LABEX Ressources21, ENSAIA/INRA, Université de Lorraine, Vandoeuvre-lès-Nancy, France

Serpentine (ultramafic) outcrops in Europe cover > 10,000 km2 and have a low fertility and low productivity, making them unattractive for traditional agriculture. These areas are generally slowly being abandoned by local farmers, affected by strong rural exodus and landscapes undergo a process of closure. However, ultramafic landscapes have the potential to provide multiple ecosystem services that can contribute to Europe's goals towards ensuring food security, production of renewable raw materials and renewable energy. Agromining aims at cultivating metal hyperaccumulator plants that are able to accumulate nickel and other strategic elements from metal-enriched soils and transport them to the shoots (> 1%), which can then be harvested as a bio-ore. Such metal-rich biomass can be used to recover highly valuable metals such as nickel, and also to produce energy (heat, electricity) and hence the circular economy. Nickel agromining can thus offer an eco-efficient alternative to classical pyro- or hydrometallurgical processes without disturbing the soil cover and the geology from soils and rocks that would be considered as low-grade ores or sterile material unsuitable for conventional mining methods. Phytomining agro-ecosystems can lead to better soil resource efficiency and can offer a fully integrated, new agromining agriculture that could cover thousands of km2 in Europe, benefit local communities with a sustainable rural development and provide a wide array of ecosystem services which will need to be optimized under a life cycle assessment methodology: (1) Production of bio-sourced metal products; (2) Production of energy biomass; (3) Restoration of soil fertility for conventional agriculture (Ni stress); (4) Limiting Ni intake by local populations and farmers; (5) Use and conservation of local biodiversity (plant and soil fauna and microflora) as cultivated ecosystems; (6) Storage of carbon in cultivated soils and (7) Enhancement of pollination activity at landscape level. In SE Asia, there are also vast areas of ultramafic (lateritic) soils where agromining can be applied. These include both forested and cleared areas uneconomic for traditional mineral exploitation, as in Malaysia, Indonesia and New Caledonia. Work is currently underway in Sabah to restore some value to land abandoned after failed oil palm crops. Agromining can also be integrated into the planning of progressive mineral exploration and post-mining restoration for new mineral concessions. Nickel agromining may therefore be helpful in changing the economical balance in historically-disadvantaged ultramafic regions of the world.

Analysis of the Toxicity of Combustion Aerosol: Chemical Composition of Different Combustion-Emissions and their Molecular Biological Effects on Air/Liquid-Interface Exposed Lung Cells

R. Zimmermann1, T.G.Dittmar2, T.Kanashova2, J.Buters3, S.Öder3,1, H.Paur4, M.Dilger4, C.Weiß4, B.Buchholz5, B Stengel5, K.Hiller7, S.C.Sapccariu7, K.A.BeruBe8, T.Krebs9, T.Streibel1, J.Schnelle-Kreis1, M.Sklorz1, J.Passig1, J.Orasche1, P.Jalava6, M.Happo6, M.-R.Hirvonen6, O.Sippula6, J.Jokiniemi6 and further HICE co-workers (et al.)

1 Joint Mass Spectrometry Centre, Rostock University (Analyt. Chem.) &Helmholtz Zentrum München (HMGU/CMA),Germany,
2 MDC, Berlin, D;
3 ZAUM, Technical University Munich, D;
4 KIT (ITC/ITG), Karlsruhe, D;
5 University of Rostock (Inst. of Piston Machines/Int. Combust. Engines)D;
6 University Eastern Finland-Kuopio;
7 Uni Luxemburg;
8 Cardiff University, UK;
9 Vitrocell GmbH, Waldkirch, D;

Combustion aerosol emissions are important for air pollution induced health effects. The acute response of lung cells onto combustion aerosols include e.g. oxidative stress, inflammation or apoptosis. Only few links between aerosol chemical composition and biological effects have been established yet. In the framework of the Virtual Helmholtz Institute-HICE (www.hice-vi.eu), physical and chemical properties of combustion emissions as well as their biological effects on lung cells (human epithelial cells, A549, BEAS2B, primary cells and murine macrophages, RAW) are jointly analysed. Partly animals were exposed (BL6 mice) for validation purposes. Chemical composition and physical parameters of the emissions were thoroughly characterized. For addressing the biological activity/toxicity of the aerosols, the lung cell-cultures were realistically exposed by novel air-liquid interface (ALI) exposure-systems. After 4h exposure biological effects were analysed by multi-omics characterisation (transcriptomic, proteomic and metabolomics level). Emissions of wood-pellet- and log wood-stoves, ship engines, car diesel - and gasoline-engines were investigated by this approach using two field-deployable ALI-exposure-station systems and a mobile S2-bio safety laboratory. After exposure biological effects were comprehensively characterized (viability, cytotoxicology, multi-omics) and are put in context with the chemical and physical aerosol data. Interestingly, the observed biological response-strength differs considerably for different aerosol sources and is not correlated to the deposited PM2.5-mass. This points towards large differences in the relative toxicity of the aerosol emissions from different combustion sources and fuel types. Furthermore adverse and protective effects are observed for different compounds. For example, well burnt-out, low-PM2.5 pellet-burner emission cause higher adverse biological effects than organic-rich, high-PM2.5 logwood stove-emissions. The high abundance of antioxidant compounds such polyphenols in the logwood stove-emissions likely explains this counter-intuitive observation. The latter findings are supported by detailed analyses of activated cellular response pathways (GO-term analysis), depicting regulation of pathways such as pro-inflammatory signalling, xenobiotic metabolism, phagocytosis or oxidative stress and findings from the animal exposure experiments. Further experiments included e.g. exposures with simulated atmospherically-aged emissions (UV-aging in flow tube).

Short Plennary

The role of forests and their impact on people's health

Andrzej Konieczny
Director General of the State Forests
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In the past, forests in Poland occurred virtually on the entire territory of the country. The last centuries brought about various socio-economic processes with dominating economic objectives as intense industrial and rural development, due to that, the forest structure changed profoundly. A major influence on the forest structure had been exerted by the historical circumstances, especially the time of wars and Poland's partitions. In the end, Poland's forest cover decreased to 20,8 % in the year 1945. The species composition pauperized and the biological diversity deteriorated. The reversal of this process began only after World War II, as soon as the afforestation of non-agricultural land started. Nowadays, the forest area in Poland is 9230 thousand hectares (according to the Central Statistical Office of December, 31st, 2016), which constitutes a forest cover of 29,5 %.

Polish forests thrive and perform various functions, i.a. 1) environmental functions, e.g. creating a positive impact on climatic conditions and water circulation in the environment; 2) social functions, as creation of favourable health and recreation facilities for the society; 3) productive (economic) functions, mainly production of biomass and timber, as well as game management. Forests in this climatic zone are the indispensable factor to preserve the ecological stability of the country. Moreover, this is the form of land use that provides the production of timber resources. The State Forests serve the society by managing forests and delivering important products and services of non-merchantable value. Furthermore, forests are common good, they boost the quality of human life, therefore they have a significant impact on people's life and health.

Polish forests, performing various functions, promote the development of tourism, recreation and health recovery, especially on areas of great natural and scenic values, also on areas considered as health resorts. What is more, forests have a positive impact on climate, as they participate in cleaning the air of CO2, forests reduce noise and affect positively the microclimate of urban areas. According to the policy regarding forests and forestry in Poland, the State Forests will continue to develop the recreation, leisure and health facilities on forest areas by evolving tourist infrastructure. The State Forests are active participants of projects aimed at mitigating climate change and promoting ecological wood housing. The State Forests, managing state property, realize in a socially responsible way the development strategy of the country, profitable for the society, economy and environment.

ROCKET FUEL OXIDISER (*MELANGE*) – POLISH METHOD OF DISPOSAL

Waldemar Maliszewski, Dariusz Mikolajek, Tomasz Borkowski

Rocket fuel oxidiser (melange) was used in ground-to-ground rockets (inter alia Scud) and ground-to-air rockets by the armies of the Warsaw Pact for the combustion of high-energy liquid fuels (Tonka, Izonit). After the collapse of the Soviet Union and of the Pact, large quantities of this oxidiser remained as deposits on the territories of countries that participated in the Pact, former republics of the Soviet Union and countries using Soviet weapons.

Vapours cause severe inflammation of the respiratory tract. They may cause direct pulmonary oedema or bronchopneumonia as a delayed effect. In case of ingestion, death occurs as a result of perforation of the stomach or intestines. Toxic dose is 2 – 3 g, lethal dose is 4 – 8 g. It causes coagulation of protein substance and necrosis as well as deep changes due to skin charring.

POLISH METHOD OF *MELANGE* DISPOSAL

Spilt over large body surface may cause a shock and collapse. In contact with eyes, it causes dehydration and coagulation of protein in corneal and conjunctival epithelium. The resulting coagulative necrosis usually protects tissues from further penetration of the oxidiser. In toxic inflammations, extent exceeding 15% of body surface may be fatal.

In 2005 – 2007, under a targeted project co-funded by the Ministry of Science and Higher Education, an eco-friendly method of disposal of rocket fuel oxidiser was jointly developed by the Wrocław University of Technology and Grupa Azoty Jednostka Ratownictwa Chemicznego Sp. z o.o. in Tarnów. This method involves the transformation of *melange* into a solution of nitric (V) acid by means of removal of nitrogen oxides from the oxidiser with the use of disproportionation reaction and diazonisation reaction. Reaction product – nitric (V) acid – used for the production of nitrogen fertilisers.

This method is environmentally friendly and eco-safe. No liquid or solid waste is produced in this process. Waste gases from the reactor and tanks are absorbed in the absorption system and are not released into the air. The absorbate is disposed of in the process of oxidiser processing.

In 2007, in Grupa Azoty Jednostka Ratownictwa Chemicznego Sp. z o.o., a mobile *melange* disposal plant was designed and built in Radekiv, Ukraine, funded by the Polish Ministry of Foreign Affairs with disposal capacity of 7 mt/24h. This plant allowed for the disposal of *melange* in the place where it was stored.

In 2008, 215 Mg of oxidiser were destroyed in Ukraine. The disposal product (50% nitric(V) acid) was transported to Poland and used in chemical plants for the production of fertilisers.

In 2009 – 2010, the Military Property Agency contracted Grupa Azoty Jednostka Ratownictwa Chemicznego Sp. z o.o. to dispose of ca. 906 Mg and in 2014 - 5 Mg of *melange* stored in Poland.

This process was conducted in a stationary plant adjusted to the disposal method with the use of urea. *Melange* was transported in tankers from Jaromin, Bieszkowice and Mrzeżyno to the place of disposal in Tarnów. The disposal product (nitric acid) was used for the production of fertilisers.

SESSION A
MONDAY, June 11, 2018
12:10-15:40

Chemistry, health risks and solutions for atmospheric air pollution

Session Chairs:
E. Konduracka ekonduracka@interia.eu
S. Cormier stephaniacormier@lsu.edu

KEYNOTE

PM Air Pollution – Are EPFRs (Environmentally Persistent Free Radicals) a marker of PM's health impacts?

Slawo Lomnicki, F. Hassam, A. Bruce-Keller, C. Guo

Louisiana State University

Studies of detrimental effect of air particulates on human health have a long history. However, despite a consensus of the research community on the detrimental effects of ambient air PM concentration on health, a major determining factor of PM toxicity is heavily disputed. Studies point to PAHs, transition and toxic metals, nitrates and sulfates as the PM components responsible for PM toxicity, however a direct correlation remains elusive. Thus a question needs to be asked if there is a different mechanism or component that may be a key factor to their toxicity. Recently discovered EPFRs may be a "missing piece of the puzzle". Recent studies have indicated that common methods for collection and extraction of PM can alter or destroy the EPFRs thus introduce a significant artifact in the experiment, which can translate to inconsistent experimental results. New methods have been developed to overcome this issue. When using new collection method, it was discovered that EPFRs have a large spatial and temporal variation within the mall area, such as urban location, independently from the PM concentration, thus contributing to potential varying toxicity outcomes. The Presence of EPFRs on PM also affects the fate of other organics upon deposition in physiological media

Using a PM-EPFR model, the oxidative stress potential was found to be dependent on the concentration of EPFRs. In fact EPFRs have been already correlated with serious health outcomes as asthma exacerbation. Ultrafine PM can migrate through the epithelium into the systemic circulation, transport to cerebral microvasculature and interact with human cerebral endothelial cells, evoking oxidative stress in the latter and lead to degradation of blood-brain barrier. As a result, chronic exposure to EPFRs can lead to a chronic oxidative stress in the BBB and to irreversible changes in brain function and physiology. The in vitro (hCMEC/D3 cells) and in vivo (mouse) studies of the exposure to EPFRS indicate that EPFRs can induce oxidative stress in the cerebral microvascular cells. There is a potential link (as evidence by our data) between the endothelium damage caused by the EPFR exposure and the Central Nervous System inflammation, through the BBB leakage as evidenced by the tight junction degradation. This is a cascade of events associated with the exposure to PM containing EPFRs. In case of chronic exposure some indication exists, that this may lead to the neurodegeneration.

Fate of selected pollutants of concern: Surface and Environmentally Persistent Free Radicals (EPFRs) assisted oxidation

Ajit Ghimire, Farhana Hasan, Balamurugan Subramanian, Phillip Potter, Xia Guan, Slawo Lomnicki

Louisiana State University, Department of Environmental Sciences

Formation of Polyaromatic hydrocarbons (PAHs) and Environmentally Persistent free radicals (EPFRs) typically occurs side by side during combustion related activities. EPFRs when reacted with O2 or with aqueous medium either in lungs or in an environment form Reactive Oxygen Species (ROS). The formed ROS can transform PAHs into oxy-PAHs. Since these oxy-PAH are more soluble than their parent PAH, they are more bioavailable and effect the physiological activities. It is generally believed that the cytochrome P450 metabolism converts PAHs to their hydroxylated, toxic form. Our hypothesis suggest, that EPFRs on PM can activate and desorb PAHs to a larger extent causing additional biological stress to their ROS generation capabilities.

For the studies presented, we analyzed the effect of Fenton's reagent and EPFR-laden particles on the formation of oxy-PAHs from anthracene adsorbed on particles. Fenton's solution did not yield any Anthracenol and yielded only one isomer of Anthraquinone. We found the formation of various isomers of Anthracenol and Anthraquinone in the presence of EPFRs in aqueous media, indicating the increased bioavailability of PAHs. Since Fenton's solution did not produce any Anthracenol, it indicates an important role of EPFRs in PAHs activation. The hydroxyl radical concentration gradient around PM can be a critical factor in this process. Additionally, the PAH activation was distinctly higher when we used substituted PAH i.e. 1- Methyl Naphthalene (1-MN) co-inhabited in the same particles with EPFRs. EPFRs showed clear oxidation of 1- Methyl Naphthalene both at ambient and physiological conditions. Oxidation products of 1-MN were Naphthoquinone, 1- Naphthalene carboxaldehyde, 4 Hydroxy 4 Methyl 4H-Naphthalene 1 one, and Hydroxy-Methyl Naphthalene.

Dioxin-like PCB 126 increases systemic inflammation and accelerates atherosclerosis in lean LDL receptor deficient mice

Mike Petriello, Michael C Petriello, J. Anthony Brandon, Jessie Hoffman, Chunyan Wang, Himi Tripathi, Ahmed Abdel-Latif, Xiang Ye, Xiangan Li, Liping Yang, Eun Lee, Sony Soman Jazmyne Barney, Banrida Wahlang, Bernhard Hennig, and Andrew J Morris

University of Kentucky

Exposure to dioxins and related persistent organic pollutants from airborne and dietary exposures likely contributes to cardiovascular disease (CVD) risk through multiple mechanisms including the induction of chronic inflammation. Epidemiological studies have shown that leaner individuals may be more susceptible to the detrimental effects of lipophilic toxicants because they lack large adipose tissue depots that can accumulate and sequester these pollutants. This phenomenon complicates efforts to study mechanisms of pollutant-accelerated atherosclerosis in experimental animal models where high-fat feeding and adipose expansion limit the bioavailability of lipophilic pollutants. Here, we investigated whether a model dioxin-like pollutant, PCB 126, could increase inflammation and accelerate atherosclerosis in Ldlr -/- mice fed a low-fat atherogenic diet. We fed Ldlr -/- mice the Clinton/Cybulsky diet (10% kcal fat, 0.15% cholesterol) and sacrificed mice at 8, 10, or 12 weeks post PCB (2 doses of 1 µmol/kg) or vehicle gavage. To characterize this novel model, we examined the effects of PCB 126 on markers of systemic inflammation, hematological indices, fatty livers, and atherosclerotic lesion size. Mice exposed to PCB 126 exhibited significantly increased plasma inflammatory cytokine levels, increased circulating biomarkers of CVD, altered platelet and red blood cell counts, increased accumulation of hepatic fatty acids, and accelerated atherosclerotic lesion formation in the aortic root. PCB 126 also increased circulating neutrophils, monocytes, and macrophages as determined by flow cytometry analysis. Exposure to dioxin-like PCB 126 increases inflammation and accelerates atherosclerosis in mice. This low-fat atherogenic diet may provide a useful tool to study the mechanisms linking exposure to lipophilic pollutants to increased risk of CVD. Ongoing studies are now focused on decreasing the toxicity of dioxin-like pollutants using healthful nutrition.

A Study of tree species phytofiltration properties in the green infrastructure of the city of Yerevan (Armenia)

Gayane Nersisyan, Hasmik Hovhannisyan

Center for Ecological-Noosphere Studies of the Nationa Academy of Sciences RA

It is common knowledge that one of the cost - effective methods applied in measures designed for the decrease of environmental pollution levels is the use of ecologically tolerant tree species with high phytofiltration potential in urban greening. Heavy metals and dust are one of major pollutants of the Yerevan environment – Armenia's capital city.

The goal of this research was to ecologically assess the tolerance of Yerevan street and park tree species and to select tree species with phytofiltration properties which would be appropriate for Yerevan greening. The research objects were soils and basic tree species growing in 10 parks and squares and 20 streets throughout the city.

The obtained research outcomes allow concluding that the assortment of trees growing in Yerevan parks and squares and streets includes some 50 and 30 species, respectively. Yerevan parks, squares and streets are not adequateley planted. Studies have found that the contents of heavy meatals emphasizing Mo and Ni in plants that grow in Yerevan exceed the acceptable norms. The research carried out recently has detected mercury in Yerevan plants as well. The selected ecologically tolerant tree species having best phytofiltration properties include Robinia pseudoacacia L., Fraxinus excelsior L., Fraxinus pennsilvanica Marshall, Populus alba L. and Koelreuteria paniculata Laxm.

Keywords: Urban greening, tree species, heavy metals, phytofiltration properties.

Health impact of suspended particulate matter in some Hungarian cities assessed by Airq+

Anna Paldy[1], Tibor Málnási, Márta Szalkai Janos Bobvos, Tamás Rudnai

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Air pollution is one of the major environmental risks; the global burden of respiratory and cardiovascular diseases as well as lung cancer can be significantly reduced by the decrease of this exposure. It is well known that mortality is by 15-20 per cent higher in cities with high air pollution than in clean cities.

The air quality of the Hungarian cities considerably improved between 2005 and 2013, it was the best in 2009, when the limit concentrations were not surpassed. The highest air pollution was measured in 2005 and 2006. The evaluation of the emission and immission data has not been the task of the public health authorities since 2002, however the short- and long term health impact assessment of air pollution - with special regard to suspended particulate matter - and the information of the public still belong to the public health system.

The health impact assessment of air pollution was carried out for 13 cities with on-line monitoring stations for the years of 2005-2013 by the Airq+ program developed by WHO in 2015. Daily air pollution data were retrieved from the database of the National Air Quality Monitoring Network. For the assessment of the short term impact of air pollution PM10 data, while for the long term effect PM2.5 data (computed from the PM10 data multiplied by a factor of 0.8) were used. The short and long-term health outcomes were all cause and cause specific mortality (cardiovascular diseases, lung cancer, COPD, hospital admissions, years of life lost, lost work days, restricted activity days) were computed by using relative risks from international literature as well as daily air pollution concentration. A log linear method was used to calculate the health impacts.

The decrease of the daily mean PM2.5 concentration to 25 µg/m3 in a short term could avoid 0.5-2% of total mortality in the study period. Both the number of lost working days and the number of days with restricted activity could be reduced by 5% in the most polluted year 2005, in other years the gain could be between 1-2.2% in Budapest. The hospital admission due to circulatory diseases could be decreased by 1% and by 2% due to respiratory diseases in the capital.

In the long run the yearly PM2.5 concentration over 10 µg/m3 is responsible for 4-14% of all cause mortality with great variability among cities (a yearly mean of 1500 cases in Budapest and 150 cases in Debrecen, the second biggest city. 10-15% of lung cancer deaths, 4-14% of COPD deaths can be attributed to PM2.5 pollution. The yearly mean life loss was 800 years in Budapest in the total population while 150 years among the population younger than 64 years.

Our results strengthen the evidence that by reducing air pollution the burden of disease can be reduced significantly, especially on a long term

Aristolochic acid I and Balkan Endemic Nephropathy etiology: a potential exposure pathway through soil

Lavinia-Paula Draghia, Alexandra T. Gruia, Camelia Oprean, Alexandra Ivan, Ada Cean, Mirabela Cristea, Roxana Damiescu, Nikola M. Pavlovic, Virgil Paunescu, Calin A. Tatu

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Known as carcinogenic and nephrotoxic substances produced in Aristolochia species, aristolochic acids (AAs) are considered (co)factors in Balkan endemic nephropathy (BEN), a severe kidney disease geographically restricted to discrete rural areas of the Balkan Peninsula. The exposure pathways to these toxins are still questionable for the villagers living in the BEN areas, although AAs have been directly involved in BEN etiology. Chronic exposure to AAs through the food chain and environmental pollution could provide an explanation for the presence of BEN in the countries where no folkloric use of the plant has been documented (Bulgaria and Croatia), unlike the areas where Aristolochia plants have been used as traditional medicine in various ethnobotanical preparations (Romania and Serbia). We can assume that additional exposure pathways are likely to occur, as our team has previously demonstrated that under controlled laboratory conditions AAs can contaminate crop plants through absorption/adsorption from soil. In this presentation, we attempt to provide additional support to this potential exposure pathway, by revealing the presence of AAI in soil and soil organic matter samples collected from BEN (endemic and non-endemic) areas and non-BEN areas. The samples were solvent extracted, analyzed and quantified by liquid-chromatography coupled with ion trap mass spectrometry (LC/MS). Our results showed the presence of AAI in small concentrations, both in BEN and non-BEN soils, especially where Aristolochia plants and seeds were present.

SESSION B
MONDAY, June 11, 2018
12:10-15:40

Topics of growing awareness related to environmental health

Session Chairs:
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KEYNOTE

Electromagnetic fields and human health

David O. Carpenter

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Human exposure to electromagnetic fields (EMFs) has increased enormously in recent years with the advent of mobile phones, cell towers, WiFi, smart meters, 5G, the Internet of Things, in addition to fields associated with radio, TV and electricity. While we all benefit from these technologies, it is increasingly certain that excessive exposure to both extra low frequency (ELF) EMFs from electricity and radiofrequency (RF) EMFs used for communication is associated with increased risk of human disease. The most serious is well-documented increases in incidence of cancer. Elevated exposure to ELF EMFs is associated with elevations in rates of childhood leukemia, and rates of childhood leukemia are also elevated with residential proximity to high-powered radio transmission towers. Of more recent concern is evidence for increased incidence of gliomas, glioblastomas and acoustic neuromas in individuals who hold a mobile phone to their ear for long periods of time. Because the latency for development of brain cancer after exposure is long, and extensive use is recent, we are likely to see significant increases in rates of these diseases in the future. Recent studies by the US National Toxicology Program and by the Ramazinni Institute in Italy have reported the same tumors in rodents at exposures from mobile phones and cell towers, respectively. Women who wear an active mobile phone in their bra are at elevated risk of breast cancer. There is strong evidence that both male and female fertility is reduced by excessive EMF exposure. In addition a syndrome of relatively non-specific symptoms, electro-hypersensitivy (EHS), is occurring in some people. Sensitive individuals experience headache, fatigue, tinnitus, "brain fog" and sometime cardiovascular effects upon exposure to both ELF and RF EMFs. Individuals who develop this syndrome are often seriously impaired. While EMFs in this frequency range are "non-ionizing", in that they do not have sufficient energy to directly damage DNA, there is strong evidence that they generate reactive oxygen species, which indirectly does damage DNA, alter brain metabolism and trigger a variety of cellular and gene-induction responses. Unfortunately safety standards for RF EMF exposure in most countries are based on the false assumption that exposures at intensities that do not cause tissue heating have no adverse effect. These standards must be changed.

Rapid method to quantify carbon nanotubes (CNTs) in environmental media

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The concerns regarding potential environmental release and ecological risks of multi-walled carbon nanotubes (MWCNTs) rise with their increased production and use. Therefore, it is necessary to determine the environmental concentration of the MWCNTs. Several analytical approaches have been demonstrated to quantify MWCNTs in environmental and biological samples based on their optical or thermal-stability, but most methods are most likely affected by the change of the characteristic properties of MWCNTs (e.g. length, diameter, aggregation). The characteristics information of the MWCNTs is usually missing for environmental samples, leading to the measurements inaccurate. In this presentation, our recently developed microwave induced heating method was further studied for the feasibility of quantifying MWCNTs in environmental samples. Our findings indicated that the suppliers, length and diameter of the MWCNTs did not affect the microwave responses due to the unique dielectric heating of MWCNTs with the microwave energy. Although the aggregated MWCNTs were observed not to be active in absorbing and converting the microwave energy to heat, a 2-step pre-treatment procedure (high temperature exposure and acetone based surfactant solution addition) was proposed to disperse bundled MWCNTs that deposited in field samples, making the microwave method applicable. The presented microwave induced heating method with pre-treatment process could provide a solution to the environmental quantification of CNTs and it can be further leveraged to study ecotoxicity of CNTs and to assess risks of using nanomaterials in our everyday life.

Agricultural Field Measurement of Radioactive Cesium in Fukushima

Yoshikatsu Ueda[1], Naoto Nihei, Minoru Tanigaki, Yomei Tokuda

[1]*Kyoto University*

Radioactive Cesium fell down to cultivation area around Fukushima prefecture by the accident of Fukushima Daiichi Nuclear Power Plant on 2011. We conducted various methods to clean up soil for agriculture. One of the major method is to strip topsoil up to 5cm. This decontamination method has been carried out inside highly polluted cultivation field by radioactive cesium and not on the levee around the field still now. We investigate the contamination variation around cultivation area by using the walking radiation measurement system KURAMA(Kyoto University RAdiation MApping system) and by direct measuring of radioactive cesium concentration. We also checked the radioactive cesium in irrigation water for checking the weather dependency. We made map of radioactive cesium concentration on paddy fields (500m x 200m) by KURAMA. In the map, we can recognize there are still high level contamination on levees and in fields without stripping topsoil.

Occurrence and removal of selected pharmaceuticals from the aquatic environment

Joanna Surmacz-Górska Ewa Felis, Adam Sochacki, Anna Węgrzyn, Joanna Kalka, Monika Nowrotek, Korneliusz Miksch

Silesian University of Technology

The Environmental Biotechnology Department (Silesian University of Technology) is involved in research on pharmaceuticals removal from the wastewater since the beginning of the XXI century. Its experience and results gained within a few projects allow to present the issue of occurrence and removal of selected pharmaceuticals from the aquatic environment. For this purpose two test substances were selected - sulfamethoxazole and diclofenac. Sulfamethoksazole is classified as an antibiotic (more specifically: as a sulfonamide), which has a broad spectrum of anti-bacterial way of action. In EU countries, sulfamethoxazole is sold on a prescription. For example, only in Poland its annual consumption is at the level 32.0 Mg. The second substance, diclofenac, belongs to the group of non-steroidal anti-inflammatory and analgesic drugs. The medicines containing diclofenac can be sold both on prescription and over the counter. In Poland its annual consumption is estimated at 21.0 Mg. The residues of these drugs are detected in various compartments of the environment. The main routes of getting these drugs into the environment are wastewater treatment plants, because they are not completely removed from the wastewater during the treatment process. The removal efficiency of diclofenac and sulfametoxazole in conventional wastewater treatment plants based on the activated sludge method are estimated to be in the range of 5.0 – 81.0% and 4.0 – 91.7%, respectively. It has been observed that the temperature of wastewater affects the removal of these two substances. When these substances are removed by means of biological low-cost methods, e.g. constructed wetlands, the effectiveness of their removal is also different. For example, the removal efficiency of diclofenac by means of constructed wetland systems was observed to be in the range of 0.0 – 88.0%. The operation regime, as well as the presence of plants in the system, affect the effectiveness of the elimination of this compound. The contribution of endophyte organisms was also significant. Due to the fact that these substances are not completely removed from wastewater by biological methods, the polishing step is required. The methods of polishing wastewater, based on various physical and chemical techniques, including ozonation, UV radiation or other advanced oxidation processes (AOPs), can be effective in the context of pharmaceuticals' degradation. Ozonation is one of these methods – after 30 min of this process, the removal of both diclofenac and sulfamethoxazole from the treated wastewater exceeded the value of 90%. However, when the physico-chemical methods are used, it is necessary to confirm the ecotoxicological safety of each process, because the post-reaction mixture may be more toxic than the starting substance. Such an example may be an increase in the toxicity of the mixture after the reaction of photo-Fenton for sulfamethoxazole - the toxicity of the mixture after the reaction towards Daphnia magna increased from <1.0 to 9.3 TU. The consequence of sulfamethoxazole in the environment is the presence of genes that are resistant to its action as sul1, sul2 and sul3. Therefore, it is important to look for methods that would remove not only microcontaminants, but also resistance genes from the environment.

Physical activity attenuates alterations of the gut-brain axis and brain metastasis formation induced by PCBs

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Oral exposure to polychlorinated biphenyls (PCBs) facilities the formation of brain metastasis formation by affecting the integrity and dynamic of the blood-brain barrier. Because the gut is the first tissue that is affected by PCB ingestion, we investigated the impact of PCBs on the gut microbiome and the gut integrity. In addition, we evaluated the impact of exercise on these effects. Male mice were divided into two groups, with one group having free access to exercise-wheel for 5 weeks. At the end of the exercise period, mice were gavaged with a mixture of PCBs (PCB153, PCB138 and PCB180; 150 µmol/kg) or with oil (control). Microbiome was assessed using PhyloChip assay based on determination of bacterial 16S rRNA isolated from mouse feces. We observed a substantial shift in microbiome composition that was correlated with the activity level of mice. Specifically, the phylum Tenericutes was far more abundant in samples from sedentary mice, while several Enterococcaceae classified in the phylum Firmicutes were more abundant in samples from exercised mice. Moreover, exercised mice were characterized by more diverse bacterial composition. Treatment with PCBs significantly alternated the microbial composition and disrupted the integrity of the gut barrier integrity in sedentary mice. Importantly, exercise attenuated PCB-induced changes in the gut and the formation of brain metastases. Overall, these results indicate that exercise changes the microbial composition of the gut and attenuates toxic impact of PCBs on tissue barriers.

Impact of Hurricanes Irma and Maria on Puerto Rico Maternal and Child Environmental Health Health Research Programs

Carmen M. Vélez-Vega, Michael Welton, Zaira Rosario, Colleen Murphy, José Cordero, Phil Brown

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Puerto Rico Testsite for Exploring Contamination Threats (PROTECT) and Center for Research on Early Childhood Exposure and Development in Puerto Rico (CRECE) Centers are National Institute for Environmental Health Science (NIEHS) funded Superfund Research Programs that have been investigating perinatal health outcomes among Puerto Rican mothers and infants since 2010. PROTECT an NIEHS Superfund Research Program Center, tests the hypothesis that exposure to phthalates and chlorinated volatile organic compounds contributes to the unusually high rate of preterm birth in Puerto Rico.

The "Center for Research on Early Childhood Exposure and Development in Puerto Rico (CRECE Protocol Number: A8570215)," an NIEHS/EPA Children's Environmental Health Center, focuses on early childhood development in a subset of children born in the PROTECT cohort, to evaluate the impact of environmental exposures (particulate matter, phenols) and modifying factors on children's neurodevelopment. PROTECT/CRECE have been very active in the Hurricanes Maria and Irma recovery efforts–collaborating with other groups to ensure the safety and welfare of team members, study participants, community health center partners, and members of the surrounding communities. These efforts have given our team first-hand experience in the impact of the hurricanes and the difficulties of the recovery. We identify access to care, maternal stress, access to nutrition, and changing environment as major challenges to maternal and child environmental health following Hurricanes Irma and Maria. Furthermore, we propose to include disaster preparedness into our programs' future strategy, recognizing that our close proximity to the storms' impact and recovery, we are able to reflect accurately in order to prepare for the future, using our experiences to improve Puerto Rico's maternal and child health resilience. Examples of successful interventions, and proposed interventions is proposed for this presentation.

SESSION C

Monday, June 11, 2018

15:50-18:00

Environmental issues and local population exposures at former military sites in Central and Eastern European countries

Session Chairs:
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KEYNOTE

The impacts of soil contamination on tree rhizosphere bacterial communities in a forest on an old military site

Jaco Vangronsveld, Sofie Thijs, Wouter Sillen, Pieter van Dillewijn, Jonathan Van Hamme, Nele Weyens

Hasselt University, Belgium

Soils contaminated with explosives due to ordnance decommissioning, manufacturing and use, is a common issue worldwide. Trinitroaromatic explosives are of concern due to their toxicity, mutagenicity and carcinogenicity. An effective, sustainable and economic remediation alternative for 'dig and dump' remediation is phytoremediation, the use of plants and bacteria to remove pollutants from soil. Trinitrotoluene (TNT), is recalcitrant to degradation, and advanced tools are required to mine soils for novel degradative bacteria and better exploit phytoremediation at explosives contaminated sites. Genomic, physiological and analytical data will be presented characterizing the microbial communities at a 100-year old TNT-contaminated site, a site where we went to search for bacteria with interesting genes for TNT-degradation. Further, the construction of a collection of genotyped bacteria with degradative and plant-growth promoting properties will be discussed. Field tests showed a significant effect of TNT on soil microbiota diversity and composition, both in the non-vegetated bulk soil and in the rhizosphere of young sycamore samplings. Key-species enriched in TNT polluted soil were identified, and a draft genome for Raoultella ornithinolytica strain TNT was prepared, from which a homolog of the Old Yellow Enzymes (OYE), an enzyme able to liberate nitrite from TNT, was identified and characterized. Metagenome libraries are being used to search for additional OYE homologues. Mesocosm experiments showed a positive effect of inoculating OYE-containing microbes in the rhizosphere of grasses, with significant effects on TNT-transformation rate, plant biomass and health. Genomics-enabled microbial enrichments is paving the way for microbe-stimulated phytoremediation for military site restoration.

Impact of military territories to the environment and place of phytotechnology with miscanthus biomass production

Valentyna Pidlisnyuk[1], Tetyana Stefanovska, Larry Erickson, Josef Trogl

[1]*Jan Evangelista Purkyne University*

There is no data on the exact area that is currently being used for military purposes worldwide. Very large areas serve as protective buffers around military installations, or are needed at the time of military exercises. The impact of military chemical pollution on the environment is manifold. It is caused by everyday military activities, training, and the production and testing of weapons and ammunition. It has been estimated that over 260 different chemical substances are released into the environment due to military activities, and that military activities account for 10 - 30 % of the chemical degradation of the environment. One of the perspective approach for military sites revitalization is union of phytostabilization with production of biofuel crops which permits to restore land to agricultural use or urban land bank and meet the demand for biomass production as alternative energy sources or bioproducts. The sterile, perennial grass Miscanthus x giganteus is considered one of the most promising in that approach. It exhibited good production properties while used for remediation of brownfield sites, former mining sites and abandoned agricultural lands.

We initiated investigations on using M. x giganteus for restoration of former military sites located in Ukraine, Slovakia, and Czech Republic. The research sites are diverse and included: airport of the former Soviet Union Air Force (Mimon, Czech Republic and Sliac, Slovakia), former military storages (Kamenetz-Podilsky, Ukraine), military training place (Dolyna, Ukraine) and place of recent military operations in the East of Ukraine (Kurakhovo). The main contaminants at the research sites are different metals, additionally at the location in Mimon spilled jet fuel (kerosene) was detected. Locations are classified as contaminated and damaged ones by the local environmental authorities at the corresponding countries and requested revitalization. They also poses the constant environmental health risks to citizens of the nearby located communities. Two years Lab experiment with the soil from the military sites in Kamenetz-Podilsky, Ukraine and Sliac, Slovakia ensured that M.xgiganteus was successfully cultivated at that metals contaminated soils and biomass obtained was only slightly contaminated and may be used for further processing. The coefficient of phytoprocess effectiveness C was much lower for stems and leaves in comparison to roots and no correlation of metals in the plant parts to significant gradients in soils was found. One year Lab experiment with military soil from Dolyna and Kurakhove, Ukraine illustrated that while rhysomes of M.xgigateus were treated by plant growth regulators before planting the improving of the biomass quality was detected. Two field plots were established at the abandoned military locations in Dolyna, Ukraine and Mimon, Czech Republic for studying influence of agronomic factors to the biomass production.

The results prove applicability of M. x giganteus for simultaneous phytostabilization of former military sites and production of energy biomass which may be processed for direct burning, transformed to biofuels or further bioproducts. It is intended to continue the research in the labs and at the fields in order to observe the applicability of the proposed approach at the long-term scale.

Environmental risk assessment of heavy metal contamination at military sites in Ukraine: avoidance and reproduction test with Collembola

Iwona Gruss[1], Jacek Twardowski, Tatyana Stefanovska, Valentyna Pidlisnyuk

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Military activities have produced contaminated environments at many sites around the world. There are different types of contamination related with military activity, among others, hydrocarbons, heavy metals, nuclear waste and pesticides (Cristaldi et al., 2014). Chemicals can have immediate destructive or toxic effects that may persist for a long time in soil, water and tissues of animals (Tchounwou et al. 2012). The aim of this research was the environmental risk assessment of heavy metal contamination at military sites in Ukraine using avoidance and reproduction test on Collembola (springtail). Soil used for the tests was sampled in December 2017 from Dolyna, Ivano-Frankivsk region, Ukraine (48°58'35.25N, 23°59'21.285 E) from two plots – contaminated and control site. The place is former military site used as former tank training site. The soil type, both contaminated and control was soddy- podzolik heavy clay. The contamination level of both soils was tested using Rentgen-Fluorescence Analizator Expert 3L.EN 15309:2007. It was determined that site is characterized with the following total heavy metals: Zn, As, Cd, Pb; Cr, Ni, Cu, Mn, Sr. In some places of the locality the concentrations of pollutions exceeded MPL. The control soil was free from contamination. The avoidance test (ISO 1999a) and reproduction test (1999b) were conducted with the use of springtail species Folsomia candida. In order to create air porous space for springtails, both the control and contaminated soil were mixed with sand in the proportion 3:1. 9 levels of contamination were established: 1%, 1.5%, 5%, 10%, 15%, 25%, 50%, 75%, 100%. The duration of the avoidance test was 7 days and reproduction test 28 days. In the avoidance test the concentrations from 1.5 to 100 % significantly decreased the number of F. candida in contamination in comparing to control. At the same time avoidance was not observed in the first concentration (1%). The half maximal effective concentration (EC 50) for the test was 16%. According to reproduction test, the negative effect on the number of juveniles was observed from the dose 15%. The contamination with heavy metals on the military areas indicated the short and long-term toxity risk on the springtail Folsomia candida.

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Acknowledges: The research was partially supported by NATO program "New Phytotechnology for Cleaning Contaminated Military Sites"

Actual Questions Of Population Health Risk Assessment Of Former Military Sites In Czech Republic (Cr) And Ukraine (Ua)

Yuriy Chayka, Olexander Yavorovsky

O.O.Bogomolets National Medical Univesity

Soviet Army former military sites cause significant negative influence on the population health of nearby territories. Investigation of 2 selected former military sites in CR and UA are presented. Hazard identification is provided. Health impacts are discussed. Risk assessment with management steps are introduced including phytoremediation technics (using Miscanthus x gianteus), which are already launched and investigated.

Growing miscanthus x giganteus in post-military soil and soils contaminated by petroleum hydrocarbons: remediation and biomass production

Diana Nebeská [1], Hana Malinská, Josef Trögl, Valentina Pidlisnyuk, Martin Smaha, Michaela Holubová, Andrea Medžová

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Former military airport Hradčany near the city of Mimoň (Liberecký region, Czech Republic) was highly contaminated by oil products after activities of Soviet troops during occupation between 1968-1991. Intensive remediation process combining biodegradation with venting and air sparging was applied and the concentration of NES (non-polar extractable substances) decreased below the risk limit of 5000 mg/kg. However there's still residual contamination in soil and groundwater and suitable reclamation of this area needs to be considered. A perspective way is the growth of perennial second generation biofuel crops which have potential to increase the decontamination, improve soil properties and produce applicable biomass. Miscanthus x giganteus, a perennial C4 plant, is a good candidate for this process. To test its possibility of growing in post-military land contaminated by hydrocarbons and investigate the effect of its growth to soil parameters the pot experiment was established.

Four different contamination variants were prepared: control agricultural soil from field near Hradčany, airport soil and for simulation of historic oil contamination also mix of airport and oil refinery soil in ratios of 3:1 and 1:1 (m/m). Beside hydrocarbon contamination significant concentrations of several heavy metals (Zn, Pb, Cd, Cu) were also determined by ICP-OES method. Another complication is the low concentration of bioavailable nutrients in soil and pH 7.6 which is higher than optimum required by plants. Despite these facts Miscanthus showed good tolerance and biomass production in airport soil was comparable to control. On the other hand hydrocarbon contamination over 8000 mg/kg C10-C40 appeared to be limiting factor for Miscanthus growth and produced biomass was negligible. This stress was also confirmed by Fv/Fm fluorescence test.

Phospholipid fatty acids (PLFA) determination was used to describe living microbial biomass and rough structure of soil microbial community during two years of growth. The amount of living microbial biomass and the structure of microbial community are important indicators of soil quality and ecosystem health. Total PLFA content revealed significantly higher abundance of microorganisms in oil contaminated soils as compared to control and airport soil. However microbial community structure and cy/pre stress indicator suggest that in contaminated variants microbial community is exposed to higher stress. Comparison of year-on-year results indicates positive influence of Miscanthus growth on the amount of living microbial biomass especially in control and airport soil where the plant growth was not limited by contamination.

Acknowledgement: The research was supported by NATO SPS MYP #G4687 and involvement of students was covered by UJEP Internal grant agency.

The composition of nematode community associated with *niscanthus x giganteus* grown at dolyna militarty contaminated site

Tatyana Stefanovska, Valentina Pidlisnyuk, Andrzej Skwierch, Franciszek Kornobis.

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Heavy metals are present in the soil of Dolyna military site in determined concentration. It negatively influence biological, chemical and physical properties of the soil and enter the food chain and can be critical for living organisms and humans. Using Miscanthus x giganteus perennial, C-4 carbon fixation, grass' biomass for biofuel production and for remediation of Dolyna site may help to improve contaminated by heavy metals soil quality and stability. To evaluate success of improvement of soil health change in the process of remediation the cost effective, reliable indicators are needed. The nematode representing the group of soil micro-fauna which correlate with soil functions assemblage and trophic structure are very sensitive to variation of disturbing activity and considered as very promising and best study biological indicators.

In 2017 the study was performed to assess the response of the nematode community while growing M. x giganteus at Dolyna (Western part with Sod- podzolic heavy clay soil. This study was design as long term and it is continuing The preliminary nematode community was analyzed at heavily polluted and control (less polluted) soils with/without planting of M. x giganteus, and first year age plantation of the crop at military sites By using of Rentgen-fluorescence analizator Expert 3L.EN 15309:20 was determined that s site is characterized with the following total heavy metals belonging to third class of dangerous: Zn, As, Cd, Pb; Cr, Ni, Cu, Mn, Sr. In some places of the locality the concentrations of pollutions exceeded MPL.

Nematodes were recovered from the soil rhizosphere at a depth of 40 cm at contaminated using Biermann's funnel, sieving techniques. The isolated nematodes were morphologically and by using molecular biology tools identified to genus and species Nematodes isolated from the polluted/control site were assigned to four ecological groups: Plant feeders>Bacterial feeders > Fungal feeders The significant differences observed in total abundance of that the nematodes from all trophic groups at control plot (695 s/ccm) in comparison with the heavily polluted ones (435 s/ccm). The nematodes representing of three tropich groups were less abundant at heavily polluted site in comparison with control. Predator nematode was not recorder at the military site. This group occupies population of omnivores and predators those occupy the highest position in a food web and very sensitive to disturbance. This finding indicates that soil in military site have high degree of disturbance.

The research is continuing and in the future researches will be focused at calculation od nematode diversity indexes and selecting the most sensitive to soil pollution nematode taxa and impact the duration of miscanthus growing to nematode community structure.

Session D

MONDAY, June 11, 2018
15:50-18:20

Coastal and aquifer pollution

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KEYNOTE

Sustainable Development of Several Coastal Lakes in The Southern Baltic Area

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The northern part of Polish coast are home to numerous coastal lakes of various connectivity with an open sea. Despite the fact these lakes display a wide range of ion composition, salinities, stratification patterns, and ecosystems they have been rarely studied in a complex and long-term way. Few of lakes are located on ecologically protected area or are habitats for migratory birds. A two-year seasonal survey of the physical characteristics and chemistry of 11 lakes was carried out to assess their resistance on local pollution sources or impact of sea water intrusions. Moreover, due to limited information regarding the concentration of metals in water and bottom sediments current study aims to complement the knowledge concerning water-bottom sediment interface of coastal lakes in Poland. Moreover, one of the minor aims was to assess water quality of the coastal lakes basing on physiochemical parameters which is unique in Poland, since classification rules being in force mainly concerns brackish water reservoirs and are based on biological monitoring. Within the framework of the study more than 350 water and sediment samples were collected seasonally in 2014 and 2015 from intermittently closed and open lakes and lagoons (ICOLLs) spread through Polish coastline. pH and electrolytic conductivity were measured in the field and double-checked in the laboratory. Full ionic characteristic of water samples consisted of major cations and anions was determined using ion chromatography while the inductively coupled plasma optical emission spectrometry has been used in multielemental determination. Moreover, dissolved oxygen, total dissolved solids and hardness were determined. Relationship between electrolytic conductivity and concentration of ions for coastal lakes with corresponding regression lines and equations was assessed and some seasonal fluctuations were discovered according to the level of lake's isolation. Water quality assessment was based on two commonly used indexes: Water Quality Index (WQI), Heavy Metal Pollution Index (HPI) and Contamination Index (Cd). Analysis revealed that the WQI1 values ranged from a minimum 31.6 to a maximum of 75.0 indicating that 71% of seasonally studied waters were of good quality. WQI2 values ranged from a minimum 17.6 to a maximum of 1298 which was out of scale due to □-oligohaline characteristic of lakes. It classified 61% of coastal waters as excellent. HPI values ranged from a minimum 27.1 to a maximum of 65.9 indicating significant domination of waters of good quality over those of poor quality. The contamination index varied between -6.7 and 83.6 revealing high contamination of Jamno, Gardno, Koprowo, Dołgie and Resko Przymorskie lakes in Spring, 2014 which was an effect of almost eight times higher than usual inflow of heavy metals to the Baltic Sea in 2012-2013 reported by official, regional monitoring reports. Our study reveals that: (i) the water quality of the studied lakes is good according their physiochemical characteristic; (ii) physiochemical water quality depends on connectivity with the Baltic Sea; (iii) not all the indexes were well correlated with each other; (iv) discussed indexes assess the possibility of industrial water use and do not express the degree of water pollution.

Identification of hotspots of genotoxicological and faecal pollution along the Danube and Sava rivers – the whole river surveys

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The level of genotoxic pollution was assessed along the Danube River and its most significant tributary Sava River by measuring the level of DNA damage in aquatic organisms collected from the selected sites. The Danube River survey was conducted within the Joint Danube Survey 3 project in 2013 on 34 sites along the 2285 rkm using mussels (Unio sp.) and fish (Alburnus alburnus) as bioindicators. The Sava River survey was conducted within the Globaqua project in 2015 at 12 sites along 900 rkm using fish (A. alburnus/Alburnoides bipunctatus) as bioindicators. The level of DNA damage was evaluated by the comet assay in haemocytes of mussels and blood cells of fish.

The level of faecal pollution along the rivers was studied in parallel with genotoxicological surveys by using the standard indicators, total coliforms, Escherichia coli and Enterococci. Quantification was performed with Colilert/Enterolert Quanti-Tray 2000 and MPN approach. Quantitative PCR (qPCR)-based assays for analysis of human- or animal-associated genetic Bacteroidetes faecal markers have been used for tracking the source of pollution (microbial source tracking -MST). The human-associated BacHum and HF183II, the ruminant-associated BacR and the pig-associated Pig2Bac fecal markers were selected. The hotspots of faecal pollution were detected at both rivers. Presence of pollution was especially evident in the countries in which the legislation related to wastewater treatment and management is not fully implemented. In the case of the Danube River the most critical section of the river was the Pannonian plain (sector VI) while in the case of the Sava River the most affected section was the lower stretch of the river. The results of MST revealed the presence of human-associated fecal markers BacHum and HF183II in the majority of the analyzed samples. High correlation was observed between the standard fecal indicators and human associated faecal markers. Within the Danube survey, the highest levels of DNA damage were recorded in organisms from the section VI, which is under the impact of untreated wastewater discharges. In 2013 the Sava River was characterized with a lower level of both faecal and genotoxic pollution in comparison with the Danube. Similar observations were found within the Sava River survey in 2015 where the level of DNA damage in fish specimens from Sava was lower in comparison with the samples from the Danube. At both rivers detected genotoxic potential was traceable to the deterioration of quality by communal and industrial wastewaters.

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Evaluation of drinking water quality and health state of population in Chisinau Municipality

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In Republic of Moldova, the supply with water is a serious problem, because water sources are not uniformly distributed across the country, and water quality in very frequent cases doesn't correspond to existing national standards. About 50 percent of Moldova's population has no access to safe drinking water. Almost 60% of the population is supplied with water by a decentralized system (wells, springs). More and more attention is paid to the exploitation of artesian wells. Hygienic and epidemiological investigations effectuated during the last two decades showed that the quality of the water had a significant impact on human health. Currently the problem of water resources in rural areas is very actual.

The research purpose was hygienic evaluation of water quality and health state of the population in Chisinau Municipality.

Methods. It was studied the results of laboratory investigation of water according to sanitary-chemical and sanitary-microbiological indicators in Chisinau Municipality and health state of population in the period of 2013-2017.

Socio-economic situation in Republic of Moldova has greatly affected the health system and activities of public health system. It was worsened hygienic problems related to chemical and biological pollution of the environment. There is a high level according to the sanitary-chemical and microbiological indicators of the nonstandard water samples from the rural communal villages. The water quality of public wells does not meet sanitary and hygienic requirements. Thus, according to the results of the laboratory investigations, the water quality in 83% wells does not meet the sanitary norms on sanitary-chemical indicators and in 64% it does not correspond to the microbiological indicators. Mostly the water in the wells is polluted with nitrates, contains a large amount of salts, B. coliforms, Enterococci and E. coli. The lowest quality is water from wells, the percentage of non-standard samples, including sanitary-chemical indicators, is increasing and in most cases is not recommended for drinking without special treatment. Among the localities with the lowest water quality can be mentioned the following cities: Singera, Durlesti, Codru, Vadul lui Voda and the following villages: Bacioi, Fauresti, Ghoienii Noi, Condrita, Budesti, Bubuieci, Humulesti and Bic. Microbiological indices also didn't exceed the established hygienic norms. The share of water from the aqueduct networks per total (urban and rural aqueducts, including health care institutions) that did not meet hygienic norms on sanitary-chemical indicators: in 2015 constituted 17, 3 %, compared to 17, 6% (2013) and 16, 1% (2014), and by microbiological indicators constituted 6.7% respectively compared with 7.8% (2013) and 10, 9% (2014), which shows a stabilization of water quality with a tendency to improve. In the structure of morbidity the most spread diseases of the studied population were chronic hepatitis and cirrhoses (24.6%), digestive system's diseases (19.6%), genitourinary system's diseases (8.8%), diseases of osteo-articular system (6.8%).

Results of water quality assessment and the health state of the population in some localities from Chisinau Municipality justify the need for hygienic, medical, administrative, educational measures to improve water supply and insurance of the hygienic-epidemiological welfare of population.

The effect of spruce dying and air pollution on water quality on the example of springs within the Skrzyczne range area

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At the beginning of the year 2018 Polish law has been customized to the EU Water Framework Directive in the act „Prawo wodne" (Law of water). Even though spring waters has been considered in crenology as underground waters this act classifies spring waters to surface waters (chapter 3, article 22, paragraph 1). On this basis an attempt of using surface waters quality classification (Dz.U. 2016, poz. 1187 ordinance) according to water samples collected in Skrzyczne range area in the years 2009, 2011 and 2012 was undertaken. The surface water classification was used just in the research scope of data which was limited to chosen physicochemical features: temperature, conduction and Li+, Na+, NH4+, K+, Ca2+, Mg2+, F-, Cl-, NO3-, SO42-, PO43-, HCO3- concentration. The classification showed that all springs in the research area release waters of the third quality class which is defined in the ordinance as „state below good". The main factors of classifying water samples to the third quality class were low pH and high nitrates concentration. In comparison, the classification for underground waters (Dz.U. 2016 r., poz. 85. ordinance) gives more diverse results and showed that the first quality class was noted in 92 cases, the second class in 32 cases, the third class in 10 cases and forth in 67 cases. The main factor of classifying waters to the second class was high ammonium ions concentration, to the third class – high nitrates concentration and to the forth class – low pH. This classification describes water in classes I to III as of good chemical state and water in classes IV to V as of weak chemical state. According to another ordinance: Dz. U. 2017, poz. 2294, 43% of collected samples are drinkable and 57% are characterized by to low pH or to high ammonium ions concentration to be suitable for drinking. Usage of the three law classifications showed that the surface water classification isn't fully proper for spring water as pH below 6,5 is natural for water in springs located within godula sandstone layers including research area, while the pH for the first class in this classification (considered natural) is between 7,8 and 8,4. As the purpose of the classification is assessing the degree of anthropogenic changes in surface waters it needs to be modified especially in area where spruce dying occurred.

Photocatalytic removal of sertraline from water over titania/chitosan hybrid materials

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Pharmaceutical industry is one of the most developed industry in the world where the increase of production is estimated to 6-7 % per year. Pharmaceuticals are biologically active, stable compounds having negative impact on many ecosystems, especially aquatic environment. Research developed in many countries showed, that residues of pharmaceuticals are present in the inflow and outflow of sewage treatment plants, in surface and ground water, drinking water and also in sea water. Pharmaceuticals are continuously introduced to the environment from many emission sources like pharmacies, hospitals, health centers, farms, households and many other. Traditional sewage treatment plants are not adapted to remove this kind of pollutants.

The most promising method for decomposition of pharmaceuticals seems to be photocatalysis, due to complete degradation of hardly removable compounds to water, carbon dioxide and inorganic acids in most cases. This process proceeds with UV or sunlight in the presence of semiconductor. Titanium dioxide P25 is the most common photocatalyst, due to its high activity, good photochemical stability, antibacterial property, resistant to pH changes, relatively cheap and widely available. Disadvantage of this photocatalyst is recovering it from the reaction solution after the process is completed. This step is time-consuming and expensive. Immobilization of the photocatalyst on the surface of appropriate natural polymer can improve certain properties like photocatalytic activity, adsorption and separation from the reaction mixture. In this case, chitosan seems to offer many advantages since it is non-toxic, biocompatible, biodegradable and pH sensitive linear organic polymer.

In this work, we prepared four hybrid materials TiO2/CS (titanium dioxide/chitosan) by three different methods and with application of two types of chitosan. This materials were examined in the photocatalytic reaction of decomposition of sertraline being one of usually prescribed antidepressant drug. The photolytic process was also conducted for comparison.

Photocatalysts were prepared, using different methods as follows. Titanium dioxide P25 was dispersed in the solution of chitosan in the acetic acid. In the first method (1) this suspension was added to glutaraldehyde. In the second case (2) the suspension was added to the sodium hydroxide and cross-linked by formalin. In the last method (3) sodium hydrogen carbonate and formalin was added to the above suspension. In next step this mixture was added to solution of sodium hydroxide and epichlorohydrin and heated for 2 h.

Results of photocatalytic decomposition of sertraline shows that activity of photocatalysts does not depend on the preparation method: in every cases, after 240 minutes of irradiation the degree of removal of sertraline was around 70 %. Photolysis resulted in a small degradation of the tested compound (37 %). Further research demonstrated that photocatalysts based on medium molecular weight chitosan (MMW) showed higher activity than photocatalyst based on high molecular weight chitosan (HMW).

The obtained results showed that titania/chitosan hybrid materials can be successfully applied in the photocatalytic process of sertraline removal from water.

Innovation in Coastal and Aquifer Remediation and Monitoring

Heather Henry, William A. Suk

NIEHS/NIH, Research Triangle Park, North Carolina USA

Coastal ecosystems and aquifer systems are important sources of food and drinking water; yet, these areas tend to become reservoirs of contaminants from numerous industrial, agricultural, and other anthropogenic disturbances. Remediation of contaminated coasts and aquifers is a challenge due to the complex biological, geological, chemical, and other physical processes governing the interactions between pollutants and the environment. Hence, developing monitoring and remediation technologies for coasts and aquifers requires a multi-disciplinary perspective. The NIEHS Superfund Research Program supports several multi-disciplinary grants focusing on monitoring and remediation of coastal and aquifer systems. These approaches include basic research on the interactions between biogeochemical parameters, community-based sampling, small business remediation product development, and post-disaster fate and transport assessment. Ongoing work tests the efficacy of amendments to aquifers and sediments to stop the transfer of pollutants into drinking water and/or the food chain. Furthermore, innovative monitoring technologies identify which contaminants are available to biological systems and help guide cleanup operations. In working closely with impacted communities and other end-users, researchers are beginning to identify solutions that will help protect the important ecosystem services provided by coastal and aquifer resources.

SESSION E

WEDNSDAY, June 12, 2018

11:00-13:30

Chemistry, fate, transport, and health effects of persistent halogenated contaminants (with emphasis on brominated and fluorinated compounds)

Session Chairs:
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KEYNOTE

Copper salts as catalyst substances responsible for formation of dioxins and other halogenated compounds during burn process in fireplaces and heating stoves

Adam Grochowalski, Małgorzata Węgiel, Anna Maślanka, Ryszard Chrząszcz

Cracow University of Technology

Certain metals act as catalysts for halogenated aromatic compounds formation in thermal processes, providing a surface upon which dioxins can readily form during and post-combustion processes on the fly ash and bottom ash obtained from wood or coal combustion1.

Copper is one of the most potent catalyst for dioxin-like compounds formation in thermal processes and have been found in multiple studies to be correlated with increased dioxin/furan formation2-5. The catalyst used in this experiment is commercially available on the market in Poland as well as in some European countries and widely used for chimney cleaning as a soot removal agent in house heating stoves, fireplaces and in power generation boilers. It contains mainly copper sulphate and ammonium chloride. In numerous of industrial scale boilers the catalyst is continuously feed with the average load of average of 1 kg/ton of hard coal.

Results and discussion

For example, for clean beech, oak and birch wood burning in closed fireplace in this work, the bottom ash and fly ash obtained from ca 15 kg of burned wood, contained dioxin on the level of 10.6 ± 0.85 ng-I-TEQ/kg and 2.8 ± 0.4 ng-I-TEQ/kg respectively. The use of the catalyst caused dioxin concentration of about 15,600 ng I-TEQ/kg in bottom ash and even 30,000 ng I-TEQ/kg in fly ash with the uncertainty of 25 - 50%. In stack gas the concentrations were 0.05 ± 0.01 ng I-TEQ/m3 and 350 ± 50 ng I-TEQ/m3 respectively. HCB and PeCB catalyzed formation also can be observed, however in much less scale. Due to the inability to calculate stack gas emissions from coal-fired furnaces for heating individual houses and wood-fired fireplaces not calculated emission of dioxin in stack gas. However, it is demonstrated a significant increase in the emission of dioxins and polychlorinated benzenes in stack gas caused by the use of copper catalysts.

Dioxin in eggs

From the large study on the determination of dioxins in hen egss in the period 2015-2016 year in Poland we have found that eggs from backyard farms were contaminated with dioxins in the range: 1.9 ± 0.19 to 11.4 ± 1.5 pg WHO-PCDD/F-TEQ/g fat. The average value from 78 measurements is: 5.21 pg WHO-PCDD/F-TEQ/g fat. In the case of free range eggs from organic farms obtained values are in the range of 0.10 ± 0.02 to 1.20 ± 0.11 pg WHO-PCDD/F-TEQ/g fat.

In the case of caged hens values are in the range of 0.11 ± 0.02 to 0.65 ± 0.10 pg WHO-PCDD/F-TEQ/g fat.

In EU maximum allowable level of dioxin in eggs is 2.5 pg WHO-PCDD/F-TEQ/g fat (Commission Regulation (EU) No 1259/2011).

On the possible source of contamination of dioxins and furans in eggs from hens kept in backyard farms I pointed to the thermal source. Dioxins/furans congener profile clearly indicates in this case the thermal source, which here can be understood as:

1. burning of waste in household stoves in rural areas.
2. the use of copper catayst for soot removal.

New developments in the synthesis and use of reactive activated carbon impregnated with iron nanoparticles for remediation of persistence organic pollutants in contaminated sediments and water

Souhail Al-Abed, Slawo Lomnicki, and John McKernan

United States Environmental Protection Agency (USEPA), USA

Persistent organic pollutants (POPs) are toxic substances released into the environment by human activities. Of all POPs released into the environment, Polychlorinatedbiphenyl PCBs are among the most dangerous. They are highly toxic, and can last for years or decades before breaking down. Adsorptive materials such as activated carbon (AC) have been shown to effectively sequester PCBs desorbed from sediment and thus reduce their bioavailability in the aquatic environment. Meanwhile, reactive metal particles such as Fe, and Fe/Pd have been proven to electrochemically dechlorinate PCBs to lower congeners and eventually to bio-available biphenyl (BP). We synthesized and tested reactive activated carbon (RAC) impregnated with nano palladized iron using its coupling of adsorption and dechlorination of polychlorinated biphenyls (PCBs). Iron was placed in the mesoporous of the GAC using in situ chemical precipitation forming Fe nano particles due to the restriction of Fe crystal growth in the GAC pores. Fe nano particles surfaces were then modified with a discontinuous layer of Pd. The RAC system can combine the physical adsorption of PCBs with their chemical dechlorination. The ability of RAC adsorb PCBs into its pores in close proximity to the Fe/Pd particles and the role of Fe/Pd system to dechlorinate PCBs make the RAC an effective strategy for PCBs remediation contaminated sediments. In this presentation, the synthesis of RAC system, novel preparation and characterization, and environmental application to cleanup of PCBs will be discussed.

Development of magnetic nanocomposite materials as reusable adsorbents for chlorinated organics in contaminated water

Angela M Gutierrez, Thomas Dziubla and J. Zach Hilt

University of Kentucky

The constant growth in population worldwide over the past decades continues to put forward the need to provide access to safe, clean water to meet human needs. There is a need for cost-effective technologies for water and wastewater treatment that can meet the global demands and the rigorous water quality standards and at the same maximizing pollutant efficiency removal. Current remediation technologies have failed in keeping up with these factors without becoming cost-prohibitive. Nanotechnology has recently been sought as a promising option to achieve these goals. The use of iron oxide magnetic nanoparticles as nanoadsorbents has led to a new class of magnetic separation strategies for water treatment. We have developed magnetic nanocomposite systems able to capture polychlorinated biphenyls (PCBs), as model organic pollutants, in aqueous solution, providing a cost-effective water remediation technique. Two distinct methods were employed to develop these polyphenolic nanocomposite materials. The polyphenolic moieties were incorporated to create high affinity binding sites for organic pollutants within the nanocomposites. The first method utilized a surface initiated polymerization of polyphenolic-based crosslinkers and co-monomers on the surface of iron oxide magnetic nanoparticles to create a core-shell nanocomposite. The second method utilized a bulk polymerization method to create macroscale films composed of iron oxide nanoparticles incorporated into a polyphenolic-based polymer matrix, which were then processed into microparticles. Both methods produce nanocomposite materials that can bind chlorinated organics, can rapidly separate bound organics from contaminated water sources using magnetic decantation, and can use thermal destabilization of the polymer matrix for contaminant release and material regeneration. The polyphenol functionalities used to bind organic pollutants were quercetin multiacrylate (QMA) and curcumin multiacrylate (CMA), which are acrylated forms of the nutrient polyphenols with expected affinity for chlorinated organics. The affinity of these novel materials for PCB 126 was evaluated at equilibrium conditions using a gas chromatography coupled to electron capture detection (GC-ECD) for quantification purposes, and the data was fitted to the nonlinear Langmuir model to determine binding affinity (KD) and maximum biding capacity (Bmax). The KD values obtained demonstrated that the presence of the polyphenolic-based moieties, CMA and QMA, as crosslinkers enhanced the binding affinity for PCB 126, and this expected to be a result of their aromatic rich nature which provides sites for $\pi - \pi$ stacking interactions between the nanoparticle surface and the PCBs in solution. These values are lower that the reported affinity coefficients for activated carbon, which is the gold standard for capture/binding of organic contaminants in water and waste water treatment. Furthermore, upon exposure to an alternating magnetic field (AMF) for a period of 5 minutes, over 90% of the bound PCB on these materials was released, offering a low-cost regeneration method for the nanocomposites. Overall, we have provided strong evidence that these novel nanocomposites have a promising application as nanoadsorbents for specific organic contaminants in contaminated water sources providing high binding affinities, a low-cost regeneration technique and capable of withstanding under environmental conditions.

Biogeochemical characterization of a dual-pathway microbial remediation strategy for chlorobenzenes at the anaerobic-aerobic groundwater interface

Steven Chow, Michelle Lorah, Amar Wadhawan, Neal Durant, Edward Bouwer

Johns Hopkins University

Halogenated organic chemicals have been produced and improperly released into the environment for over a century, leaving thousands of contaminated sites around the world at risk and in need of remediation. At the Standard Chlorine of Delaware (SCD) EPA Superfund Site (New Castle, Delaware, USA), groundwater is contaminated with a persistent source of chlorobenzenes (CBs) and is discharged into an extensive wetland surface water system. Natural anaerobic-aerobic gradients in contaminated wetlands similar to the SCD site may potentially be leveraged to facilitate bioremediation of these contaminants. Reductive dechlorination of higher chlorinated CBs under anaerobic conditions can lead to the accumulation of daughter products such as monochlorobenzene and benzene, which are more toxic and bioavailable than their parent compounds. Aerobic biodegradation can readily mineralize less chlorinated daughter compounds to harmless end-products, however, oxygen availability often limits this degradation pathway in anaerobic sediments. Deploying microorganisms capable of both degradation pathways in a permeable barrier at a wetland surface represents a low-cost and novel strategy to treat persistent sources of CB contamination.

We have demonstrated that this treatment paradigm is viable using a model barrier in laboratory column experiments. Both anaerobic and aerobic degradation pathways were maintained for 1 year under various organic carbon dosage levels, with up to 72% mineralization (3.5 mg/L) of initial 1,2,4-trichlorobenzene contaminant achieved. Through sacrificial sampling, we are able to probe the spatial distribution of microbial biofilm and identify trends and characteristics of a well-functioning degradative community. Additionally, biodegradation processes can be confounded by a wide range of alternative electron acceptors such as nitrate, ferric iron, and sulfate. They create overlapping redox conditions that may favor competing non-biodegradative microbial pathways limiting the effectiveness of engineered treatment systems. In our ongoing work, we utilize parallel model barriers to determine the performance of both dual- and single-pathway degradation under alternative redox conditions. Here, we evaluate the influence of varying concentrations of electron acceptors nitrate and sulfate on individual biodegradation pathways, overall bioremediation outcomes, and the underlying microbial biofilm communities. Utilizing the results of these experiments, we will better understand the functionality and limitations of implementing this biobarrier system at scale in the field for sites such as SCD.

Adverse human health effects including congenital malformations related to the use of agent orange

Vladimir Bencko[1], Rony Eben Ezra

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Agent Orange consist of 50% n-butyl esters of 2,4,5-trichlorophenoxy acetic acid and 50% 2,4-dichlorophenoxyacetic acid. These compounds are chemical plant growth regulators, which mimic the effect of plant hormones, provoking plants into frantic growth before they wither and die. The toxicity of Agent Orange is attributed to the contamination with dioxin, which was perhaps the most toxic molecule ever synthesized by man. Agent Orange's actual effect on human health remained controversial because even though dioxin at certain levels was clearly capable of causing serious diseases, those same diseases could also result from other causes. Dioxin is a persistent organic pollutant that will accumulate in animal fat and plant tissues and therefore can enter the food chain. The US National Toxicology Program has classified dioxin as "known to be a human carcinogen", causing namely, chronic lymphocytic leukemia, soft tissue sarcoma, non-Hodgkin lymphoma and Hodgkin disease with sufficient evidence of an association. Severe acute intoxication of dioxin caused chloracne, porphyria, transient hepatotoxicity, and neurotoxicity. Chronic persistence of dioxin in the human body may contribute to development of atherosclerosis, hypertension, diabetes, vascular changes, and neuropsychological impairment several decades after massive exposure. However, such chronic effects are nonspecific and multifactorial. This presentation elaborates the aforementioned and other health effects of Agent Orange with a special attention to congenital malformations issues.

Identification of an Immobilization Technology for Per- and Polyfluoroalkyl Substances (PFAS) Contamination in Soil and Sediments

John McKernan, Edwin Barth

U.S. EPA

The production and use of per- and polyfluoroalkyl substances (PFAS) has contaminated soil, groundwater, and surface water that impacts drinking water supplies (public and private) in Region 2 and across the nation. Many commercial and consumer products contain PFAS including surface treatments for textiles, paper and plastics; fluids used in metal plating operations; and aqueous film forming foams (AFFF) used for firefighting. The most commonly studied PFAS are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). PFAS contaminated soils can act as a long-term source of contamination to groundwater and surface water. Technologies for PFAS remediation in soil are in their infancy stage, with excavation and disposal in landfills the only currently viable option at many sites in the U.S. PFAS remediation is challenging since some compounds are resistant to destruction or degradation. The overall objective of this work is to identify a remediation approach that is capable of immobilizing PFAS in soil. The presentation will discuss current research utilizing commercially available sources, and a developed formulation for PFAS stabilizing agent. Testing methods being used for these agents will be discussed as well. End results of this work will determine efficacy of various stabilizing agents. The research team believes the final stabilizing agent will likely have cementitious properties, and be added directly to the contaminated soil in some weight or volume percentage blended, then reacted (likely with water) to activate the stabilizing matrix. This research will have significant impact in the U.S., since it proposes an in situ method of treating PFAS contaminated soils, which will eliminate this source of contamination to groundwater and surface water. This in situ treatment method for PFAS impacted soils will treat the problem at the source, thus minimizing disposal of these wastes at landfills.

SESSION F

WEDNSDAY, June 12, 2018

11:00-13:30

Environmental and health impacts of minerals/metals and mining activities

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KEYNOTE

Revitalisation of post-mining areas for sustainable tourism

Anna Ostrega

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Post-mining areas are characterized by a specific potential for various forms of tourism. The tourism industry is experiencing stable, moderate growth even despite periods of economic downturn. However, tourist preferences are changing – research indicates a decline in interest in passive recreation (sun, sea, sand) for active tourism and oriented to new cognitive values (culture, education, nature), as well as experiences and emotions. A shift towards a healthy lifestyle is observed as well.

This creates opportunities for the development of rural areas, which are characterized by idyllic sites, access to healthy food and strong cultural traditions and which thanks to mining activities enriched their landscape with water reservoirs. These types of areas are very sensitive to the development of tourism, which through the expansion of tourist centers, as well as the increased traffic of cars can have a negative impact on the natural environment and the comfort of living of local residents.

In such cases, sustainable tourism is particularly important. An example of designing sustainable tourism products is the Pojezierze Tarnowskie project (Małopolska Region, Poland). It involves the revitalization of several water reservoirs after sand and gravel extraction for recreational, tourist and nature purposes. Tourist attractions are built on the basis of cultural values of the communes covered by the project, including the mining heritage, as well as the natural values.

Sustainable tourism means also economical space management limited to providing adequate rest facilities, for the display of natural and landscape values enabling "healthy" rest. In the context of sustainable tourism, the revitalization of post-mining areas for such functions is an added value, since save green area.

Heavy metals and lipids in the tissue and bee production at traditional and organic bee-keeping conditions and the ways of their levels' correction

Iryna Kovalchuk

Institute of animal biology NAAS

"The studying physiologic and biochemical specifics of ecologic and technologic conditions influence on the level of mineral and lipid elements nutrition in the organism and products of melliferous bees' and their quality. The methods of decreasing heavy metals content in the tissues of different anatomic sections and also in honey, ambrosia and wax, and the ways of increasing their physiologic activity and biologic value using in bees' feeding nanoaquacitrates of microelements and humic dietary supplement «Humilid».

Methodological elements of the researches of regularities of heavy metals and lipids content in the tissues of different anatomic sections of the organism and bee products were elaborated. The peculiarities of its changes at the influence of technological load of different intensity and also the differences of division of these substances in the tissues and bee products under the conditions of traditional and organic bee keeping were studied.

The optimal quantity of this preparation during spring feeding was established.

It was established that using nano aquacitrates Cr, Se i Ge in feeding melliferous bees for correction of mineral and lipid components level in the tissues and products provides the enhancement of viability of the working bees with the increase in organism, ambrosia and wax of structural and energetic lipid content and decrease of the toxic heavy metals level.

Limiting horizontal water filtration using drainage screen modules to reduce the hydraulic interaction of artificial objects and the natural environment

Serhii V. Klimov[1], Anastasiia V. Klimova

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In the context of climate change, it is important to minimize the changes that are introduced in the territory adjacent to the object of human economic activity. In some cases, this can be done with the help of drainage-screened modules - an antifiltration screen that redistributes the zone of influence of the drain placed near it. As a result, the drain regulates, to a greater extent, the zone of human economic activity (drainage system, tailing dump, populated area, etc.) and to a lesser extent lower the level groundwater in the adjacent territory. The use of drainage-screened modules in tailing farms, for the organized storage of mineral waste of enterprises allows to increase the filtration stability of dike, ensuring the uniform operation of the tailing dams, as well as reliable removal of intercepted groundwater. This is achieved by the fact that in the tailing farm, which consists of alluviation maps, the dike are intensified a drainage-screened module. Water, filtered through the body of the dike and under it, is intercepted by a drain. Part of the filtration flow, which is not intercepted by the drain, is stopped by the anti-filtration screen. The drainage-screened modules on the side of the dike may additionally be equipped with a draining element that is hydraulically connected to the drain, which ensures an organized accelerated drainage of groundwater into the drain, substantially reducing the possibility of waterlogging the downstream part.

In Ukraine, the area of drained land is 9.7% of the total area of arable land. About 60% of swamps, wetlands and wetlands are also drained. The NUWEE offers a regime for the exploitation of peat deposits with organization works in the form of a cycle, so that in a certain territory of the peat swamp, works on the preparation of deposits for development, in the next places - peat extraction, waterlogging, peat formation and peat accumulation was carried out in such volumes and in such a sequence that the total reserves of peat in the region remained constant. To implement these principles, several sites are created in one peat deposit, on which a different groundwater tables will be maintained. In some areas, old peat deposits are being developed, and in other, young deposits, conditions are created for intensive peat formation, which in the course of their development will efficiently absorb from the atmosphere "greenhouse" gas - CO2, almost without producing methane. For the delineation of these areas, is proposed the use of drainage-screened modules.

This article will describe the design, use cases and the rationale for the main parameters of the drain-screened modules.

RISK ASSESSMENT OF ZN-PB ORES MINING AND USEFULNESS OF NATIVE PLANT COMMUNITIES IN DECREASING ITS IMPACT ON AFFECTED AREAS

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Bukowno is a small town of the Silesia-Krakow region in the Southern Poland, which rich silver, lead and zinc deposits supported one of Europe's oldest mining areas. Mining of ores started in this area during the twelfth and thirteenth centuries, when metal deposits were discovered, and continued to these days. As a result of such a long history of mining activity, a large amounts of wastes have been deposited in heaps that have not been reclaimed. Heaps are composed of mining residues and waste rocks which are characterised by properties unfavourable for ecosystem development such as sensitivity to erosion, poor water retention and heavy metal contamination.

We established that the concentrations of Zn, Pb and Cd in samples of grounds taken from the mining and adjacent areas exceeded several times the limits for the level of intervention values according to the Dutch List (1996), while nutrient contents and enzyme activity were at low levels. To help in the interpretation of the ground quality and verify the risk we used biochemical approaches, such as enrichment factor (EF), ecological risk index (RI), Nemerov Pollution Index (PINemerov) as well as enzyme activity index (EAI). Results of the factors calculations indicated that these areas create serious environmental problems and are hazardous to human health, therefore choosing the efficient reclamation method is crucial for their proper treatment. A method to diminish the negative impacts of tailings on the surrounding landscape is to cover them with vegetation composed of native, metal tolerant and adapted to harsh growing condition plant species. Such a plant-based remediation technique is known as phytostabilization which main aim is not to clean a contaminated site, which is very difficult and long-lasting in a strongly contaminated area, but to stabilize it and reduce the risk to human health and the environment.

In order to verify the suitability of native species for the area (Dianthus carthusianorum, Biscutella laevigata Gypsophila fastigiata, Silene vulgaris and Armeria maritima) for the stabilization of mine tailings we established a field experiment. The usefulness of these species for the stabilization and/or remediation of Zn-Pb tailings we controlled also in a three-year pot experiment with these plants cultivated in a substrate of flotation materials. In our experiments the cultivation of calamine flora representatives resulted in an amelioration of the substrate properties such as the increment of nutrient levels and the enzyme activity, as well as a decrease of soluble Cd and Pb. Considering positive results of our experiments and a low-cost, easy implementation and an aesthetic value of the phytostabilization with the use of native calamine flora species, this technique seems a promising method for the restoration of Zn-Pb mining affected areas.

Rhizobia as the microorganisms potentially improving the growth of legumes in heavy metal polluted areas

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Heavy metal polluted areas, *i.e.* postindustrial and post-mining waste heaps, which can be found also in the southern part of Poland (Olkusz Ore Region), can threaten the health of all organisms, including humans'. Such kind of deposits, with increased concentrations of noxious metals (up to 40000 mg Zn, 1650 mg Pb, and 170 mg Cd per kg of soil), that also show water and nutrients deficiency, are highly susceptible horizontal (erosion) and vertical (percolation) dispersion of the pollutants. Plants which are adapted and resistant to such harsh conditions, as metal excluders or (hyper)accumulators may be used for remediation of the environment according to the principles of phytoremediation. Since the usage of only plants for reducing the heavy metal pollution in soils has been demonstrated to be a long-lasting process, the synergistic use with microorganisms may highly enhance the extraction rates. Microbiota may influence the process directly, increasing the availability of metals in the rhizosphere and/or uptake and/or translocation of the metals. Microbiota may also promote the plant's growth. Plant growth promoting rhizobacteria (PGPR) like Rhizobia may possess traits improving plant growth and development, *i.e.* being able to produce auxins, siderophores, acetoin, organic acids, to solubilize phosphorous, to fix dinitrogen and to reduce the levels of ACC (1-amino-cyclopropane-1-carboxylic acid, the immediate precursor of the stress hormone ethylene). The aim of this study is to characterize the PGP traits of microorganisms associated with *Trifolium repens* (white clover), which inhabits the about 100-years old zinc-lead waste heap in Bolesław (S. Poland), and compare them to bacteria originating from an unpolluted control area.

SOIL MICROBIOME DYNAMICS DURING REVEGETATION OF PYRITIC MINE TAILINGS: UNDERSTANDING MICROBIAL BIOINDICATORS OF SOIL ACIDIFICATION

Raina M Maier[1], John Hottenstein, Julie W. Neilson, Juliana Gil-Loaiza, Robert A. Root, Jon Chorover

[1] *University of Arizona*

Challenges to the reclamation of pyritic mine tailings arise from in-situ acid generation that severely constrains the growth of natural revegetation. While acid mine drainage (AMD) microbial communities are well studied under highly acidic conditions, fewer studies document the dynamics of microbial communities that generate acid from pyritic material under the less acidic conditions necessary to establish plant growth. This research characterizes the taxonomic composition dynamics of microbial communities present during a six-year compost-assisted revegetation field study in extremely acidic pyritic mine tailings. A complementary microcosm experiment was performed to identify successional community populations that enable the acidification process across a pH gradient. Taxonomic profiles of the microbial populations in both the field study and microcosms reveal shifts in microbial communities that play a pivotal role in facilitating acidification during the transition between moderately and highly acidic conditions. The potential co-occurance of organoheterotrophic and lithoautotrophic energy metabolisms during acid generation suggests the importance of both groups in facilitating acidification. Taken together, this research suggests that key microbial populations associated with pH transitions could be used as bioindicators for either sustained future plant growth or for acid generation conditions that inhibit further plant growth.

SESSION G

WEDNSDAY, June 12, 2018

14:30-17:50

Exposure science and risk reduction approaches for indoor pollution

Session Chairs:
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KEYNOTE

Assess school environmental effects on children's health and performance and evaluate environmental policies' impacts

Shao Lin[1], Yi Lu, Ziqiang Lin, Wayne Lawrence, Emily Lipton, George Thurston, Haider Khwaja, Xiaobo Xue, Iulia Neamtiu, Eugen Gurzau

[1] *School of Public Health, University of Albany*

Background/ Objectives: More than half of surveyed schools in the United States (U.S.) have reported at least one environmental issue. Currently, there are paucity of studies evaluating school environmental health indicators, however, few studies have (1) assessed multiple environmental hazardous in school settings; (2) evaluated environmental policy impact; and (3) examined the relationship between school environment and academic performance. To fill these knowledge gaps, this presentation will describe the results of our multi-completed and ongoing studies investigating how school environmental factors affects occupants' health and performance, and whether environmental policy changed school environment and health.

Methods/Findings: By using the rich existing datasets in New York State (NYS), such as School Building Condition Survey, traffic data, industrial facility and hazardous waste data, we identified and evaluated approximately 20 school environmental health indicators. We also validated these indicators through multiple studies by linking various school/home environment indicators, in-/out-door indicators with school occupants' health and performance. We found that the increased risk of asthma was significantly associated with poor school conditions, such as cockroach infestations, noticeable moldy odors, roof leaks, air intake near truck delivery area, and air intake blockage. We also observed that schools within 1 to 5 miles from industrial facilities and within 1 mile of an airport have increased risks of emergency department visits due to respiratory diseases after controlling for sociodemographic characteristics. While evaluating the potential health impact of the U.S. Environmental Protection Agency (EPA)'s NOx Policy (an emission reduction policy) on respiratory diseases among children in New York State, we found that mean daily ozone concentrations significantly declined statewide and in 5 out of 8 regions following the NOx reduction policy. The overall adjusted respiratory hospitalizations also significantly declined statewide following the policy after controlling for temporal trends. The beneficial effects were greater in children who were older, non-black, and whose parents paid out-of-pocket or Medicaid insured. Some results from U.S. studies will be compared with our findings from the Schools Indoor Pollution and Health: Observatory Network in Europe" (SINPHONIE) study.

Conclusion: We have identified and comprehensively evaluated school environmental health indicators. We also found multiple school environmental factors were significantly associated adverse health outcomes. Air pollutant reduction policy had positive impacts on both air pollution and childhood asthma. The indicators and methods we developed and research findings from our NYS research and SINPHONIE projects can be referred to other countries.

Fate and Transport Processes for Assessing In-Building CVOC Concentrations from Subsurface Sources

Kelly Pennell, Elham Shirazi, Mohammadyousef Roghani

University of Kentucky

Chlorinated volatile organic compounds (CVOCs) impact hundreds of thousands of hazardous waste sites throughout the United States. In addition, other countries in Europe, as well China, Australia (and other countries) have shown this problem to also be a significant challenge. CVOC groundwater plumes extend long distances from chemical source locations. Vapors partition from these groundwater plumes and migrate through the vadose zone; ultimately entering into buildings. The spatial and temporal variability of chemical concentrations detected in buildings that originate from contaminated groundwater plumes has raised many questions, including variability of indoor air CVOC concentrations.

The building air exchange rate (AER) is a controlling factor for indoor air quality—in terms of general air quality in buildings, as well as mitigating the impacts of pollutants originating from hazardous chemicals. In addition, a new consideration—sewer gas intrusion and the role of preferential pathways has highlighted the importance of entrance “pathways” when evaluating fate and transport of CVOCs from groundwater into building spaces.

To date, few hazardous waste fate and transport models have adequately accurately accounted for AERs, or chemical entrance pathways. Rather the assumption that the building is well-mixed and conventional chemical entry sources has guided most investigations. Drawing on research from air quality studies that have shown variation in AERs based on geographic location, building construction, and age of the building structure, this presentation will highlight the importance of understanding AERs when attempting to qualify inhalation exposure risks. This presentation will summarize the results of field data and a newly published three-dimensional model that emphasizes the importance of airflow inside and around buildings. Important factors for determining inhalation exposure risks associated with indoor air pollution and chemical source locations will also be highlighted.

Sewer Systems and Volatile Organic Compounds: Indoor Air Considerations for Buildings near Contaminated Groundwater Plumes

Mohammadyousef Roghani, Kelly G. Pennell

University of Kentucky

Volatile organic compounds (VOCs) have been the focus of hazardous waste investigations for many decades. Several recent reports of VOC vapors entering building sewers and other piping infrastructure systems call for new perspectives to inform exposure risk assessments at hazardous waste sites. This presentation will include a discussion field data that show spatial and temporal variability of vapor-phase VOC concentrations in sewer systems located near hazardous waste sites. In addition, a conceptual model for inhalation exposures will be presented based on field data and case studies where VOCs within piping systems resulted in unacceptable indoor air concentrations Lastly, the presentation will highlight advanced characterizations methods, including high-frequency sampling, passive sampling, tracer gas testing; and will also discuss a numerical modeling technique to better understand this exposure pathway.

Assessing the association between home indoor environment and respiratory health among school age children in Romania

Yi Lu[1], Shao Lin, Wayne R. Lawrence , Ziqiang Lin, Eugen Gurzau, Eva Csobod, Iulia A. Neamtiu

[1] *Department of Environmental Health Science, School of Public Health, University at Albany, State University of New York*

Exposure to indoor air pollutants at home is associated with respiratory diseases. As lifestyle changes with rapid economic growth in Romania, the aim of our study is to describe the characteristics of Romanian homes and their impact on children's respiratory health.

Information on respiratory symptoms was collected from 280 Romanian elementary school students and their parents in 2011. Home characteristics and demographic information were collected from questionnaires answered by parents. The association between home characteristics and respiratory symptoms was assessed through multivariate logistic regression controlling for school indoor exposure. In sensitivity analysis, comparison between respiratory symptoms and perceived school environment reported by students and parents was assessed by Cohen’s kappa coefficient.

Exposure to environmental tobacco smoke was associated with both asthma and allergy symptoms. Additional risk factors identified for allergy symptoms include living in apartments, living near pesticide sprayed areas, and the use of incense sticks. The significantly higher risk of flu-like symptoms was associated with mold and dampness issues, the use of air conditioner, and the use of a gas heater/iron stove in children's bedrooms. Agreement between student’s and parental reported respiratory symptoms was low to moderate with higher prevalence of respiratory symptoms reported by parents. The perception of school environment had better agreement among reports by parents and students.

Our findings suggest that an increase in respiratory symptoms among Romanian school-age children can be partly related to their environmental exposure at home. Combining student and parental reports of respiratory symptoms may largely improve the accuracy of outcome assessment, especially in studies of young children.

INDOOR ENVIRONMENT AND RESPIRATORY HEALTH IN ROMANIAN PRIMARY SCHOOL CHILDREN

Zigiang Lin[1], Palumbo, Jillian R, Lin Shao, Neamtiu Iulia, Zhang Wangjian, Csobod Eva, Gurzau Eugen

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Objective: School environment may have an impact on children's health, but few studies have focused on indoor comfort factors such as temperature, humidity, and noise in relation to potential effects on children's health. Our cross-sectional study used data from the European Union's Schools Indoor Pollution and Health Observatory Network in Europe (SINPHONIE) project in order to assess children's allergy, asthma-like symptoms, and flu-like symptoms in relation to classroom comfort and environmental factors.

Methods: The study used self-reported data from three questionnaires to identify classroom conditions and student health outcomes for 280 students. We used backwards variable selection and unconditional logistic regression to assess the outcome-environment relationship while controlling for demographics, family history of allergy, and home exposures.

Results: We found significantly increased risks for allergy and flu-like symptoms associated with hot classrooms in the heating season, significantly increased the risks for asthma-like symptoms associated with noisy classrooms, and a protective effect was observed for allergy with good perceived outdoor air quality.

Conclusions: Romanian classrooms rely on natural ventilation, which may contribute to increased temperature and humidity in the heating season. Further research warrants the use of SINPHONIE's objective measurement data to validate our findings.

Next steps: We will use logistic (SEM) model to study the effects of indoor air and outdoor air quality, as well as all other contributors to pollution on asthma, allergy and flu-like symptoms in Romanian schools. SEM is a graphical model for the relationship among measurable and latent variables to develop relationship equation. SEM can control highly correlated variables in the model, and is more efficient to compare traditional variable selection method.

Study conditions and air pollution in pre-university institutions

Dmitri Iunac[1], Angela Cazacu-Stratu

[1]*Nicolae Testemitanu State University of Medicine and Pharmacy*

Children and teenagers represent the society of the future in whom we invest, or at least it should be so. Not just financially, but also educationally, activity and living conditions, their health. Among the respiratory diseases, children often suffer from bronchitis and asthma.

The decisive role in the pathogenesis of these diseases is manifested by a lot of risk factors such as: harmful environmental factors, diet, passive smoking, indoor and outdoor environment, climatic conditions, food additives and dyes, using of pharmaceuticals without medical prescription, family lifestyle.

There were investigated a study conditions of the children at 12 schools from from Chisinau, were determination of microclimatic features, concentration of CO2 and CO, determination of fungal pollution.

In cold period air temperature values was very low during studying. At school were registered temperature values of 17oC. In the beginning of the lessons the average values of temperature were 16,2±0,4, and in the end it was 15,6±0,1. Relative air humidity in classrooms varies during the lessons, but exceeds hygienic normative level (hygienic norm 30-60%) at all investigated schools. Concentration of the carbon dioxide exceeds admissible limits in the end of the lessons at all schools, but the biggest value was registered in 3 schools exceeding hygienic normative (MAC - 0,1%) in 3 times. Pollution of the buildings with fungus (Penicillium, Mucor) and high relative air humidity presents the main factors in development of chronic respiratory diseases.

Investigations conducted in the study have demonstrated the existence of conditions that may have a negative or positive impact on the health of children. The assessment of the complex of investigated factors has been demonstrated by the spirographic indicators in both bronchitis and bronchial asthma.

Dietary Factors May Decrease the Effects of Environmental Hazards on Asthma and Allergy in Children

Wayne R. Lawrence[1]* Shao Lin, Ziqiang Lin, Namratha Gurram, Iulia Neamtiu, Eugen Gurzau

[1] *University at Albany, State University of New York*

Background: The effect of exposure to environmental pollution on adverse respiratory health has emerged as a major public health concern, and previous studies suggested certain dietary habits potentially improve respiratory health. However, limited information exists on the interactive effects between dietary factors and environmental exposures on respiratory health and allergy, especially in children. We therefore investigated if dietary habit modified the relationship between environmental exposures and respiratory health.

Method: The study population consisted of 280 students' ages 6 to 11 years in Romania using the SINPHONIE dataset, which is the largest study aimed at improving air quality in schools and kindergartens in Europe. Parental reported information on respiratory health was collected and primary symptoms were categorized as allergy, flu-like, and asthma-like symptoms. Information on environmental pollution were obtain from information pertaining to student's general environment including exposure to environment tobacco smoke, traffic-related pollution, and mold. Additionally, we also collected sociodemographic information. Logistic regression analysis was performed, controlling covariates.

Results: Dietary habit was associated with respiratory health, where those who did not primarily consume fish had the highest odds of asthma-like symptoms (OR 6.64; 95% CI 1.148, 28.471), compared to those who consumed fish daily (OR 1.34; 95%CI 0.495, 3.648) when exposed to heavy traffic. Compared to children who did not eat fish daily, among those who did, exhibited a protective effect against developing allergy symptoms when residing near heavy street traffic (daily fish consumption, OR 0.149; 95%CI 0.030, 0.72 versus non-daily fish consumption, OR 5.40; 95%CI 0.933, 31.436). As for cooking oil, a positive interaction was observed for environmental exposure and asthma. We found that cooking with sunflower oil was protective against exposure to visible mold in bedroom and allergy-like symptoms (OR 0.26; 95% CI 0.073, 0.933), compared to not using sunflower oil (OR 1.93; 95%CI 0.382, 9.820). However, students that did not cook with butter daily showed a protective effect against asthma-like symptoms when exposed to cultivating spray near dwelling (OR 0.31; 95%CI 0.105, 0.911) compared to those that cooked with butter daily (OR 2.28; 95%CI 0.655, 7.941). In addition, a similar effect was observed for the association between residing near busy traffic and allergy symptoms when cooking with olive oil (OR 0.14; 95% CI0.030, 0.724).

Conclusion: Our results suggest that dietary habit interacts with the associations between environmental exposures and child respiratory health. Findings show that certain dietary habits mitigate the effects of exposure to environmental pollution on adverse respiratory health.

Plant as remedy for improving indoor air quality

Stanislaw Gawronski

Warsaw University of Life Sciences

Impacts of air pollution on human health and well-being are well documented worldwide by World Health Organization. Every year 4.3 million premature deaths occur from exposure to indoor air pollution and 3.7 million deaths are attributed to outdoor pollution (1). Nowadays, in civilized countries, between 85-95% of time man spent indoor where air quality often is worse than outdoor. This is because besides fact that indoor air, due to exchange became soon nearly the same as outdoors, there are also indoor sources of air pollution. They emit among other following pollutants: formaldehyde, cigarette smoke, CO, NO2, NO, CO2, toluene, benzene, trichloroethylene (TCE), dust (PM – particulate matter)), especially the fraction PM2.5 and smaller In case of some of the pollutants, their content often exceed permissible levels. Known harmful effect of air pollutants on man health, indoor air quality still remains a hot issue. Besides various industrial technologies an important role may play phytoremediation in which we “hire” plants to work for pollutants absorbing/adsorbing, and/or degradation/deactivation. The use of plants makes this technology of air purification is inexpensive and their maintenance also acts as a hortitherapy.
In pollutants accumulation by plants, besides gravitation, there are also involved other forces what we showed in our study (2).
Phytoremediation is a young scientific discipline, a lot of research is focused on the intensification of this technology. Increased interest in indoor phytoremediation results not only from often high indoor pollution but also because it is relatively easy to create a safe space in our vicinity. Since cleaning the outdoor air is difficult and would take many years, the possibility of creating a safe space is an attractive alternative.
In recent years more attention has been paid to indoor phytoremediation and intensification of this technology. One direction in this research is use of plants with Crassulacean Acid Metabolism (CAM) system of photosynthesis. In contrast to C3 and C4, CAM plants take up CO2 from the atmosphere also at night. Especially interesting are species known as facultative CAM which may alter their prevailing system of photosynthesis from C3 to CAM and vice versa in adverse environmental conditions.

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2. H. Gawronska.. and B. Bakera. Phytoremediation of particulate matter from indoor air by Chlorophytum comosum L. plants. (2015) Air Quality, Atmosphere, and Health; 8 (3): 265–272, doi: 10.1007/s11869-014-0285-4

SESSION H

WEDNSDAY, June 12, 2018

14:30-17:50

Environmental risk assessment/epidemiology

Session Chairs:
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KEYNOTE

Bioavailable forms of metals and Human Health Risk Assessment

Anicenta Bubak

Cenia-Ekspertyzy

One of the step in the Human Health Risk Assessment (HHRA), based on United States Environmental Protection Agency (US EPA) methodology, is determination of ingested dose. In the case of soil and its contaminants oral route of exposure is very frequent. Orally taken substances are absorbed in gastrointestinal tract into the body.

Toxicological parameters expressed as reference dose (RfD) or oral cancer slope factor (CSFo) refers to ingested doses, and usually are completely different from adsorbed dose. This is especially important for the metals, because of their chemical and physical properties. Metals may exist in soil in a variety of forms, like a rocks, ores, and also as a result of anthropogenic activity.

Metals, mainly minerals, may be poorly soluble in water, what influence on their bioaccessibility and later bioavailability. Bioaccessibile fraction is defined as a portion of physiologically soluble metal *in vitro* that may be available for absorption into the body. Bioavailable fraction is an ingested dose that crosses the gastrointestinal epithelium and becomes available for distribution into internal target tissues and organs (e.g. by circulatory system).

Human health risk based only on total forms of metals may be overestimated. Risk adjusted to oral bioavailability can have significant impact on cleanup goals, remediation techniques, cost effectiveness risks perception and land management.

Surrounding greenness, air pollution and general health in preschool children

Sandra Andrusaityte[1] Regina Grazuleviciene, Inga Petraviciene, Audrius Dedele

[1] *Vytautas Magnus University*

Background and aim. Epidemiologic studies suggest causal links between exposure to traffic-related air pollution and negative effects on children health. There is some evidence that contact with green spaces has positive effect on health; however, the research in young children is sparse. The aim of this study was to examine the association between residential surrounding greenness level, nitrogen dioxide (NO2) exposure, and preschool children health.

Methods. This cross-sectional study included 1 489 children (ages 4 to 6) residents of Kaunas city, Lithuania. We used mother-child pair's questionnaire data to obtain individual participants' characteristic data. We assigned individual exposure to greenness levels as GIS assessed the average of satellite-derived Normalized Difference Vegetation Index (NDVI) within a 100 m buffer of each participant address. Individual exposure to ambient NO2 we assigned using the Land-use regression (LUR) model. We estimated residence exposure of NO2 as continues variables (interquartile range (IQR) and increase per 10 µg/m3) and dichotomized exposure by median. A multivariate logistic regression was used to investigate exposure associations with children health status, controlling for potential confounders.

Results. Poor general health was reported in 14.0% of children aged 4 to 6 years. The annual mean estimated NO2 air concentration was 15.98 µg/m3 (interquartile range (IQR) = 2.76 µg/m3). Poor general health was more prevalent among 4–6-year-old children residing in higher than median NO2 exposure areas to compare with below or equal median (13.3% and 14.6%, accordingly). A 10 µg/m3 increase in NO2 level was association with 24 % (aOR 1.24; 95% CI: 0.69-2.23) increased odds ratios of poor health, after adjustment for covariates. The stratified by environmental exposures multivariate model showed, that low greenness exposure together with higher NO2 level exposure were associated with statistically significant higher adjusted odds ratios for poor health in 4–6-year-old children (aOR 1.72; 95% CI: 1.11-2.66).

Conclusion. The findings of this study demonstrate combined effects of the important role that increased residential greenness and reduced NO2 air pollution even below limit value can play a beneficial role in reducing the risk of young children's poor general health.

Keywords: air pollution, children, poor health

Lung cancer in black coal miners in the Czech Republic, 1992-2015

Tomášková Hana[1], Horáček J., Šlachtová H., Šplíchalová A., Urban P., Jirák Z.

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In the framework of the study focused on risk assessment of lung cancer in black-coal miners in the Czech Republic was found significantly higher risk in miners with acknowledged coal-workers' pneumoconiosis (CWP) comparing with the general Czech men population. The risk in miners without CWP was not higher than in the men population in the Czech Republic. The aim of the following study is a detail analysis of lung cancer cases including the histopathological findings.

The analysed cohorts were created by miners with CWP compensated in the years 1992-2013, in total 3,476 miners (CWP-1), and other cohort without CWP, that consisted of 6,687 miners (CWP-0) who finished the work underground after achieving the maximum permissible exposure (MPE < 90%). Information on personal and working anamnesis was obtained from the medical records. From the National Oncological Register (NOR), information on lung cancer, histopathological findings (WHO classification of tumours of the lung, 2015) and smoking was provided. The smoking status was estimated based on the medical records and data in the NOR. Statistical analysis was done using the non-parametric tests (significance level of 5%) and the calculation of risk ratio with the 95% confidence interval (CI). All analyses were performed in STATA version 14.

During the study period 1992-2015, in total 169 (4.9%) miners from the sample CWP-1 and 180 (2.7%) miners from CWP-0 contracted lung cancer (diagnosis C34 according to the ICD-10). The risk of lung cancer in the sample CWP-1 was significantly higher (RR = 1.82; 95% CI: 1.48-2.25) comparing with the sample CWP-0. Missing information on smoking was detected in 18% of lung cancer cases in the sample CWP-1 and was unable to be completed. The complete smoking information was available in the sample CWP-0. The proportion of active smokers was 16% in the CWP-1 vs. 57% in the CWP-0, the proportion of ex-smokers was 58% vs. 41% and non-smokers 8% vs. 2%. The histopathological subtype was not introduced in 17% of cases in the CWP-1 and 21% in the CWP-0, adenocarcinoma was found in 25% of cases in the CWP-1 and 20% in the CWP-0, squamous cell carcinoma created 40% vs. 34% of cases, small cell carcinoma 12% vs. 26%, other subtypes created 22% vs 20% of cases. The statistically significant difference (p=0.030) was found in the histopathological subtypes between the samples.

The risk of lung cancer was significantly higher in miners with CWP comparing with the miners without CWP. The prevalence of non-smokers in both cohorts was marginal, in the cohort CWP-1 the proportion of ex-smokers was higher. In both cohorts, as well as in men population in the Czech Republic, the squamous cell subtype of lung carcinoma predominated. In CWP-1 miners the second place was covered by adenocarcinoma followed by small cell carcinoma, conversely in miners without CWP the second most frequent subtype was small cell carcinoma and adenocarcinoma.

The study has been conducted with the financial support of the Research Support Foundation, Vaduz. Markus R. Tödtli Consulting.

Dynamic approach to transfer of potentially toxic elements in the soil-plant system

Edita Baltrėnaitė

Vilnius Gediminas Technical University

Environmental, biological and ecosystem-specific variables may affect the transfer of potentially toxic elements (PTEs) from soil to plant including variation in a PTE concentration, type of a PTE, as well as in plant physiological parameters like biotransformation ability.

The interface of the soil and a plant, or in other words, the concentration of a PTE in a plant with respect to the soil, is the basis for a widely used Biological Absorption Coefficient, also known as Transfer Factor, Bioaccumulation Factor, Mobility Ratio, or Plant–Soil Coefficient, which is expressed by the proportion of a PTE concentration in a plant and soil. However, from the biogeochemical point of view, they provide a comparison of a PTE concentration in different media (plant and soil), but only in a particular place (with its typical environmental conditions) or at a particular time. Factors that highlight changes in processes rather than changes in a PTE quantities when conditions of the environment change, are needed. This can be achieved by using second-level factors, or dynamic factors.

A quantitative method using dynamic factors of bioaccumulation, biophilicity, translocation, bioavailability and phytoremediation was developed to estimate the changes in the process of uptake of PTEs by different plant species, to evaluate the influence of soil modification on PTEs' participation in the plants' metabolism, and to provide a quantitative evaluation of the phytoremediation efficiency during a specific period of time. Use of dynamic factors for PTE uptake in different cases representing aerogenic and edaphic PTE transfer towards plant uptake will be discussed.

Gestational phthalate exposure and intrauterine growth restriction

Michael S. Bloom[1], Rebecca J. Wineland, Abby G. Wenzel, Lori Cruze, John W. Brock, John R. Kucklick, Celeste D. Butts, Recai M. Yucel, Roger B. Newman

[1]*University at Albany, SUNY*

Phthalate diesters are employed in myriad commercial, industrial, and personal care applications. Biomonitoring studies in the U.S. and other nations suggest nearly universal exposure among reproductive aged women. A large body of toxicological research implicates some phthalates as developmental toxicants at high doses. However, there are few data available to assess developmental risks of gestational phthalate exposure in women, who are likely to encounter low doses on a frequent basis. To investigate the developmental toxicity of phthalate exposure, we collected urine, from 310 pregnant white and African American mothers with uncomplicated, singleton live births. Using liquid chromatography-tandem mass spectrometry (LC-MS/MS), we measured a panel of eight highly prevalent phthalate monoester metabolites in up to two urine specimens per woman, including MBP, MiBP, MBzP, MEHP, MEOHP, MEHHP, MEP, and MMP. We used logistic regression and multiple informant linear regression models, simultaneously incorporating up to two measures for each woman, to evaluate associations between natural log transformed, specific gravity corrected urinary phthalate concentrations and birth outcomes. We constructed separate regression models for each phthalate monoester as a predictor of preterm birth (PTB, <37 weeks' gestation), low birth weight (LBW, <2500 g), birth weight for gestational age (Z-score), and small for gestational age (SGA, <10th %tile of reference distribution), adjusted for maternal age, body mass index, education, smoking, and race as confounding variables. We implemented multiple imputation for missing covariates and employed stabilized inverse probability of treatment weights to accommodate missing urine specimens. Overall, phthalate concentrations were modestly higher than have been reported for U.S. women in general. We detected a higher risk for LBW (n=19) in association with higher 2nd trimester urinary MMP concentration (odds ratio (OR)=1.90; 95% confidence interval (CI)=1.11, 3.25; P=0.02), although no association with PTB (n=29). Higher 2nd trimester urinary concentrations of MiBP (regression coefficient (B)=-0.28; 95%CI=-0.54, -0.02; P=0.04) and MMP (B=-0.31; 95%CI=-0.52, -0.09; P=0.01) were associated with lower birth weight Z-scores. Finally, we detected higher risks of SGA (n=39) in association with higher 2nd trimester urinary MMP concentration (OR=1.81; 95%CI=1.14, 2.87; P=0.01), and with higher 3rd trimester urinary MiBP (OR=2.84; 95%CI=1.22, 6.16; P=0.02) and MEOHP (OR=2.79; 95%CI=1.05, 7.41; P=0.04) concentrations. Our results suggest that higher gestational phthalate exposure is associated with in utero growth restriction. The effects varied by specific phthalate structure and by the timing of the urine specimen collection. Our study was limited by the absence of 1st trimester urine collection and the short in vivo half-life of urinary phthalates, which may have misclassified some women. We were also unable to incorporate paternal exposure data into our study. However, study strengths include the large sample size, collection of up to two gestational urine specimens for each participant, and capture of clinically validated outcome data. Overall, our study contributes further evidence of phthalates' potential for developmental toxicity at levels of exposure experienced by human populations.

Peripubertal serum dioxins and subsequent adult semen quality and sperm methylome in the prospective russian children's study

Oleg Sergeyev[1], Lidia Mínguez-Alarcón, Alex Shershebnev, Yulia Medvedeva, Alexander Suvorov, Haotian Wu, Andrey Goltsov, Evgeny Loukianov, Tatiana Andreeva, Fedor Gusev, Andrey Manakhov, Luidmila Smigulina, Maria Logacheva, Victoria Shtratnikova, Irina Kuznetsova, Peter Speranskiy-Podobed, Jane S. Burns, Paige L. Williams, Susan Korrick, Mary M. Lee, Evgeny Rogaev, J. Richard Pilsner, Russ Hauser

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Background. Exposures to endocrine disrupting chemicals during critical windows of testicular development and spermatogenesis may be related to poorer semen parameters and altered sperm DNA methylation. We evaluated the association of peripubertal 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) concentration with semen parameters and sperm epigenetic markers.

Methods. The Russian Children's Study is a prospective cohort of 516 boys who were enrolled at 8-9 years of age and provided blood samples for analysis for TCDD. Subjects who reached sexual maturity and were at least 18 years of age were invited to provide two semen samples approximately one week apart. Among these, 133 young men provided 256 samples, which were analyzed for volume, sperm concentration, and motility. Total sperm count (volume x sperm concentration) and total motile sperm count (total sperm count x % motile sperm) were calculated. Unadjusted and adjusted linear mixed models were used to examine the associations of quartiles of lipid-standardized concentrations of TCDD with semen parameters. Whole-genome bisulfite sequencing of sperm was conducted to identify differentially methylated regions (DMR) between groups of selected subjects with highest (n=4, 95th -99th percentiles) and lowest (n=4, level below limit of detection) peripubertal serum TCDD concentrations.

Results. The median (range) for TCDD was 2.9 (0.4-12.1) pg/g lipid. The highest quartile of peripubertal serum TCDD concentrations was associated with a decrease (95% CI) of 40% (18, 66%), 29% (3, 64%), and 30% (2, 70%) in sperm concentration, total sperm count, and total motile sperm count, respectively, compared with the lowest quartile. The mean (SD) methylation across all CpG sites was significantly lower in the selected highest peripubertal serum TCDD group compared to the selected lowest group (49.1 ± 4.9% and 61.9 ± 5.2%, respectively; t-test, p = 0.01). We found 52 DMRs that distinguished two serum TCDD groups. One of the top scoring networks, "Cellular Assembly and Organization, Cellular Function and Maintenance, Carbohydrate Metabolism", identified estrogen receptor alpha (ESR1) as its central regulator.

Conclusions. Our study is the first to suggest that peripubertal environmental exposures may be associated with subsequent poorer semen parameters and sperm methylation profiles in young adults.

Funding: Epigenetic part of study was supported by Russian Science Foundation (RSF) [grant number 14-45-00065]; parent RCS was supported by US EPA [grant number R82943701] and by NIEHS (semen quality part) [grant number R01 ES014370].

Acknowledgements: We would like to thank the study participants, Chapaevsk government, and the Chapaevsk Medical Association and Chapaevsk Central Hospital staff."

Heavy metals in water and risk assessment: A case study of the Czarna Przemsza River source in Zawiercie, Poland.

Agnieszka Gruszecka-Kosowska, Olga Janoska

AGH University of Science and Technology

Water quality is one of the most important issues nowadays. Especially because there are many kinds of pollution that affect on water contamination. The natural source of the Czarna Przemsza River is located in the Zawiercie city, form which inhabitants use water for consumption purposes since 1980s, even though according to the law the source is unofficial and there are no results of official water quality tests. The water quality of the Czarna Przemsza River source in Zawiercie was investigated in four sampling campaigns representing each season in years 2016 and 2017. Concentrations of analyzed 15 elements were compared with permissible limits of drinking water according to Polish legal acts and European Union, World Health Organization, United States Environmental Protection Agency, and Canadian guidelines. The research revealed that water from the analyzed source was not suitable for consumption due to exceeded concentrations of metals and metaloids. Health risk assessment for Zawiercie's inhabitants was calculated based on questionnaire surveys results, while water from the source is consumed regardless of its quality and in the resident exposure scenario. The total non-carcinogenic risk value was above 1, which means that risk existed and total carcinogenic risk was above 1x10-6, which pointed unacceptable risk level. Elements that caused highest risk were As, Pb, Se, Tl, and Ni.

Relationships between air pollution level of PM10 and health status of 8-10 year old children – Results from the Hungarian National Children's Respiratory Surveys (2005-2017)

Peter Rudnai[1], Mihály János Varró, Márta Szalkai, Tamás Szigeti, Réka Kakucs, Ádám Hofer, Tamás Pándics

[1] *National Public Health Institute*

Health status of the children is preferably studied all over the world for evaluation of the health effects of various environmental factors. In Hungary, 3 country-wide surveys (in 2005, 2010/11 and 2017) have been carried out involving 9-10 year old children of 3rd grade elementary school classes.

Objectives of the surveys were to assess the prevalence of chronic respiratory symptoms and other health indicators among school-children as environmental health indicators, and a basis of policies and programmes for mitigating or eliminating adverse health effects of various environmental pollutants.

Health status of the children was assessed by an anonymous questionnaire completed by the parents. The questions covered the children's past (perinatal and early childhood) and present health (respiratory, allergic, psychosomatic) status, the parents' respiratory and allergic diseases, characteristics of the home environment (including environmental tobacco smoke exposure) and socio-economic status of the family. Data on 24 hour concentrations of PM10 in 25 towns (excluding Budapest) were taken from the National Air Quality Monitoring Network and from these average concentrations were calculated for the heating and the non-heating periods, and also for the whole year. Chi-square tests, Mann-Whitney's U-test and logistic regression analysis (with adjustment for gender, age, environmental tobacco smoke exposure and socio-economic status) were used for statistical evaluation of the associations between air pollution and health status of the children.

Evaluation of the data of 7827 children aged 9-10 years living in the studied 25 towns showed that the prevalence of doctor-diagnosed asthma and allergy was significantly higher in towns with PM10 concentration above 50µg/m3 in the heating and 30 µg/m3 in the non-heating periods and above 40µg/m3 for the whole year. Results of the logistic regression analysis showed that a decrease of the yearly average PM10 concentration by 10µg/m3 would decrease the risk of diagnosed allergy by 9%.

The prevalence of doctor-diagnosed asthma and allergy among school children was found to be significantly associated with their long-term exposure to high level of PM10 concentration.

Session I

Thursday, June 14, 2018
9:00-11:30

Environmental and health benefits of renewable energy sources

Session Chairs:

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S. Al-Abed al-abed.souhail@epa.gov

KEYNOTE

Environmental pollution - A threat of the Earth's life and a killer of 9 million human beings a year

Antoni Stasch

European Business Club Association e.V.

In our lecture we present the results of the R&D of the European Business Club e.V from last 12 years in the environmental and health benefits connected with the 3 fold (300%) decreasing of the Levelized Costs of Energy (LCOE) of the production of the clean and affordable:
Thermosolar energy at cost of 0.042 € / kWh
Photovoltaic energy at cost of 0,03 € /kWh
3 fold cheaper energy in the systems of nano and perovskite photovoltaic arrays and at space stations photovoltaic
We show that such decreasing is possible by the substituting of 75% surface of the expensive thermosolar (980€/m2) collectors or photovoltaic panels (480€/m2) by more than 20 times cheaper (8-15€/m2)parabolic or spherical mirrors used in the Concentrated Solar Power Plants in California, Spain and Morocco (in part of DESERTEC project)
Such 3 fold decreasing of the LCAO of clean energy is sine qua non condition for decreasing of the air, water and soil pollutions responsible for 9 million premature deaths what means 16% of all global death, that is killing more people than smoking, hunger, natural disasters, war, AIDS, or malaria
This decreasing is also:
I. A necessary condition for the 32-fold increase in the production of clean and affordable energy of the first-ever universal, legally binding global climate deal, ratified by 102 countries at the 21st World Climate Conference on November 30, 2015 in Paris
II. Important for the Successful realizing of the "Breakthrough Energy Coalition" program of Bill Gates, http://www.b-t.energy, whose investment volume exceeds 2,000 billions of US $ ($ 2 trillion)

The next presented very important solutions of European Business Club Association especially important in countries of Middle and East Europe enable:
1. Further decreasing in Central Europe the LCOE by using to cover up to 80% of costs of thermosolar collectors or photovoltaic panels and other components of energy production and storage systems the funds from the Aid Programs of the European Union, Switzerland and Norway
2. Synchronization of the energy production with daily demand by hybridization of 3 and more systems of the clean energy in an “off the grid” and “partially of the grid” systems
3. Storage of the Energy:
in Powerwall Tesla / Panasonic battery packs of Elon Musk
in huge (up to 9 TWh) energy storages of Daimler and BMW using partly (in 16%) exhausted batteries after 10 years of power supply of electric cars
in efficient, passive thermal energy storage systems of the “Plus Energy Building “
4. Further increasing up the profitability threshold by concentrated nanophotovoltaic, and perovskite photovoltaic.

Ecological evaluation of the production of alternative fuel from waste

Mateusz Malinowski[1], Katarzyna Grzesik

[1] *University of Agriculture in Krakow*

The aim of this study was to identify and assess the potential environmental impacts caused by refuse-derived fuel (RDF - alternative fuel) production from mixed municipal waste, in a mechanical–biological waste treatment plant in Krakow, Poland.

The study was based on life cycle assessment (LCA) methodology, employing EASETECH model. The system boundaries include only those operations which lead to the production of RDF. The adopted functional unit is 1 Mg of mixed municipal waste generated in Krakow, which enters the mechanical–biological waste treatment plant.

Impact of ozone pretreatment on the biometallurgical properties of toxic wastes

Maciej Gliniak[1], Anna Lis

[1] *University of Agriculture in Krakow, Faculty of Production and Power Engineering*

Ozone can be used to mitigate the discharge of solid inorganic pollutants from power plants to the aquatic environment. The toxicity of metals also present in waste from electricity or heat production and strongly depends on their speciation. The knowledge on the metal transformation during ozonation of solid wastes from power plants effluent is essential to assess their negative environmental impacts. The bioavailability and stechiometries of the reaction with ozone of selected metal sulphides – CdS, CuS, FeS and ZnS – were investigated. A stechiometric factor of 2.1-2.9 moles of ozone per mole of metal sulphide and apparent second constant of pH > 6.8. During experiments the metal bioavailability was ranged in the order Cd < Cu < Fe < Zn. The highest bioavailability was reached with specific ozone doses of 1.01-1.38 gO3/g waste.

Analysis of the biochar production form waste biomass – process influence on quality parameters

Marcin Jewiarz[1]

[1] *Faculty of Production and Power Engineering*

Paper presents preliminary results of the waste biomass torrefaction process. As a test material, several types of husks were used. Research aims in analysis of the change in key factors like: bulk, specific and absolute densities , ash content, volatiles and fixed carbon, net calorific value and concentration of selected elements. Test material will be treated in different process time and temperature regimes. Results obtained during research will be used in further development of technology, according to material structure.

Energy management in crops under cover during storage heat in the accumulators: energy and ecological effects

Hubert Latala, Sławomir Kurpaska

University of Agriculture in Krakow

Plant cultivation under controlled conditions stimulates to apply innovations related to the reduction of energy consumption and optimal control of plant growth factors (temperature, relative air humidity, solar radiation and feeding plants with carbon dioxide). It is known that searching for technical solutions used in the production processes should be integrally related to the improvement of the product quality and reduction of its costs. Undoubtedly, reduction of production costs in facilities under covers may be performed, inter alia, by using the excess of heat from the inside of the facility for heating the object.

The system of heat accumulation comprised elements which suck hot air from the upper part of the facility and the system which distributes heated air to the plant zone. Heat storage in the accumulator was performed with the use of an autonomous control system. This system, based on the algorithm, controlled both the charging and discharging process including the set parameters of the microclimate inside the facility. The energy effects (the amount of heat, parameters of the microclimate inside the tunnel), issues concerning drying and humidification of air pressed through the stone bed and the amount and quality of tomato yield were analyzed. The effects of accumulation were calculated into fuel consumption and the reduction of hazardous substance emitted to atmosphere was calculated. Moreover, the obtained effects in the form of plant yield were presented.

Gasification of waste and biomass - energetic and environmental effects

Stanisław Famielec

University of Agriculture in Krakow

Gasification is a thermal process for converting solid fuels into gaseous ones. It enables energetic usage of such materials which cannot be used directly for combustion, e.g. some groups of organic waste or waste biomass containing too much water or contaminants to be applied in other thermal processes. The presented work describes some of the most important issues concerning gasification in terms of energetic and environmental aspects. It shows also the result of gasification tests conducted at the Faculty of Production and Power Engineering, University of Agriculture in Krakow.

Polish concept and 46 years research and training on primary prevention of environmental risk factors (e.g. cancer prevention, sustainable development focused on better environmental health in industrial and recreational areas)

Jan W. Dobrowolski

World Academy of Arts and Science

The author started in 1968 with the national school on problem-solving training of students over 30 subjects of studies focused on the Human environment better environmental health based on interdisciplinary case studies in different model areas followed from 1972 by the international schools on common action for improvement primary prevention of environmental health hazard integrated with sustainable development (starting with regions the oldest in Europe border park in the Pieniny and. Tatra Mts) in cooperation with experts and students from various Europen countries, Japan (including Minamata disease of civilization) India, USA etc.including linkage with qualified tourism (encological, medical etc.).He was chairmn of 15 Intel. Conferences on Sustainable Development and Eco-Innovation from 1989 to 2015 and Intel Seminar on Environmental Heath in the Central and East Europe in 1990.He contributed also to transdisciplinary innovative study on primary prevention of cancer/leukemia within Com.of Protection Public Health founded and chaired by Professor Aleksandrowicz (including epidemiological and environmental studies in control areas versus cancer clusters). He was the scientific leader of model research projects on environmental health in such industrial regions like the Stel Work in Krakow-Nowa Huta. "Katowice:" Metallurgical Center etc. followed by innovative approach to integration eco toxicological study, personal monitoring of trace metals and new methods of more efficient reclamation of contaminated areas including laser biotechnology, followed by training in this field interested students from developed and developing countries from Asia, America, Europe and Africa based on case studies in Poland.

SESSION J

Thursday, June 13, 2018

9:00-11:10

Social, political and economic impacts and considerations related to environmental stressors

Session Chairs:
A. Baker ajmb@unimelb.edu.au
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KEYNOTE

Applying Resilience Theory to Community Engagement with Residents Facing Cumulative Environmental Exposure Risks: Lessons from Louisiana's Industrial Corridor

Margaret A. Reams[1], Jennifer K. Irving

[1] *Louisiana State University*

The presence of legacy pollutants, on-going chemical manufacturing activities, and population shifts have introduced complex, cumulative exposure risks to residents of many highly industrialized communities. These "industrial corridors" are found in numerous nations and present unique challenges to environmental health science professionals, public and private sector decision makers, and residents seeking to make their communities healthier and safer. Social-ecological resilience theory offers a useful framework for the design and implementation of community engagement efforts to help stakeholders take action to reduce their exposure risks. A resilience framework views the human community as a coupled social-ecological system, wherein disturbances to the equilibrium of the system – acute and/or chronic – are inevitable. It recognizes three key capacities of more resilient communities. These are the abilities of community members to self-organize to address changing threat levels, to hold scientifically sound understandings of the risks, and to learn from past experiences and take action – individually or collectively – to adapt to or mitigate the hazards in their local environment. We apply this resilience theory framework to two case studies from Louisiana, conducted through the Louisiana State University (LSU) Superfund Research Center's Community Engagement program and supported by the National Institute of Environmental Health Sciences (NIEHS). The cases are from the Louisiana communities of St. Gabriel and Camp Minden, and each illuminates a critical path by which resilience theory can be applied to guide community engagement within a contentious, real-world setting. In each case, the three components of the resilience framework were supported by specific program mechanisms and activities. We also include a statistical analysis of our recent randomized survey of over 500 residents of Louisiana's industrialized communities to determine the influences on household-level adaptive behaviors to reduce acute and chronic environmental exposure risks. The results of the Logistic Regression analysis indicate that residents with more knowledge about specific environmental hazards, along with confidence in their ability to implement risk-reduction measures - such as checking air-quality forecasts and then limiting outside activities - were much more likely to adopt the exposure-reducing behaviors, even when controlling for socioeconomic and demographic differences among respondents. These "lessons learned" from Louisiana communities facing cumulative environmental exposure risks provide evidence that application of resilience theory to the design and implementation of community engagement programs can increase the longer-term effectiveness of the efforts and enhance overall environmental health resilience. In addition, they provide practical insights about how to operationalize and apply these theoretical concepts to real-world environmental health challenges faced by residents of industrialized communities throughout the world.

Community Resilience and Critical Transformations: The Case of St. Gabriel, Louisiana

Jennifer Irving

Louisiana State University (USA)

Social-ecological resilience theory is a conceptual framework used to describe and explain the capacity of complex systems to persist or return to their original state following perturbations or disturbances. Originally developed to describe ecological systems, resilience includes three components: the amount of disturbance a system can withstand and remain within the same state, a system's ability to self-organize, and the extent to which a system can increase the capacity for learning and adaptation or adaptive capacity. Resilience thinking has since been used as a framework to study many different types of systems. For example, social resilience is the ability of human communities to withstand shocks to their social infrastructure such as environmental disasters or social, economic or political upheaval and adaptive capacity has been used to describe how individuals act to reduce their exposure to pollution. While much of the research on resilience is concerned with maintaining the "original state," systems that exhibit high levels of adaptive capacity, may be able to take advantage of disturbances to reach new, more resilient states. I use qualitative case study methodology, with newspaper articles and public documents serving as data sources, to examine how resilience has evolved in the community of St. Gabriel, Louisiana. St. Gabriel is a small, predominantly African American town located on the east bank of the Mississippi river in Louisiana's chemical corridor, an 85-mile long swath of land between New Orleans and Baton Rouge that is home to a high concentration of petrochemical plants and hazardous waste facilities. I highlight two critical events, or disturbances, that the citizens of St. Gabriel were able to capitalize on that appear to have led to critical transformations to more resilient states. The first is the community's successful organization in opposition to a large hazardous waste facility in the 1990's and the second is community members' participation in workshops designed to help citizens better participate in local environmental decision-making processes. St. Gabriel's response to these two events resulted in more equitable environmental planning and the prevention new exposure risks in the community. It also illustrates how efforts to enhance or build the different components of resilience, may enable a community not just to return to its prior state after a disturbance, but reach a new, even more resilient state.

Behavioral and psychosocial risk factors in high school students – results from the Y.A.B.S. study

Jana Babjakova, Lubica Argalasova[1], Ludmila Sevcikova, , Diana Vondrova, Martin Samohyl, Alexandra Filova, Jana Jurkovicova, Michael Weitzman

[1]*Institute of Hygiene, Faculty of Medicine, Comenius University, Bratislava, Slovakia*

The Youth and Parents Risk Factor Behavior Survey in Slovakia (YABS) originates from The Behavioral Risk Factor Surveillance System (BRFSS) and The Youth Risk Behavior Surveillance System (YRBSS), originally designed by CDC, Atlanta, USA.

The aim is to assess several behavioral factors in youth and adults according to the model CDC survey taking into account national specificities. The project will identify persons at risk and target the attention of teachers, researchers, policy makers and general public on these issues.

The project in the model region, Bratislava, Slovakia is focused on behavioral and psychosocial risk factors in a representative sample of high school students (15-19 years old) and their parents. There were 2,384 questionnaires distributed in total (798 for students + 1,586 for parents), the response rate was (64% + 46%). The survey was anonymous and voluntary, approved by Ethical Committee of Faculty of Medicine Comenius University and Faculty Hospital.

The most important health risk behaviors in students' sample were identified (tobacco and alcohol use, violence, risky sexual and dietary behavior, inadequate physical activity). The prevalence of smoking in the students' sample was 19.9 %; 60 % of students were drinking alcohol at least once in the last month and 19.9 % more than three times a month. The percentage of students exposed to physical violence was 22.4 %; 11.8 % admitted that they humiliated, amused or physically attacked their classmates; 38.5 % of their parents were sending sms and/or emails when driving. The percentage of sexually active high school students in our sample was 39 %. The percentage of students using PC over 3 hours daily was 59.7 % Monday-Friday and 72 % Saturday and Sunday, watching TV more than 3 hours daily was 8.9 % Monday-Friday and 26.3 % Saturday and Sunday. The proportion of students consuming soda several times daily was 26.5 %. In comparison, U.S. adolescents smoke less (15.7%), drink less alcohol (50.8%), but they admit more physical violence in schools (25 %).

This is a comprehensive study, based on combination of two validated studies. Parents are directly involved into the study, that makes challenges for the analysis and for future prevention and intervention. The data from parents will be analyzed and paired with students. The interesting results are expected and intervention proposals suggested in the future.

Implementation of "Intended Nationally Determined Contributions" of the Republic of Armenia in rural communities

Amalia Hambartsumyan[1], Aram Gabrielyan

[1]"Khazer" Ecological and Cultural NGO

Implementation of "Intended Nationally Determined Contributions" of the Republic of Armenia in rural communities" project under financial support of the GEF Small Grants Program which aimed to change the situation and directly involve community members into the improvement of social and economic situation, as well as into revealing and solving of ecological issues of their area. In the current situation the economic and social development of communities is almost entirely dependent on subsidies and subventions provided by the government.

This, of course, does not contribute to strenghten the capacity of local self-government and self-sufficiency. In addition, the situation significantly impede the exercise of public initiative, in particular, the implementation of investment projects.

The main idea of the Project is to establish Climate Civil Revolving Investment Fund, which on the basis of an inalienable property right will belong to community members. The capital of fund will consist of two components: a/Investment funds provided by this program, other donors and sources, and b/permanent and sustainable annual environmental subvention allocated to community. The fond is accomplished by the fees paid by the organizations for usage of natural resources and negative impact on the environment.

The objective of the Project is to urge and encourage participation of community residents and CSOs in social-economic development issues and in revealing and finding solution of ecological problems existing in their environment. The question of real involvement of residents is of major importance for establishment of Climate Civil Revolving Investment Fund, which in its turn envisages the sufficient level of self-organization. The primary unit for social self-organization is the community.

We invite all the communities to join the Project, to initiate the Climate Civil Revolving Investment Fund establishment and to participate in investment projects competition

To enlarge the scope of content and financial capacity of this innovative project it is planned to form a consortium of supporters, the intention to be involved in which several communities have already expressed their interest.

Civil Revolving Investment Funds have already been established in some communities of the Lori and Shirak regions, where implementation of the projects on climate change adaptation and mitigation is envisaged.

Film about "Climate Revolving Investment Civil Fund"

https://www.youtube.com/watch?v=22WWdjNGoJI&feature=youtu.be

At this moment the members of consortium are:

- WWF-Armenia,
- "Country Water Partnership" Armenia NGO,
- WCC Armenia Round Table Foundation.

Anthropocene and the contemporary environmental situation

Omair Khan

University of Pannonia, Veszprem Hungary

According to the new studies the human life is now facing a new epoch of Anthropocene. The Nobel laureate Paul Crutzen proposed the starting date of this new epoch as 1784, the year that James Watt patented the steam engine, the symbol of the start of the the industrial revolution. The phenomenon of the Anthropocene is not new. The difference is that the mankind took too much time to realize it as a reality. Still we have contrarian who oppose this phenomenon as we have people who reject global warming.

It is the period during which human activities are considered to have a significant impact on the global environment, which begun around the time of industrialization, in late eighteenth century. Number of geologist have tried to explain this new epoch of Anthropocene. Famous Nobel Laureate Crutzen explain it as the 'carbonification' of our atmosphere by the burning of coal extracted from the lithosphere. The environment which we share with all the other species, has become less immune to the contemporary challenges. The current average temperature of the earth is 1.48 degrees Celsius which is expected to be between 3-5 degrees Celsius at the end of the century, if the human activities keep going at the same pace. The current world is more insecure and unstable then ever due to anthropogenic activities as the concentration of Greenhouse gases has increased in couple of decades. These greenhouses gases regulate the overall temperature on the earth's surface. It is, in principle, a natural process by which certain gases like carbon, methane, carbon dioxide, water vapors, nitrous oxide which re- radiate heat back to the earth's surface, without this regulation or the process our planet would be considerably colder and most likely uninhabitable. But over the past two decades the use of fossil fuel and the concentration of the carbon has seriously increased to a very serious level. According to reports, in May 2013 atmospheric concentration of CO2 reached 400 parts per million for the first time in several million years. This has increased the Ocean acidification by 30% since pre-industrial revolution. The parts of the world are experiencing unprecedented and unusual changes. Ten out of thirteen years were the warmest on record since the century has started. The situation is more alarming for the coral reefs as the warm water will damage 99% of the coral reef across the globe. In response to this increased in earth average temperature, the sea level has raised by 1.6% and the area of dead zones has increased in the past couple of years. These anthropogenic emission of green house gases increased by 70% between 1970 and 2004. Since the start of 21st century the global and national level steps have been taken in order to halt or at least lower the negative human impact on the surrounding environment. This problem of Anthropocene is more a global issue rather than a national or region issue and the world has already taken enough time to realize it. Therefor the struggle and efforts will be more effective, prominent and more obvious if this phenomenon of Anthropocene and its impact will deal in a global effort. And efforts have been made in past two decades. This Paris Agreement of the 2015 under the auspices of UN Framework Convention on Climate Change was a global success by getting them together on a same issue and under a legal binding of keeping the global average temperature by 2 degrees Celsius. The UNFCCC and its annual meeting of COP has had faced success in the last two decades since the struggle against the global climate change has started in 1997 in face of Kyoto Protocol. Since COP has faced series of failure in case of Bali, Copenhagen, Doha conferences. But this Paris Agreement of 2015 is little different from the previous ones. It was the first time when the agreement got a global acceptance from 196 nations and has a legal status of some portion of the agreement as well. And then in last year annual conference of 2017 not

even the countries but many international NGOs, big corporates and independent states also participated and pledged their possible contribution and financial support in curbing this phenomenon of Anthropocene.

The aim of the paper is to highlight and awareness of anthropogenic phenomenon and its worse impact, which has made the survival of millions of species, including humans, difficult in the contemporary world. At the end, small portion of the paper is also dedicated to the recommendations and the success of Paris Agreement as well.

SESSION POSTERS
TUESDAY, June 12, 2018
11:20-13:20

1. Chemistry, health risks and solutions for atmospheric air pollution

The phyllomicrobiome of Hornbeam (Carpinus betulus L.) and Benjamin fig (Ficus benjamina L.) and their potential role in detoxification of air contaminants

Lukasz Kowalkowski[1], Sofie Thijs, Jaco Vangronsveld, Stanislaw W. Gawronski

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Air is one of most crucial factors having an impact on human life and its quality. Air main pollution is composed of organic compounds (among others) e.g. PAHs (polycyclic aromatic hydrocarbons) or BTEX (benzene, toluene, ethylbenzene, xylene).Our knowledge- about pollution-degradative role of phyllomicroorganisms living on above-ground plant parts is currently in its early stages but with promising preliminary results. Complete analysis of phyllometagenome offers most complex information about species living on leaves surface, species that might have the ability to degrade organic pollutants. This nucleotide material contains DNA fragments encoding proteins associated in pathways involved in degradation of above-mentioned compounds (e.g. mono- and dioxygenases (e.g. of benzene) and bacterial P-450 cytochrome). Specie on which study is conducted is common hornbeam (Carpinus betulus L.), plant often grown in form of hedges where it is exposed to traffic pollution. Being trimmed, it keeps its leaves during winter what allows it to maintain phytoremediative role by its microbiome even during such cold season. Second plant's phyllomicrobiome under scope is of benjamin fig (Ficus benjamina L.), a popular indoor plant. Conducted research is based on culture-based experiments and non-culture-based experiments to establish microbial diversity on plants in different environments, to isolate interesting microbial strains and to gather in-depth information from metagenomes.

EFFECT OF AMBIENT AIR CHEMICAL CARCINOGENS ON THE THYROID CANCER MORBIDITY OF THE POPULATION

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The problem of increasing incidence of thyroid cancer (TC) in the population is actual today for Ukraine, and it has become especially important after the accident at Chernobyl NPP. Today, the fact of influence by external factors on the formation of TC, the most important of which is considered to be radioactive irradiation of various types and inadequate admission of iodine to the body, is generally recognized. However, some features of the emergence and growth of the incidence of this pathology can be considered as consequences of involvement in this process of other factors - chemical pollution of the environment.The purpose of the work was to assess the role of atmospheric air pollutants - priority chemical carcinogens in the formation of morbidity of the population on TC.

Materials and methods of research. In the atmospheric air, 8 prior carcinogenic compounds were investigated, whose priority is determined by the degree of prevalence in the environment, carcinogenic activity and the population of the population that may be subject to their influence.The research was conducted on the territory of two Ukrainian cities. Analysis of data on atmospheric air pollution of cities and population morbidity was conducted in the dynamics of 20-year observations. To assess the influence of carcinogens of atmospheric air of cities on the incidence of the population on TC, a methodology for risk assessment was used.

Results and discussion. Analysis of the dynamics of atmospheric air pollution in cities during the period under investigation (according to the size of the carcinogenic risk) and the incidence of TC in the population from these cities of the same observation period showed that they are generally of a similar nature, which may indicate a relationship between these parameters. However, given the fact that carcinogen, unlike many toxic compounds, does not act on the body instantaneously, but causes long-term effects in the body that, which with certain conditions and circumstances, can manifest themselves through a significant period of time after exposure, a graphical comparison of the data of contamination and morbidity of TC, as well as the search for correlation bonds were conducted not only at identical time intervals (year in year), but also with the time-shift in incidence rates from pollution indicators.

The correlation analysis method found a positive correlation between atmospheric air pollution by carcinogens and standardized indicators of the morbidity on TC of urban population with shift in time of manifestation of maximum cumulative effect (~ 10 years). In other words, the conditional period of the emergence of TC from exposure to air polluted by carcinogens was revealed.It was established that the incidence of the population correlates not only with the total indices of carcinogenic risk of polluted air, but also with varying degrees of certainty with the concentrations of some carcinogens (formaldehyde, benz / a / pyrene, cadmium, chromium VI) also with a bias of 10 years. The results of research will allow us to specify the preventive measures to reduce the oncological morbidity of the population.

SEEDS OF PLANTS OF EUROPEAN BIO- AND AGRICENOSIS RESPOND TO SMOKE IN A DIFFERENT WAY

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The indirect effect of swailing (burning of grasses) is the emission of smoke consisting of physiologically active volatiles, hence the aim of the study was to identify the impact of smoke generated by simulated swailing to seeds of different angiosperms occurring or grown Europe. The response to smoke was more or less differentiated within a taxon, e.g. in the case of tomato. The stimulation of germination and/or increased seedling vigour was established in green- and red-leafed basil, white and red cabbage, white clover, celery and wild thyme. Similar effect was obtained for the seeds of broadleaf plantain and German chamomile. In the latter case smoke replaced the impact of light on positively photoblastic seeds. The inhibition of germination and/ or reduced seedling vigour was demonstrated in case of caraway, dill and forget-me-not. As similar results were obtained both in vitro and in the soil, it can be assumed that the impact of smoke on plant habitat composition is likely.

References:

Bączek-Kwinta R. (2017). Swailing affects seed germination of plants of European bio-and agricenosis in a different way. Open Life Sciences, 12(1), pp. 62-75. doi:10.1515/biol-2017-0007

INFLUENCE OF SYNOPTIC SITUATIONS ON THE CONDITION OF AIR POLLUTION WITH SUSPENDED PARTICULATE MATTER IN KRAKOW IN 2015

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The aim of the study was to determine the variability the concentratio of PM10 suspended particulate matter depending on synoptic situations in the heating season in 2015 in Krakow. The average daily PM concentration at the air monitoring station in al. Krasińskiego on the background of synoptic situations defined by Niedźwiedź for the upper Vistula basin. The highest concentration was noted for the synoptic types Swa, Sea, Wa and SWc. The decrease of atmospheric air temperature was conducive to an increase concentration of PM10 suspended particulate matter.

Keywords: air quality, synoptic situations, particulate matter PM10, heating season.

2. Environmental and health impacts of minerals/metals and mining activities

SITE-SPECIFIC ECOLOGICAL RISK ASSESSMENT FOR THE AREA OF THE FORMER MINING ACTIVITY

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One of the main threats to soil multifunctionality is soil contamination with chemical pollutants, including metals and organic compounds e.g. PAHs. The high level of chemicals may cause an adverse effect on soil organisms and create hazard for human health. For assessing the risk from chemical contamination the ecological risk assessment (ERA) procedures are recently applied. ERA evaluates the likelihood of occurring adverse ecological effects as a result of exposure to stress (e.g. contamination). For the site-specific assessment of contaminated sites the Triad method is suggested. The Triad is a weight of evidence approach integrating three fields of research (chemistry, ecotoxicology and ecology).

The aim of the study was application of the ERA with Triad methodology for the assessment of the area subjected to the long time exposure to contamination.

The research area (about 100 km2) was located in the south-western part of the Upper Silesia region in Poland in the vicinity of the coal mine operating from the end of the 19th century till 2000 and coking plant with over 100 years coke production. 24 sampling points were collected with respect to different soil conditions and direct influence of local and trans boundary contamination/emission sources. The basic physicochemical and biological properties were determined in the soil samples. Applied ERA procedure comprised three different Lines of Evidence - LoE (chemical, ecotoxicological and ecological). The measured concentrations of selected pollutants (11 metals and 16 PAHs) were evaluated according to the Polish guidelines and were included into chemical LoE. The battery of biotests was applied to describe ecotoxicological and ecological LoE of the research area. Analysis and integration the results in different LoEs allowed to calculate of integrated risk indexes and to delineate the limited area of possible high ecological risk.

Limiting horizontal water filtration using drainage screen modules to reduce the hydraulic interaction of artificial objects and the natural environment

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In the context of climate change, it is important to minimize the changes that are introduced in the territory adjacent to the object of human economic activity. In some cases, this can be done with the help of drainage-screened modules - an antifiltration screen that redistributes the zone of influence of the drain placed near it. As a result, the drain regulates, to a greater extent, the zone of human economic activity (drainage system, tailing dump, populated area, etc.) and to a lesser extent lower the level groundwater in the adjacent territory. The use of drainage-screened modules in tailing farms, for the organized storage of mineral waste of enterprises allows to increase the filtration stability of dike, ensuring the uniform operation of the tailing dams, as well as reliable removal of intercepted groundwater. This is achieved by the fact that in the tailing farm, which consists of alluviation maps, the dike are intensified a drainage-screened module. Water, filtered through the body of the dike and under it, is intercepted by a drain. Part of the filtration flow, which is not intercepted by the drain, is stopped by the anti-filtration screen. The drainage-screened modules on the side of the dike may additionally be equipped with a draining element that is hydraulically connected to the drain, which ensures an organized accelerated drainage of groundwater into the drain, substantially reducing the possibility of waterlogging the downstream part.

In Ukraine, the area of drained land is 9.7% of the total area of arable land. About 60% of swamps, wetlands and wetlands are also drained. The NUWEE offers a regime for the exploitation of peat deposits with organization works in the form of a cycle, so that in a certain territory of the peat swamp, works on the preparation of deposits for development, in the next places - peat extraction, waterlogging, peat formation and peat accumulation was carried out in such volumes and in such a sequence that the total reserves of peat in the region remained constant. To implement these principles, several sites are created in one peat deposit, on which a different groundwater tables will be maintained. In some areas, old peat deposits are being developed, and in other, young deposits, conditions are created for intensive peat formation, which in the course of their development will efficiently absorb from the atmosphere "greenhouse" gas - CO2, almost without producing methane. For the delineation of these areas, is proposed the use of drainage-screened modules.

This article will describe the design, use cases and the rationale for the main parameters of the drain-screened modules.

Isolation and characterization of Rhizobium bacteria from Lotus corniculatus root nodules growing on serpentine soil

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Legumes are known as pioneer plants colonizing metal contaminated soils with low content of nutrients (e.g. N,P). These plants ability to growth in such hard conditions has been explained by their capacity to engage in symbiotic interactions with nitrogen-fixing rhizobia and mycorrhizal fungi. We report the isolation and characterization of Rhizobium bacteria from root nodules of Lotus corniculatus, growing on nickel rich serpentine soils in Southern Poland. All isolates were screened for nodulation ability in sterile culture and resistance to heavy metals. 50 isolates confirmed the ability to form effective nodules on Lotus roots and were used for genetic characterization by rep-PCR (BOX) and sequencing of the dnaK, glnII, and recA genes and were classified to 2 different taxonomic groups. Our results pointed out that, despite the high concentration of heavy metals present in the soil Lotus nodules harbors an bacterial flora showing a low genetic diversity as well as a high level of resistance to heavy metals that could potentially help plant growth in contaminated soil and may be useful for phytoremediation. Detailed results will be presented at the poster session.

Lung cancer in black coal miners in the Czech Republic, 1992-2015

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In the framework of the study focused on risk assessment of lung cancer in black-coal miners in the Czech Republic was found significantly higher risk in miners with acknowledged coal-workers' pneumoconiosis (CWP) comparing with the general Czech men population. The risk in miners without CWP was not higher than in the men population in the Czech Republic. The aim of the following study is a detail analysis of lung cancer cases including the histopathological findings.

The analysed cohorts were created by miners with CWP compensated in the years 1992-2013, in total 3,476 miners (CWP-1), and other cohort without CWP, that consisted of 6,687 miners (CWP-0) who finished the work underground after achieving the maximum permissible exposure (MPE < 90%). Information on personal and working anamnesis was obtained from the medical records. From the National Oncological Register (NOR), information on lung cancer, histopathological findings (WHO classification of tumours of the lung, 2015) and smoking was provided. The smoking status was estimated based on the medical records and data in the NOR. Statistical analysis was done using the non-parametric tests (significance level of 5%) and the calculation of risk ratio with the 95% confidence interval (CI). All analyses were performed in STATA version 14.

During the study period 1992-2015, in total 169 (4.9%) miners from the sample CWP-1 and 180 (2.7%) miners from CWP-0 contracted lung cancer (diagnosis C34 according to the ICD-10). The risk of lung cancer in the sample CWP-1 was significantly higher (RR = 1.82; 95% CI: 1.48-2.25) comparing with the sample CWP-0. Missing information on smoking was detected in 18% of lung cancer cases in the sample CWP-1 and was unable to be completed. The complete smoking information was available in the sample CWP-0. The proportion of active smokers was 16% in the CWP-1 vs. 57% in the CWP-0, the proportion of ex-smokers was 58% vs. 41% and non-smokers 8% vs. 2%. The histopathological subtype was not introduced in 17% of cases in the CWP-1 and 21% in the CWP-0, adenocarcinoma was found in 25% of cases in the CWP-1 and 20% in the CWP-0, squamous cell carcinoma created 40% vs. 34% of cases, small cell carcinoma 12% vs. 26%, other subtypes created 22% vs 20% of cases. The statistically significant difference (p=0.030) was found in the histopathological subtypes between the samples.

The risk of lung cancer was significantly higher in miners with CWP comparing with the miners without CWP. The prevalence of non-smokers in both cohorts was marginal, in the cohort CWP-1 the proportion of ex-smokers was higher. In both cohorts, as well as in men population in the Czech Republic, the squamous cell subtype of lung carcinoma predominated. In CWP-1 miners the second place was covered by adenocarcinoma followed by small cell carcinoma, conversely in miners without CWP the second most frequent subtype was small cell carcinoma and adenocarcinoma.

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Activity of antioxidant enzymes in rats` blood with experimentally induced diabetes under influence of chromium citrate

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Experimental and clinical studies show that an important role in the pathogenesis of diabetes is devoted to oxidative stress, which is an integral part of metabolic disorders (Maritim A, et al, 2003). It is believed that the oxidative stress in the course of diabetes is the result of free radicals formed during the autooxidation of glucose (Miyata T, et al., 1999). The reason for an increase of ROS in type 2 diabetes is hypercoagulation, hyperglycemia and hyperinsulinemia. The level of these active forms of oxygen is controlled by antioxidant enzymes, so the antioxidant state of the blood is an important factor in the course of diabetic complications. There are a number of studies that indicate that chromium can alleviate insulin signaling and may improve systemic insulin sensitivity (Hummel M, et al., 2007). Chromium biosensation from inorganic compounds is low (about 1%), but it grows to 25% when chromium is introduced in the form of organic compounds (citrates, picolinates, nicotinates) (Stoecker B.J., 1999).

The aim of the research was to find out the effect of different amounts of organic compound of chromium citrate on the activity of enzymes in the antioxidant defense in blood of aloxane-induced diabetic rats.

The research conducted on 40 white laboratory rats that were in vivarium conditions Institute of animal biology NAAS, weighing 100 to 120 grams, and were divided into four groups: group I - control, II, III, IV – research. The rats in the II experimental group drank clean water without additives and animals of III and IV groups for a month drank water with a solution of chromium citrate in an amount of 0.1 and 0.2 mg/ml of water. Experimentally induced diabetes was caused by intraperitoneal administration of 5% solution alloxan monohydrate ("Synbias") in an amount of 150 mg/kg body weight with the backdrop of a 24-hour hunger in animals of all three study groups. During the analysis of the results of the research, it was found that superoxide dismutase (SOD) activity decreased by 16.5%, glutathione peroxidase (GP) decreased by 23.6%, glutathione reductase (GR) decreased by 45.6%. A significant decrease in the activity of enzymes of antioxidant defense may be the cause of the modification of enzymes by active forms of oxygen under conditions of hyperglycemia.

Under the conditions of consumption of chromium citrate by rats in the amount of 0.1 mg / ml resulted in a reliable growth of GP - 8, 5%, GR - 42,6% and SOD - 42,6% is comparable to the diabetic group, indicating the stimulating effect of these doses of chromium on the activity of enzymes ROS for hyperglycemia. In the study of the activity of catalase and the content of reduced glutathione in rat erythrocytes, no significant difference was found in all experimental groups compared with the control group.

In general, the results of the conducted studies indicate the normalization of antioxidant protection against the effects of chromium citrate in erythrocytes in diabetic rats.

The response of chosen metallophytes from calamine and serpentine habitats investigated for biological reclamation of post mining areas

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The physicochemical properties of the post-flotation wastes obtained as a result of metallic ores processing are entirely unfavorable to introduce any dense vegetation cover to stabilize ground and prevent further wind-blowing of contaminated particles. Thus, the appropriate choice of taxa which tolerate such severe growing conditions and prevail in contaminated areas seems to be a matter of utmost importance. Furthermore, at the same time we could benefit from environmentally friendly approach to restore and/or remediate the highly polluted ground.

In our study, we investigated the response of chosen calamine and serpentine populations to heavy metal stress. The studies were conducted on different levels, starting with laboratory experiments up till regular field cultivation of obtained plantlets. We focused on identification of metabolic pathways, then the plant tolerance and bioaccumulation mechanisms occurring in plants under those stress conditions. Such fundamental research is a prerequisite step for genetic transformation procedures that may improve potential of adequate plant material for environmental remediation. It was found that metallicolous ecotype of Alyssum montanum, A. alyssoides (Brassicaceae) and Silene vulgaris (Caryophyllaceae) showed no toxicity symptoms and low levels of lipid peroxidation in response to elevated Pb, Cd or Ni concentrations as compared to reference non-metal adapted control. The enhanced tolerance of tested ecotypes resulted from balanced ROS accumulation and increased synthesis of various antioxidant compounds in pattern depended on respective genotype. Taking into account that the results obtained under laboratory conditions need to be confirmed during ex vitro cultivation, the field studies were conducted directly on the shelf of settling pond. It was proved that aseptically obtained plants of A. montanum and S. vulgaris had been able to grow and develop on area contaminated with heavy metals. Considering remediation potential of these metal-tolerant ecotypes, we propose to exploit such material in phytostabilization of polluted areas rather than in phytoextraction of particular metallic elements.

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Some aspects of carbohydrate metabolism in the blood of rats with experimental diabetes and under complex action of magnesium and chromium citrates

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Diabetes mellitus is a first “non-infectious pandemic” which rank a provide place among the most common diseases in all world. This is an endocrine disorder which has place under absolute or relative insuline insufficiency and characterized by uncontrolled hyperglycemia, disorders in all kinds of metabolism: carbohydrate,fat, protein and water-salt.

Therefore, the purpose of the research was to investigate the complex effects of different doses of magnesium citrate and chromium citrate on the state of carbohydrate metabolism in the blood of rats with experimental diabetes us remedy for prevention emergence and complications in the disease.

The experimental tests were conducted on the 25 white females Wistar rats (130-150 g), kept in conditions of the vivarium of the Institute of Animal Biology of the NAAS. All experimental animals were divided into 4 groups (three research groups: RG1, RG2, RG3 and one control group: CG). The animalses of CG and RG1 have been without any treatment for the disease.. The complex of magnesium citrate and chromium citrate in doses: RG2 – 250 mg Mg/ kg bw i 25 mkg Cr/kg bw; RG3 – 250 mg Mg/ kg bw i 10 mkg Cr/kg bw was added to the drinking water for all animals. The experimental diabetes was induced on the backdrop of a 24-hour fasting (the 3rd week of experiment) by a single intraperitoneal injection of alloxan monohydrate (“Synbias”) in dosage 150 mg/kg body weight in 5% saline solution. The plasma and red blood cells of rats selected after the experiment were the main materials for examination. The concentration of insulin and C-peptide in plasma, metabolites and activity of the main enzymes of the carbohydrate metabolism were determined.

A significant increase of glucose concentration is observed in the blood plasma of animals with experimental diabetes compared with control group. On purpose of differential diagnosting of hyperglycemia was assayed insulin and C-peptide concentration in the blood plasma of the experimental animals. According to the analyzing data, the concentration of insulin and C-peptide in RG1 are reliably decreased on 34,5% and 64,4% ($P<0,001$) than in Control Group of rats. Nevertheless, for the complex effect citrates of magnesium and chromium in the animals of RG2 and RG3 was showed significant increase of the insulin and C-peptide concentration compared to the index of the animals of the RG1.

The investigation of activity the main enzymes of carbohydrate metabolism was conducted in red blood cells of rats of the first experimental group showed the tendency to the 14% decrease of the glucose-6-phosphate dehydrogenase (G6PDH) activity and the 1,6% increase of the lactate dehydrogenase (LDH) activity comparing to the results in CG. In turn, it was demonstrated that the complex of magnesium and chromium citrates shows stabilizing influence on biochemical processes of glucose transformation. As a result, comparing outcomes of RG2 and RG3 to the outcomes of RG1, the increase of the G6PDH activity (11,9% and 5,3%) and the decrease of the LDH activity (2,8% and 8,6%) was observed. As follows, appliance of the complex magnesium and chromium citrates (in doses 250 mg Mg^{2+}/ kg bw i 25 mkg Cr^{3+}/kg bw) leads to normalization of carbohydrate metabolism. It is caused by positive stabilizating influence of the studied compounds on the biochamistry proces of glucose transformation in organism. The research could give us an opportunity to search for new ways of correction pathological changes, which are the cause of emergence and complications in the disease.

Health and ecological risk assessment of heavy metals exposure from soil in malopolska province

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Intensive urbanization and industrialization have released toxic chemicals such as heavy metals into the environment, threatening human and ecosystem health. Nowadays, key studies on heavy metals in soils cover potential ecological risk, geochemical cycling, assessment of health risk caused by metals, and toxicity assessment. Human health risk assessment involves several general procedures including: 1) identification of risk sources and receptors, 2) exposure assessment, 3) toxicity analysis and 4) risk characterization. In ecological risk assessment biotests are a useful tool whose application enables a fuller assessment of risk resulting from the presence of chemical substances in soils and their bioavailability and interactions.

The aim of the study was to present information and knowledge about possible ecological and health risks of heavy metals exposure from soil in the Malopolska area (southern Poland). The main sources of soil pollution with heavy metals in this area are mining-metallurgical activity involving processing of zinc and lead ores, big industrial plants, transportation, the power industry, and burning coal in individual home furnaces. In total 320 points were set. Human health risks were assessed by adapting US EPA methodology. Three biotests: Phytotoxkit, Ostracodtoxkit and Microtox were used in the assessment of soil ecotoxicity.

The Hazard Quotient (HQ) evaluation in the case of noncancerogenic effect showed low risk for each metal by soil oral contact on the residents. The hazard index (HI) obtained for the metals were generally below 1, indicating no caner adverse health effects to most unlikely. Zinc was the main noncarcinogenic metals or contaminant responsible for the health risk. In the study found that carcinogenic risk value (2.97E-07 – 1.47E-04) was generally higher then acceptable values. Ecological risk assessment, based on toxicity classes and hazard quotient (HQ), revealed that 34% of the analysed soils was characterised by a low, 31% by moderate, 15% by high and 9% by very high risk. The lack of ecological risk I revealed in 11% of the studied soils. The soil toxicity was to a great extent caused by their strong acidification. Moreover, that the areas of north-western Malopolska are most exposed to chemical degradation connected with soil contamination by heavy metals and PAHs.

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Analysis of the health risk associated with exposure to heavy metals occurring in the precipitation of dust in the Krakow.

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The aim of the study was to determine the size of deposition of dust particles and its quality based on the heavy metals contained therein, depending on the season and place of measurement. The research was carried out in the period February - September in 2017. Measuring points were created in various five locations of the Krakow city. At the same time, comparative research was conducted outside of Krakow, in small towns and villages. Dust precipitation measurement method used in research is based on use measuring plates with a sticking substance. ICP-OAS method was used to determine the chemical composition of the dust. The health exposure of Krakow residents resulting from the presence of metal in the environment was carried out. The highest averaged amounts of dust deposition over the months were from Al. Adam Mickiewicz. The largest deposition of dust, in Krakow and in the Małopolska region was found of May and June. The Hazard Quotient (HQ) evaluation in the case of noncancerogenic effect showed low risk for each metal by dust oral contact on the residents. However, it has been demonstrated that the carcinogenic risk associated with the cadmium content in the dust is unacceptable. The highest values occurred in February/March - April/May and they are comparable for all measurement points. The studies carried out show that the problem of dustiness does not only apply to the city of Krakow, but also to the whole of Małopolska region. Elevated concentrations of metals in the dust indicate the need to monitor it in the air.

Evaluation of the ecotoxicity of selected pharmaceutical residues in the aquatic environment.

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Nowadays the problem of pollution of aquatic environment by pharmaceuticals is not enough known. Presence of pharmaceuticals in water, even in small concentration, can carry high consequences for aquatic organisms, disturb biological balance in ecosystem and have an impact on a human health. Biotests in which different organisms are employed as a bioindicators is the one of the water and wastewater quality test methods. The study presents the results of the toxicity tests of water solutions containing selected pharmaceuticals from the group of non-steroidal anti-inflammatory drugs. Three bioassays were used to assess the water toxicity: Phytotestkit (Sorghum saccharatum, Sinapis alba, Lepidium sativum), Daphtoxkit (Daphnia magna) and Microtox (Vibrio fischeri).

Analysis of the health risk associated with exposure to heavy metals occurring in the precipitation of dust in the Krakow

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The aim of the study was to determine the size of deposition of dust particles and its quality based on the heavy metals contained therein, depending on the season and place of measurement. The research was carried out in the period February - September in 2017. Measuring points were created in various five locations of the Krakow city. At the same time, comparative research was conducted outside of Krakow, in small towns and villages. Dust precipitation measurement method used in research is based on use measuring plates with a sticking substance. ICP-OAS method was used to determine the chemical composition of the dust. The health exposure of Krakow residents resulting from the presence of metal in the environment was carried out. The highest averaged amounts of dust deposition over the months were from Al. Adam Mickiewicz. The largest deposition of dust, in Krakow and in the Małopolska region was found of May and June. The Hazard Quotient (HQ) evaluation in the case of noncancerogenic effect showed low risk for each metal by dust oral contact on the residents. However, it has been demonstrated that the carcinogenic risk associated with the cadmium content in the dust is unacceptable. The highest values occurred in February/March - April/May and they are comparable for all measurement points. The studies carried out show that the problem of dustiness does not only apply to the city of Krakow, but also to the whole of Małopolska region. Elevated concentrations of metals in the dust indicate the need to monitor it in the air.

Assessment of bottom sediment toxicity using biotests and consensus-based freshwater sediment quality guidelines

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The assessment of the chemical status of sediments is important for identifying the type, concentration and source of pollutants, but it does not provide any information on the synergic and antagonistic factors and their bioavailability. Bioassays are useful, cost-effective and rapid tools, as their application enables a real assessment of the risk resulting from the presence of multiple chemical stressors in bottom sediments, their bioavailability, toxicity and interaction.

In this study was presented the ecological risk associated with heavy metal and PAHs concentration in the bottom sediment on the basis of their ecotoxicological properties. The bottom sediment originated from the Rożnów reservoir situated on the Dunajec river in the Malopolska Voivodeship. Three bioassays were used to assess the bottom sediments toxicity: Phytotoxkit, Ostracodtoxkit F, and Microtox. The concentrations of heavy metals and PAHs in bottom sediments were compared with the consensus-based sediment quality guideline values (SOQs) referred to as TEC (Threshold Effect Concentration) and PEC (Probable Effect Concentration). The hazard quotient (HQ) was calculated based on the individual metal and PAH concentration as well as the concentration to its corresponding PEC. In addition, the mean PEC quotient (PECq) was calculated.

Numerical SQGs, when used with other tools such as biotests can provide a powerful weight of evidence for assessing the hazards associated with contaminated sediments. The integration of ecotoxicological and chemicals methods is necessary for an appropriate ecological risk assessment and it presents satisfactory results.

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TOXIC EFFECT OF DIFFERENT CONCENTRATIONS OF POTASSIUM BICHROMATE ON BIOCHEMICAL PARAMETERS OF BLOOD OF RATS

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Chromium is a common natural chemical element that occurs in the environment in two valence forms: trivalent Cr (III) and hexavalent Cr (VI). Cr (VI), which is used for industrial purposes, is a toxic substance that acts as a pollutant of the environment and a toxin for living organisms (Wang, et al., 2006). Cr (VI) compounds are strong oxidants that are capable of generating active forms of Oxygen in living organisms. Soluble and insoluble Cr (VI) salts are capable of causing morphological, neoplastic changes and inducing mutagenicity in human and animal cells (Marouani et al., 2011). Also, Cr (VI) induces acute and chronic toxicity, neurotoxicity, dermatotoxicity, genotoxicity, carcinogenicity, immunotoxicity and overall environmental toxicity (Li ZH et al., 2011). The aim of research was to was to detect the effect of different concentrations of Cr (VI) on the biochemical and hematological parameters of blood in rats.

The research conducted on white male Wistar laboratory rats, weighing 250 to 300 grams. Rats were divided into eleven groups: one control group and ten research groups. The rats in the control group were injected daily intraperitoneally with 150 ml of physiological saline solution. The rats in the research groups were injected daily intraperitoneally with the different doses of K2Cr2O7 diluted with physiological saline solution: Animals of I,III,V,VII,IX research groups received 0.5, 1, 2.5, 3.5, 5 mg Cr(VI)/kg body weight per day for 7 days. And animals of II,IV,VI,VIII,X research groups received 0.5, 1, 2.5, 3.5, 5 mg Cr(VI)/kg body weight per day for 14 days.

The research material was the blood of rats obtained during decapitation. We discovered that the concentration of urea in blood plasma of rats was significantly increased in the I research group by 50%, in the II research group by 22%, in the VII research group 9,5 times and in the VIII research group 4,8 times, compared to the control. Creatinine content in blood plasma of rats was significantly increased 5,5 times in the VII research group, in the IX research group by 34,7%, compared to the control. Concentration of cholesterol in blood plasma of rats was significantly increased in the IV research group by 40,2%, in the IX research group by 106%, compared to the control.

Under the influence Cr(VI) the level of leukocytes was significantly increased in the X research group by 35,7%, compared to the control. This can be explained by activation of leukocytopoiesis by Cr(VI). In all other research groups there was a tendency of increase of leukocytes, compared to the control. Number of erythrocytes and hemoglobin concentration were significantly increased in the VII research group by 36,3% and by 31,4%. And this can be explained by the release of erythrocytes from blood depots by the action of low doses of Cr (VI).

The results of the research show that the activity of urea, creatinine and cholesterol increased by the action of potassium bichromate in blood of rats. Potassium bichromate also caused increase of number of leukocytes, red blood cells and hemoglobin concentration in the blood of rats.

INVESTIGATION OF THE CONTENT OF SOME TRACE ELEMENTS IN THE TISSUES OF THE HONEY BEES AND THEIR PRODUCTS UNDER CONDITIONS OF FEEDING BY AG AND CU CITRATES

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The article presents the results of studies on the accumulation of certain mineral elements - Fe, Zn, Cu, Cr, Co, Pb, Cd in the tissues of the body of honey bees, bee-bread and honeycombs under feeding by the citrates of Ag and Cu.

The research was conducted on honey bees of the Carpathian race, which were held in multi-hull 8-frame hives. The influence of Ag and Cu citrates on their introduction into sugar feeding in the spring-summer (April-May) period was investigated. Three bee colonies in each group were selected for the research on the apiary. Control group (I) bees were fed with sugar syrup (1000 ml /week/bee family), II experimental group was kept under similar conditions to I group and fed with sugar syrup with the addition of 0.2 mg of Ag and 0.2 mg of Cu as citrate, the III experimental group - under similar conditions received Ag and Cu in the form of citrate, in doses of 0.5 mg each per 1000 ml of sugar syrup on bee colony. The duration of the experiment was 36 days.

The trace elements were added to the sugar syrup in the form of citrates water solution obtained from LLC "Nanomaterials and nanotechnology" in Kyiv and produced by the method of nanobiotechnology (M.V. Kosinov, V.G. Kaplunenko). For researches the samples of honey were selected - 10 g at the end of the research period from each bee colony. In samples of honey, the content of Fe, Cu, Zn, Co, Cr, Ni, Pb, Cd was determined on the atomic absorption spectrophotometer SF-115 PC with a computer program and its physical-chemical parameters of honey according to commonly accepted methods. The statistical analysis of the results was carried out with the definition of average values, their deviations (±m) and the degree of probability (p).

The obtained results demonstrate positive changes of the content o separate trace elements in the tissues of organism and bee products that confirms the expediency of using Ag and Cu citrate additions to correct mineral nutrition of the melliferous bees.

According to the research, intergroup differences in the content of mineral elements both in the body of bees and their products were established: increase of content of Fe, Co, Cr in the samples of the tissues of the whole organism of experimental groups, on the background of reliable decline of Zn in III experimental group and reliable decrease of Pb ($p < 0.001$) and Cd. In the bee-bread and honeycomb samples were detect lower concentrations of Pb and reliable decrease of Cd ($p < 0.05$) in the honeycombs were observed in groups II and III compared to control. Adding 0,2 and 0,5 mg of citrates of Ag and Cu to syrup resulted in some corrective action on the content of certain trace elements in the tissues of the body of honey bees of experimental groups and antagonistic effect on the level of heavy metals such as Pb and Cd.

BIOAVAILABLE FORMS OF METALS AND HUMAN HEALTH RISK ASSESSMENT

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Human Health Risk Assessment (HHRA) was conducted based on United States Environmental Protection Agency (US EPA) methodology. Residential scenario was used within the HHRA. Both total and bioavailable forms of metals were applied for HHRA estimation. Non-carcinogenic risk was calculated for set of 16 metals from surface soil. Carcinogenic risk is estimated for arsenic. Twelve metals and metalloids are listed in the ordinance of Polish Minister of the Environment of 1st September 2016 on the method of surface soil contamination assessment (published in the Journal of Laws item 1395). HHRA was conducted also for 4 metals nonmentioned in this ordinance.

Second part of the study was related to bioaccessible forms of metals. The goal of the study was comparison the HHRA results based of total, bioavailable and bioaccessible forms of metals.

HEAVY METALS IN WATER AND RISK ASSESSMENT: A CASE STUDY OF THE CZARNA PRZEMSZA RIVER SOURCE IN ZAWIERCIE, POLAND

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Water quality is one of the most important issues nowadays. Especially because there are many kinds of pollution that affect on water contamination. The natural source of the Czarna Przemsza River is located in the Zawiercie city, form which inhabitants use water for consumption purposes since 1980s, even though according to the law the source is unofficial and there are no results of official water quality tests. The water quality of the Czarna Przemsza River source in Zawiercie was investigated in four sampling campaigns representing each season in years 2016 and 2017. Concentrations of analyzed 15 elements were compared with permissible limits of drinking water according to Polish legal acts and European Union, World Health Organization, United States Environmental Protection Agency, and Canadian guidelines. The research revealed that water from the analyzed source was not suitable for consumption due to exceeded concentrations of metals and metaloids. Health risk assessment for Zawiercie's inhabitants was calculated based on questionnaire surveys results, while water from the source is consumed regardless of its quality and in the resident exposure scenario. The total non-carcinogenic risk value was above 1, which means that risk existed and total carcinogenic risk was above 1x10-6, which pointed unacceptable risk level. Elements that caused highest risk were As, Pb, Se, Tl, and Ni.

CHARACTERISTICS OF A HUMIC ACID PREPARATION AND ITS INFLUENCE ON PLANT YIELDING

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Brown coal (especially of low energy value and with high content of humic acids) can be used as a source of external organic matter (humic acids). It can improve soil properties, but also the quantity and quality of plant yield. The aim of the study was to determine the effect of soil application of humic acids on yield of maize and celery. The test plants were cultivated on coarse textured soil and medium textured soil. The studied humic acids showed low aliphaticity, which was evidenced by absorbance ratios and IR spectrum. The use of humic acids significantly increased dry matter yield of above-ground parts of the test plants, in comparison with mineral and manure fertilization (respectively by 10-22% and 15-41%). Application of a double dose of humic acids led to the obtainment of a considerably higher yield of above-ground parts, or yield of the plants fertilized with both doses were statistically the same. Application of humic acids also increased the yield of plant roots (respectively by 19-35% and 13-64% in comparison with mineral and manure fertilization).

EFFECTS OF COPPER NANOPARTICLES ON OOCYTES AND SPERM QUALITY IN VITRO

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Copper is known to be one of the most important elements for because he is necessary for a lot of biological processes. This trace element is an essential micronutrient required by all living organisms and plays a vital role as a catalytic cofactor for a variety of mettaloenzymes. Copper also has anti-inflammatory, anti-infectious and anti-bacterial properties.

The aim of the work was to investigate the effects of different concentrations of copper nanoparticles (CuNPs) in culure medium on bovine oocyte maturation and sperms viability in vitro. The COCs were matured in culture medium with CuNPs at the concentrations of 0 (control), 0,5 (1st group) and 2 µg/ml (2nd group) for 24 h at 38,5 C in an atmosphere of 5% CO2.

Sperm motility parameters such as concentration, viability and motility and some biochemical indexes of cattle seminal plasma were compared between non-treatment control and experimental groups treatment with 0,1, 1 and 2 µl/ml CuNPs after storing semen up to 4 days at 4 degrees C. Plasma total protein, aspartate aminotransferase (AST), lactate dehydrogenase (LDH) and alkaline phosphatase (AP) were determined.

Study results showed that incubation of oocytes at different concentrations of CuNPs caused discordant changes in their morphological and functional characteristics. The non toxic character of low dose of CuNPS was confirmed after 24 hours of incubation the oocytes. When incubated with CuNPs at higher concentration the inhibition of developmend of oocytes was observed. Significant increase (2.5-fold compared to the control) in the number of degenerated oocytes in the presence of CuNPs in quantities of 2 µg/ml is indicative of the toxicity of copper nanoparticulars at this concentration.

There were no negative effect in the percentage of motility, live spermatozoa and total morphological defects in experimental groups during 18 hours of storage at 4oC. The semen quality in the first group with 0,1 µl CuNPs in all times of evaluated were significant higher compared with control ($P<0,001$; $P<0,05$; $P<0,01$; $P<0,01$). Whereas the spermatozoals survivability in other experimental groups was at the level of control group. The alkaline phosphatase activity in the first group with lower concentration CuNPs was significant higher ($P<0,05$) during 18 hours of storage at 4oC the diluted semen, while in experimental groups at higher level CuNPs (1 µg and 2 µg) enzyme activity was significantly lower compared with control group at 18 and 96 hour ($P<0,001$).

The results showed the dose-dependent effect of copper nanoparticles in oocytes and sperm in vitro. It was found that CuNPs additions in dose 0,5 µg/ml had no negative effect on bovine oocyte maturation and its viability. However, supplementation of CuNPs in dose 2 µg/ml resulted in decreased by 33,3 % the number of matured oocytes. The copper nanoparticles in the concentration 0,1 and 1 µg/ml resulted in improving the viability of sperm cells, as confirmed by the obtained biochemical parameters.

CHARACTERIZATION OF TRACE METAL ANALYSIS POST-HURRICANE HARVEY

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Efforts were made to identify and characterize exposure pathways in Houston after Hurricane Harvey's torrential rainfall. Initial soil samples were collected within Manchester, TX and as fall progressed, additional sediment samples were collected within other areas of Galveston Bay (GB) and the Houston Ship Channel (HSC). The use of both soil and sediment samples permits initial characterization of potential contamination locations as well as an understanding of the role severe flooding played in the movement of contamination previously present in Houston, TX. Due to the unique hydrological dynamics of GB/HSC, there has been no comparable soil/sediment baseline contaminant data for Houston, TX. Therefore, we aimed to capture what happened after Hurricane Harvey by developing an extensive analytical suite to quantify for: polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ethers (PBDEs), organochloride (OC) pesticides, heavy metals, polychlorinated biphenyl's (PCBs), and polychlorinated dibenzo-p-dioxins/polychlorinated dibenzofurans (PCDD/PCDFs). We hypothesized any contamination present in Houston, TX was removed and deposited in Galveston Bay. Based on the analysis for our trace metal data in Manchester, TX the concentrations detected were comparable to natural crustal abundance background levels thereby supporting our hypothesis of a new baseline. Since the Manchester, TX soil samples were taken within a local community, we additionally aimed to provide preliminary risk quantification by using the United States Environmental Protection Agency's (US EPA) Regional Screening Levels (RSL) calculator. The risk values calculated using the RSL calculator, indicated levels were below actionable limits. As further characterization of the exposure pathways associated with soil and sediment samples collected continues, the results will be beneficial to the development of interventions prior to and after disasters as well as the improvement of exposure assessment methods within Houston, TX.

ENGINEERING SUPPORT TO U.S. EPA REGIONS: SUCCESSFUL PARTNERSHIPS IN CLEANING UP CONTAMINATED SITES AND COMMUNITIES

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Characterizing subsurface conditions is critical for successful site remediation and restoration. By applying the latest science through innovative site characterization technologies, a scale-appropriate understanding of contaminant distribution can be generated for a site and be the foundation for the site's remedial strategy. Examples of expert engineering technical support and applied research will be presented, and include:

- Analytics (e.g., tentatively identified compounds [TICs], x-ray fluorescence [XRF], bioavailability)

- Emerging contaminants (e.g., PFAS, RDX, DNT, 1,4-dioxane)

- Isotopes (e.g., forensics, geochronology)

- Contaminant Delineation (e.g., groundwater to surface water intersection, passive samplers, mass flux, LNAPL and DNAPL)

DIFFERENTIAL LEVEL OF CADMIUM GENOTOXICITY IN CONTRASTING ECOTYPES OF SILENE VULGARIS AS REVEALED BY COMET ASSAY

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Together with industrial development, a level of cadmium in the environment is constantly increasing. This heavy metal is particularly toxic to living organisms, including plants and animals. It is also highly detrimental to human health. Cadmium toxicity is manifested at each level of organism functioning, however its mode of action affects mainly cellular metabolism. It is also known as indirect mutagenic agent, causing DNA damage and disturbances in cell divisions, and therefore has been designated human carcinogen by the International Agency for Research on Cancer (IARC 1993). Genotoxicity of Cd has been also confirmed in plants, and this feature allowed exploitation of plant species in ecotoxicological screening. In recent years comet assay (Single Cell Gel Electrophoresis) is used as simple and reliable method of assessing DNA damage under heavy metal exposure. In our study we analyzed genotoxic effects of Cd in two contrasting ecotypes of Silene vulgaris: calamine ecotype from Zn-Pb ore mine heap, adapted to growth in Cd-polluted habitat, and non-Cd-adapted ecotype from botanical garden. Seeds of both ecotypes germinated in non-polluted garden soil, and after 6 weeks were transferred to 100 ml flask containing 0, 5, 16 and 32 µM $CdCl_2$ solution. After 7 days of incubation leaves were collected and alkaline comet assay was conducted. Nuclei were afterwards stained with DAPI and analyzed in AxioImager Multifunctional Microscope (Zeiss). Results confirmed genotoxic action of Cd to S. vulgaris. However, severe DNA damage in calamine ecotype was significantly limited in comparison with referential non-calamine one. This was particularly pronounced in the highest Cd concentration. Mechanisms allowing effective alleviation of Cd genotoxicity in calamine ecotype are now being elucidated.

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3. Chemistry, fate, transport, and health effects of persistent halogenated contaminants (with emphasis on brominated and fluorinated compounds)

The effect of selected plant secondary metabolites on biodegradation potential of soil microbiota toward structurally related phenoxy herbicides (2,4-D and MCPA) and samples phytotoxicity

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2,4-D and MCPA are the most commonly used herbicides in agriculture in Europe to selectively control the growth of dicotyledonous weeds. Phenoxy herbicides are based on ring-like structures and have at least one chlorine atom attached to the ring at different position. Their extensive use may promote contamination of soil matrices, surface and ground water and increased soil toxicity. However, there is still not enough data on the ecotoxicity of phenoxy acids. Soil bacteria are identified as potential degraders of phenoxy acids. This is determined by the presence of tfdA or tfdA-like genes. Hence, soil microorganisms serve as an alternative method of herbicide removal from the environment. However biological processes might be very slow, therefore there is a growing interest in the use of plants secondary metabolites (PSMs), which are structurally related to phenoxy acids, as stimulators of phenoxy acids biodegradation.

The aim of this study was to investigate the effect of selected phenoxy herbicides and structurally related cucurbits PSMs (2,4-D vs. ferulic acid- FA; MCPA vs. syryngic acid- SA) on the phytotoxicity and biodegradation potential of soil microbiota. The study was conducted in bacterial cultures containing liquid Mineral Salt Medium (MSM), enriched with soil microorganisms originating from agricultural soil slurry (50%:50%, v/v), amended with 2,4-D or MCPA in doses of 0.1 and 0.5 mM, FA or SA in doses of 0.25 mM. Samples were incubated in the dark at 25°C, 24 days. Subsamples for phytotoxicity assessment using Phytotoxkit test and two plant species (L. sativum and S. alba) were collected after 24 days. Obtained results were expressed as Percent Effect (PE %). Subsamples for molecular analysis (16S rRNA and genes from tdfA gene cluster) were collected 4 times during the incubation period (every 6 days).

The obtained results demonstrated a high potential of the soil indigenous bacteria to degrade phenoxy acids. This was confirmed by the presence of the functional tfdA genes (tfdA, tfdAα and tfdA Class I, II and III) that were detected in soil slurry samples, amended with herbicides and PSM. For different variants tested, the presence of different degradative genes was observed. Additionally the herbicide concentration had a significant influence on the biodegradation potential. 16S rRNA gene sequence analysis revealed ubiquitous enrichment of β-Proteobacteria in studied samples.

It was found that the ongoing physicochemical and microbial degradation processes significantly reduced the phytotoxicity of the samples amended with MCPA and SA. The phytotoxicity decreased from the initial 100% PE for all samples and after 24 days got high stimulation of root growth (ranging from -21% and -102% for L. sativum and S. alba). Similar situation was observed in samples amended with 2,4-D+FA for S. alba. L. sativum, in turn, demonstrated much greater sensitivity to 2,4-D and FA residues reaching 100% PE. This shows that the remains of 2,4-D and FA and their metabolites can exhibit greater ecotoxicity than pure compounds. The obtained results provide further confirmation that PSMs can stimulate the biodegradation of xenobiotics (2,4-D and MCPA) and selectively influence the level of samples phytotoxicity.

Assessment of PCDD/PCDF concentrations in pore water from bottom sediments using ELISA method

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Dioxins (PCDDs/PCDFs) are highly toxic and hazardous substances to human health and the functioning of ecosystems. Low solubility rates, and thus strong adsorption on organic matter and lipid molecules, determine the stability of these compounds in the aquatic environment, and due to the mobile nature of flowing waters may be displaced over long distances. Therefore, the determination of the impact of these compounds on the quality of the aquatic ecosystem is important in terms of environmental risk assessment and human exposure.

The aim of studies was to determine the concentration of dioxins (PCDDs/PCDFs) in pore water from bottom sediments collected from 2 dammed reservoirs: Rożnów (the Dunajec River) and Rybnik (the Ruda River). Both reservoirs are located in the Malopolska and Silesian provinces (south Poland). The Rożnów reservoir, located in area dominated by agriculture and forests, has retention, energetic and recreational functions. The Rybnik reservoir has energetic functions connected with the activities of the largest power plant in Upper Silesia - the Rybnik power plant. Analyses of PCDDs/PCDFs in pore water were carried out using the Abraxis ELISA Dioxin/Furan test. This test is an indirect ELISA based on the recognition of PCDDs and PCDFs using specific antibodies.

The concentration of PCDDs/PCDFs in pore water samples ranged from 8.56 to 90.92 ng EQ/L. The Rożnów reservoir was characterized by almost two-fold higher average PCDDs/PCDFs concentration (58.40 ng EQ/L) over the Rybnik reservoir (33.12 ng EQ/L). We hypothesized that organic carbon content are likely to be factor controlling PCDDs/PCDFs concentrations in the pore water of the studied reservoirs. Since pore water is a filling among sediment grains, constantly remains in contact with reservoir sediments, it may receive pollutants accumulated therein. This makes pore water a valuable tool for the assessment of the degree of pollution and potential bioavailability of selected compounds, including PCDDs/PCDFs.

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4. Coastal and aquifer pollution

CONTENT OF CD, CU, CR, FE AND MN IN FISH LARVAE OF ATHERINIDAE L. GENUS COLLECTED IN BAYS FROM THE REGION OF SEVASTOPOL

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Monitoring of water bodies is an important part of the environmental protection policy as well as the natural resources management policy. The aim of the carried out research was to assess the content of trace element in water and in fish larvae of Atherinidae genus, fished in three bays of Sevastopol. The second goal was to determine the level of bioaccumulation of these elements in organisms used in the research. The research was carried out in 2012 in three bays of Sevastopol: Galubaja, Omega, and Karantinna. The obtained results indicate that the contents of the studied elements are close to the ones observed in basins which are under the influence of human pressure. The contents of the studied elements in the larvae of Atherinidae fish had the following order: Fe>Mn>Cu>Cr>Cd. Values of the bioaccumulation factor of these elements in the larvae organisms in the following order, starting with the highest: Mn>Cu>Cr>Fe>Cd. The highest contents of Cd, Cr and Mn were found in fish larvae from the Karantinna Bay, which is located in the region with the highest anthropogenic impact. The highest Cu content was found in fish from the Omega Bay, and the highest iron content in the Galubaja Bay.

THE IMPLEMENTATION OF THE BASIN PRINCIPLE OF WATER MANAGEMENT IN UKRAINE'S LEGISLATION

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Water is a very important resource in the context of providing sustainable development. The state of water resources, they amount and quality depends of a number conditions. One of them is effective water management. The management of water resources is the essential question in EU's policy of environmental protection. Main documents in the field of ensuring water quality and water resources management, including the marine environment in EU are: Directive 2000/60/EC establishing a framework for Community action in the field of water policy; Directive 2007/60/EC on the assessment and management of flood risks; Directive 2008/56/EC establishing a framework for community action in the field of marine environmental policy; Directive 91/271/EEC concerning urban waste-water treatment; Directive 98/83/EC on the quality of water intended for human consumption; Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources.

Also the question of water management is topical in Ukraine's environmental policy and has particular meaning in the process of integration to the EU. In terms of the management of water resources especially significant are principles of management, specifically, the basin principle.

This principle fixed in the Water Framework Directive 2000/60/EC and embodied in the Water Code of Ukraine. But main changes and additions to Ukraine's legislation in the part of the basin principle were inserted in October 2016. At the same time mechanisms and plans for they implementation were not elaborated. Therefore they are not realized properly now.

However for integration to the EU Ukraine has to adapt national legislation to EU's legislation and provide its execution. According to the Annex XXX to Chapter 6 of Title V Association Agreement between the European Union and the European Atomic Energy Community and their member states, of the one part, and Ukraine, of the other part, Ukraine has distinct obligations in the field of adaptation of the Water Framework Directive 2000/60/EC and also the determined time for do its duties. In particular Ukraine should: adoption of national legislation and designation of competent authority/ies; establishment of legislative definition of the country's territory hydrographic zoning unit; development of appropriate national legislation (Regulation on Basin Directorate) making the "basin Directorate" responsible for functions provided by art. 3 of Directive 2000/60/EC (within 3 years of the entry into force of the Agreement); identification of river basin districts and establishment of administrative arrangements for international rivers, lakes and coastal waters (art. 3); analysis of the characteristics of river basin districts (art. 5); establishment of programmes for monitoring water quality (art. 8) (within 6 years of the entry into force of the Agreement); preparation of river basin management plans, consultations with the public and publication of these plans (art. 13 and 14) (within 10 years of the entry into force of the Agreement).

Thus the problem of implementation of the basin principle of water management in Ukraine's legislation is important and topical in the aspect of Ukraine's integration to the EU.

Key words: water, water resources, water management, basin principle, implementation.

CRYOPRESERVATION OF FISH BLOOD – USEFUL TOOL FOR ASSESSING GENOTOXIC POTENTIAL OF AQUATIC ECOSYSTEMS

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One of the major limitations in performing ecogenotoxicological studies is the distance between research field and the laboratory. As some of the methods used in ecogenotoxicology require fresh biological material with intact cell viability, transfer of samples to the laboratory within a few hours after sampling is usually required. To overcome this issue, we have introduced cryopreservation in our research as a possible solution. Cryopreservation is a method which includes preservation of intact, living cells at low temperature for a long time. In natural conditions freezing, forming of ice crystals and dehydration could destroy cell structures. To avoid this consequence, specific compounds were introduced, cryoprotective agents, in the method of cryopreservation. The main characteristic of these compounds is their ability to reduce ice crystal formation in cells at any temperature.

We have applied cryopreservation in the evaluation of genotoxic potential along different river streams (the Adige River, the Sava River and the Velika Morava River basin). For this purpose, we focused on the level of DNA damage of cryopreserved fish blood cells (Salmo cenerinus, Salmo marmoratus, Alburnus alburnus) by using the comet assay.

To test whether cryopreservation has the impact on cell viability, or that it induces additional DNA damage, we employed preliminary experiments in 4 Abramis brama and 8 A. alburnus specimens. Namely, from every specimen two blood samples were taken: one for analyzing cells viability and the level of DNA damage of fresh blood, and another for observing cell viability and DNA damage of cryopreserved samples. The viability of cell blood was determined by using acridine orange/ethidium bromide differential staining. For analyzing the level of DNA damage alkaline comet assay was used. Obtained results indicated that cryopreserved blood cells had approximately the same viability and the level of DNA damage as nonpreserved blood samples.

According to our results, cryopreservation is a very useful method in genotoxicology and could have many benefits: blood samples should not be analyzed immediately after sampling; samples could be transported in liquid nitrogen without concern about additional DNA damage.

CYTOSTATICS AS EMERGING POLLUTANTS - IS THERE A THREAT FOR AQUATIC INVERTEBRATES?

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Seeking for a better quality of life, consumption of pharmaceuticals is constantly increasing. Pharmaceuticals are designed to be more potent, degradation resistant, to affect protein targets at relatively low doses. Many of them are not selective and became threat to non-target organisms, especially to one living in aquatic ecosystems. Because of the inability of wastewater treatment plants to eliminate these compounds in the end they reach aquatic environments through sewage system.

Aquatic invertebrates spend at least a part of their life cycle in the aquatic environment. Mobility is not one of the traits that characterize many species of aquatic invertebrates, especially freshwater mussels and aquatic worms which are almost sedentary organisms. Due to their way of life, this species are under the influence of variety of pollutants via sediment and via water column.

Genotoxic effects of cytostatics with different mode of action – alkylation agent (cisplatin - CP), antimetabolite agent (5-fluorouracil – 5-FU), plant alkaloids (etoposide - ETO, vincristine sulphate - VIN) and other neoplastic agent (imatinib mesylate - IM) were studied in vivo and in vitro on haemocytes of two freshwater mussels species Unio sp. (U. pictorum/U. tumidus), and in vivo on haemocytes and coelomocytes of tubificid species Limnodrilus udekemianus.

Experiments were organized as short-term treatments (72h for mussels/96h for worms) in static system. Level of DNA damage was evaluated by alkaline single-cell gel electrophoresis (comet assay). Based on our results ranking of cytostatics by their effects on mussels was VIN>5-FU>ETO>CP>IM and on worms was 5-FU>ET. Worms have shown higher sensitivity for the negative effects of 5-FU and ET on the integrity of DNA molecule comparing with mussels. The lowest observed effect concentration (LOEC) for 5-FU was 52 µg/L for mussels and 0.52µg/L for worms. In the case of ET LOEC was 24 mg/L for mussels and 0.024 mg/L for worms. For VIN was detected difference in the response in U. pictorum and U. tumidus – LOEC for U. pictorum was 3.7 µg/L, while for U. tumidus was 36.9 µg/L. Significant damage of DNA wasn't detected for CP and IM. Although the PEC values for tested cytostatics are lower than the ones used in our study, it must be emphasized that in the environment, organisms are under constant influence of these pollutants and organisms are struggling with the effects of mixture of pharmaceuticals and mixture of different pollutants. Impacts of these mixtures on the aquatic organisms are still unknown, and therefore, further research should consider this fact and the studies should be organized in this direction.

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CELL SURFACE HYDROPHOBICITY DETERMINATION WITH A MODIFIED MATH TEST

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The MATH test (microbial adhesion to hydrocarbons) has been widely used to determine physiological and biochemical properties of cell walls of both pro- and eukaryotic microorganisms. It enables to measure cell surface hydrophobicity based on experimental observation of the fraction of microorganisms tending to adhere to the applied hydrocarbon phase. The cell wall hydrophobicity was found to correlate with biodegradation potential of the specialized strains against recalcitrant non-polar xenobiotics. The aim of the work was to determine cell surface properties of several bacterial and yeast species isolated from polluted environmental niches. All these microorganisms earlier proved to biodegrade various organic contaminants: aliphatic and aromatic hydrocarbons, alcohols and aldehydes. The MATH data were compared with the results obtained for the strains occurring in non-contaminated environments. The MATH coefficients were discussed in the context of the strains' biotechnological applicability for remediation of sites polluted with hydrophobic oily substances.

For the study, a modification of a standard MATH technique was introduced, which allowed for compensation of errors caused by inaccurate or incomplete phase separation and the presence of interfering hydrocarbon droplets in aqueous phase. The improved method yielded undisturbed data with remarkably higher reliability. It has particular applicability for hydrophobicity evaluation of microbial hydrocarbon biodegraders.

MONITORING INVESTIGATION OF TRACE ELEMENTS CONCENTRATIONS IN WATER IN DIFFERENT GEOCHEMICAL AREAS OF THE WESTERN REGION OF UKRAINE

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Study of mineral nutrition and trace elements sufficiency in Ukraine should necessarily be linked to the presence of different climatic and geological zones with unequal provision of mineral elements. The Western biogeochemical zone of Ukraine is conventionally divided into 7 biogeochemical provinces: Transcarpathian lowland, Transcarpathian foothills, Transcarpathian mountains, North-eastern mountains, North-eastern foothills, Forest-steppe lowlands, and Woodlands.

We studied water from underground sources, used for watering livestock and for household needs, which was sampled in various biogeochemical provinces of Western Ukraine. In selected samples, after evaporation and appropriate preparation, we determined the trace elements concentrations by atomic absorption spectrophotometry, using the spectrometer C-115 at wavelengths corresponding to the absorption maximum of each of the studied metals. Totally, 23 samples were studied. The obtained results were processed statistically.

A comparative estimation of the content of Chromium, Kuprum, Zinc and Ferum in water samples taken in different biogeochemical provinces of Western Ukraine was carried out. It was shown that the concentration of investigated microelements in selected samples of water in different biogeochemical provinces of western Ukraine is distributed unevenly. Moreover, the content of trace elements in the studied samples of water can vary significantly within a single province.

Concentrations of Chromium, Kuprum and Zinc in selected samples of water from different biogeochemical provinces of the Western region of Ukraine did not exceed the maximum permissible concentration (of 0.5 mg/L for Chromium, and 1 mg/L for Kuprum and Zinc) in Ukraine, but within one province, concentrations of the same element can vary by 10 times. In general, in plants and water in certain biochemical provinces of the Western Ukraine we detected insufficient concentrations of Kuprum and Zinc, while the concentration of Ferum somewhere significantly exceeded the permissible concentrations in both water and plants.We found a significant excess of the maximum permissible concentration of Ferum (what makes up 0.3 mg/l) in 6 samples of water, and an insignificant increase in 5 samples of water taken from the lowland areas, namely from the forest-steppe lowland and Polissya. In the mountainous and foothill areas, we detected no excess concentration of Ferrum in water.

The highest content of Chromium, Kuprum and Zinc in selected samples of water was found in Polissya biogeochemical province: 0.06; 0.036 and 0.577 µg/ml, respectively, and the highest content of Ferum was 1.30-1.22 mg/l in the forest-steppe lowland and north-eastern foothill biogeochemical provinces. The lowest concentration of Kuprum and Zinc (0.0011-0.0014 mg/l) was detected in water samples taken in the north-eastern foothill and forest-steppe lowland, Chromium (0.0013 µg/ml) - in Polissya biogeochemical province, and Ferum (0,06 mg/l) - in Transcarpathian foothill province.

In general, differences in distribution of investigated trace elements in water are probably caused by the geochemical composition of the soil and differences in the water solubility of chemical compounds in the soil of these areas, and also by environmental and man-made factors, affecting the final composition of trace elements in human and animal body and, if necessary, can be adjusted with food supplements or medical preparations.

SELECTED ORGANIC AND MINERAL SOIL IMPROVERS INTENDED FOR THE CULTIVATION OF BUTTERHEAD LETTUCE

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Poor soil quality in Poland, characterized by low content of organic matter and high acidity has a negative impact on the productivity of agriculture. Rational and balanced fertilization is necessary to maintain the existing soil fertility as well as to improve it. The aim of the research was to select such soil improver which will improve the physicochemical parameters of the soil, as well as to assess the effect of soil improvers on the growth and yielding of lettuce. Various soil improvers were used within the study: dry algal biomass from the species Scenedesmus acutus, an aqueous suspension of algae from the species Chlorella vulgaris and soil supplement - zeolite. The vase experiment was carried out in laboratory conditions. Four fertilizing combinations were used for each plant three times. Doses of fertilizers were established according to the content of nitrogen, regarding the current fertility in examined soil. Before launching the experiment and after its completion, physicochemical analysis of the soil and the tested substrates were carried out, and plant growth parameters were examined. The conducted soil analysis and pot experiment showed that among the applied soil improvers, algal biomass had the greatest impact on the improvement of soil fertility and plant productivity. Fertilization with microalgae from the strain - Scenedesmus acutus caused the increase of almost all soil parameters, including: an increase in sorption capacity by 4.95 cmol(+)/kg, total organic carbon by 3694 mg/kg, Kjeldahl's nitrogen by 1287 mg/kg, total phosphorous by 421 mg/kg, available phosphorus by 148.3 mg P2O5/100 g. Based on the obtained results, it was found that algal biomass as a source of organic matter can be used in organic farming, in which the use of soluble mineral fertilizers is impermissible.

5. Environmental issues and local population exposures at former military sites in Central and Eastern European countries

Effect of three PGRs to the growth and development of first year Miscanthus x giganteus at the contaminated by heavy metals

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Miscanthus x giganteus is a suitable for the phytostabilization energy crop and has a high potential as biomass feedstock for bio-based products production at marginal, slightly contaminated by heavy metals land. Heavy metals induce a common abiotic type of stress, which not only reduce biomass yield but also affect its quality. The application of biostimulants (PGRs) is ecological friendly approach that used widely for promoting plant growth, obtaining the bigger amount and better quality harvest and improve soil health. Recent researches proved that using of biostimulants based on PGRs also enhanced the plant's adaptation to heavy metals stress.

Our research objective was evaluate the influence of (PGRs) to Miscanthus x giganteuses to development/growth, establishment and biomass yield while producing its biomass at contaminated by heavy metals soil from former military activity at Dolyna (Ivano- Frankivsk region, Ukraine).

In 2017 the semi-field experiment was designed to evaluate the effect of three PGRs-based biostimulants: Regoplant, Stimpo and Charkor to above and belowground morphological characteristics of Miscanthus x gignateus, in particularly, plants height, tilering, root length, reproductive rhizomes viability at first year of vegetation. The PGRs used in experiment– synthetic analogs of phytohormones, amino acids, fatty acids, oligosaccharides, microelements that contain/not contain chelates or avermectin. Charkor applied for rhizomes pre-planting by its soaking in the PGR water solution. Additionally, Regoplant and Stimpo in three concentrations were spraying three times on aboveground miscanthsus part followed by rhizome soaking. The experiment conducted at three repetitions. In Control test, the rizhomes soaked in water before planting and no PGRs spraying provided during the vegetation. The ANOVA test was performed to determine significant of PGRs treatments, morhopolgical M.x giganteus characteristics.

Preliminary results indicated that Charkor treatment caused significant increasing of plant height (28%) and tillering (14%) compared with control. The same effect not found for Regoplant and Stimpo. However, spraying of Regoplant and Stimpo enhanced significantly underground root morphological characteristics. The root length and reproductive rhizome viability in Riroplant test was 3,5 and 1,5 times higher than in control. Stimpo treatment increased the root length by 1,5 times but not affected the reproductive rhizome viability. The concentration of PGR did not have effect to belowground characteristics. Plants treated by Regoplant in the smallest concentration had the biggest root length and number of new rhizomes formation. Soaking of rhizomes in Charkor solution had the same effect as Regoplant but in the slighter extent. No effect of M.x giganteus underground parts development enchantment for Stimpo test is observed. The evaluation of biomass and heavy metals uptake, including bioavailable by different part of plant which will be carrying out further will give more data to assess the role of PGRs in success of phytotechnologies with M. giganteus at the heavy metals military contaminate sites.

REMEDIATION OF MILITARY AREAS IN THE CZECH REPUBLIC: IS IT POSSIBLE TO EFFECTIVELLY PRODUCE MISCANTHUS X GIGANTEUS BIOMASS?

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Many of the military sites in the Czech Republic, formerly used by the Czechoslovak, Soviet and other Warsaw Pact armies, are currently abandoned and handed over to local municipalities. Those localities have a great potential for regional development, improving economic stability and resettlement. However, some sites are still contaminated with various dangerous substances due to the former military activities including inappropriate storage of petroleum substances in the concrete containers located in the ground. These chemicals could have a negative impact to the environment and to the health of residents who live nearby now or would potentially returned after resettlement. The history of the military sites in the Czech Republic has been analyzed and the research location - Hradcany airport near city Mimon has been selected. The research is focused on evaluation the impact of military sites to the population, determination the economic values of the different remediation technologies and selection the most valuable approach for the remediation of sites polluted by petroleum hydrocarbons.

Growing of the second-generation energy crop Miscanthus x giganteus is one of the approach whitch is tested currently at the site in Mimon. Miscanthus x giganteus is a C4 plant with the good biomass yield and it improves soil fertility during years of growing. The on-going research is focused on achieving three scientific objectives: to reduce level of contaminants at the soil, to improve soil parameters and to produce good quality biomass. The plant is autotrophic and does not need a source of organic matter using photosynthesis. In case of soil contaminated by hydrophobic substances (petroleum hydrocarbons) the rhizoremediation process has been evaluated, i.e the co-operation of plants with microorganisms which often consume petroleum substances. The plant generally supports microorganisms around the roots of so-called exudates. The working hypothesis is that in the presence of a strong Miscanthus x giganteus root system, the growth of the biodegradable bacteria will be encouraged and hydrocarbon degradation will accelerate. The follow-up economic research is focused on modeling of growing Miscanthus x giganteus at the abandoned military sites contaminated by different pollutants: metals and petroleum hydrocarbons. In case of selecting the profitable process one can expect a wider incorporation of military sites to the related development of the region.

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Growing miscanthus x giganteus in post-military soil and soils contaminated by petroleum hydrocarbons: remediation and biomass production

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Former military airport Hradčany near the city of Mimoň (Liberecký region, Czech Republic) was highly contaminated by oil products after activities of Soviet troops during occupation between 1968-1991. Intensive remediation process combining biodegradation with venting and air sparging was applied and the concentration of NES (non-polar extractable substances) decreased below the risk limit of 5000 mg/kg. However there's still residual contamination in soil and groundwater and suitable reclamation of this area needs to be considered. A perspective way is the growth of perennial second generation biofuel crops which have potential to increase the decontamination, improve soil properties and produce applicable biomass. Miscanthus x giganteus, a perennial C4 plant, is a good candidate for this process. To test its possibility of growing in post-military land contaminated by hydrocarbons and investigate the effect of its growth to soil parameters the pot experiment was established.

Four different contamination variants were prepared: control agricultural soil from field near Hradčany, airport soil and for simulation of historic oil contamination also mix of airport and oil refinery soil in ratios of 3:1 and 1:1 (m/m). Beside hydrocarbon contamination significant concentrations of several heavy metals (Zn, Pb, Cd, Cu) were also determined by ICP-OES method. Another complication is the low concentration of bioavailable nutrients in soil and pH 7.6 which is higher than optimum required by plants. Despite these facts Miscanthus showed good tolerance and biomass production in airport soil was comparable to control. On the other hand hydrocarbon contamination over 8000 mg/kg C10-C40 appeared to be limiting factor for Miscanthus growth and produced biomass was negligible. This stress was also confirmed by Fv/Fm fluorescence test.

Phospholipid fatty acids (PLFA) determination was used to describe living microbial biomass and rough structure of soil microbial community during two years of growth. The amount of living microbial biomass and the structure of microbial community are important indicators of soil quality and ecosystem health. Total PLFA content revealed significantly higher abundance of microorganisms in oil contaminated soils as compared to control and airport soil. However microbial community structure and cy/pre stress indicator suggest that in contaminated variants microbial community is exposed to higher stress. Comparison of year-on-year results indicates positive influence of Miscanthus growth on the amount of living microbial biomass especially in control and airport soil where the plant growth was not limited by contamination.

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Influence of Former Military Sites on the Population and Environmental Health in Czech Republic and Ukraine

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Soviet army remained the plenty of former military sites on the territory of Ukraine. Big number of huge areas remained with unidentified hazards for human and environmental health during dozens years. Literature review of Soviet former military sites influence on the Human and Environmental Health in Ukraine and Czech Republic is presented according to current available publications. On the example of two test sites the ways of hazard minimization are analyzed including phytoremediation technics.

Actual Questions Of Population Health Risk Assessment Of Former Military Sites In Czech Republic (Cr) And Ukraine (Ua)

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Soviet Army former military sites cause significant negative influence on the population health of nearby territories. Investigation of 2 selected former military sites in CR and UA are presented. Hazard identification is provided. Health impacts are discussed. Risk assessment with management steps are introduced including phytoremediation technics (using Miscanthus x gianteus), which are already launched and investigated.

6.Exposure science and risk reduction approaches for indoor pollution

Impact of second hand smoking on children's health

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Respiratory diseases are the fifth leading cause of death all over the world with further increasing in prevalence. Tobacco smoking is the most significant risk factor for development of respiratory diseases. Prevalence of respiratory diseases in different countries is directly related to the rate of smoking in these countries. Second hand smoking (e.g. indoor smoking) is a major risk factor for health problems of respiratory system in children.To study the impact of indoor smoking on the respiratory health of children.

A case-control study was performed in Yerevan, Armenia. Cases (n=40) were children aged 1-5 years exposed to second hand smoking at home. Control group (n=40) was formed of not exposed children matched by age. Concentrations of indoor carbon monoxide were measured by "Lascar" CO gas monitor, and fine and big particle fractions of dust by the "Dylos DC1700" air quality monitor. Urine cotinine test was performed only in case group using "Med-express Diagnostics, Cotinine". To measure the health outcomes information from medical cards were extracted. Children of both groups were registered and followed up in outpatient pediatric clinic "Manuk" at the YSMU. Special developed and validated questionnaire was used to reveal details of possible exposure to smoke. Mothers were questioned on habit to smoke at home, intensity and duration of exposure during day, as well as on availability of isolated place for child to play and sleep, etc.

The average number of episodes of respiratory diseases in case group made 5.22±2.82 per year, vs. 4.32±3.14 in control. The difference was not statistically significant ($p>0.05$), but still for 20 percent more. Children exposed to smoke had slightly elevated chances to have more than 2 episodes of acute respiratory diseases per year, in comparison with non-smoking families (OR=1.15). The chances to get disease were even higher, if parents smoked in the same room with child (OR=1.23). Anyway in both cases changes were not statistically significant ($p>0.05$), which could be attributed to relatively small sample size.

Difference in concentrations of fine particles between groups was registered. Thus, average concentration of fine particles in case group was 13104ft3 vs. to control with 4136 ft3. Any differences in concentrations both of big particles and CO in groups were not registered. Average concentration of big particles in case group was 345.82ft3, while in control it ranged to 399.70 ft3. In case group average concentration of CO made 34.4 ppm, and in control it was 35.5 ppm. Correlation analysis of fine particles and CO concentrations found strong positive association ($r=0.733$, $p<0.05$). Cotinine in urine was found in 37,5% in case group. The association between the number of smoked cigarettes and cotinine in urine was registered (Man-Whitney test, $p<0.005$).

Results obtained in this study have proved that indoor smoking is the sources of air pollution and threaten children`s respiratory health. However, any significant association between indoor smoking and respiratory diseases was not found. The implementation in future case-control study based on revealed respiratory diseases in children is of high priority.

Biological and embryonic toxicity of 'nanogermanium' citrate in male F2 and F3 generations.

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An actual task of biology and medicine is investigation of influences of metal nanoparticles on cells and tissues metabolism in human body and animal. Among the variety of existing nanoparticles of metals the particular attention should be pointed out on the organic compounds, nanoparticles of biological elements. In Ukraine the technology of obtaining hydrated nanoparticles of macro- and microelements and addition with anion residues of carbonic acids (citric, propionic, fumaric etc) has been developed, that are widely studied and used in husbandry, veterinary and medicine. Germanium is one among insufficiently investigated elements, compounds of which have biological effect. Studies of many scientists have confirmed important role of Germanium in the human and animal body. It was proved that Ge performs different functions – immunostimulating, antioxidant, hepatoprotective, antihypoxic, increasing the organism resistance and the animal productivity. Proved that, usage of Ge citrate, obtained by the method of nanotechnology, demonstrate high biological activity at significantly lower doses, than its mineral compounds. Previously carried out studies on the biological effects of Ge citrate obtained by the indicated above method, showed its stimulating effect on the reproductive function of females and the viability of the offspring of generations F1. It is advisable and scientifically grounded to study biological effects of "nanogermanium citrate" in rats females of F1 and F2 and on the development of their embryos of the generation F2 and F3.

Determine the biological and embryotoxic effects of different doses of nano-Ge in generations F2 and F3 rats females in the conditions of its long-term supply with water.

Physiological, clinical and statistical methods of research have been used. Animals of experimental groups of generations F0, F1, F2, F3 drink daily Ge citrate in such doses (mkg Ge/kg body weight): experimental group 1 (E1) — 20, E2 — 200. Females of generations F2, F3 were weighted every ten days, determined the dynamics of the average body mass befor fertilization; they were killed on the 21st day of pregnancy and the quantity of yellow bodies of pregnancy, implantation places, live and dead fetuses have been counted.

The research has established the change in the body mass of females in experimental groups regarding with control. Higher values were in females of the generation F2: E1 – by 7,3 % ($P<0,05$) and E2 – by 10,1 % ($P<0,01$). In females of the generation F3 body mass was lower in E1 – by 11,0 % ($P<0,05$), comparing with animals of control group and higher in E2 – by 2,5 %. Concerning embryonic toxicity of Ge citrate, in the applied doses for female of generations F2 and F3 no valid differences are established among animals of control and experimental groups by the quantity of yellow bodies. However, this indicator in animals of experimental groups was higher and respectively was: control group F2 - 11,0 and F3 - 11,7 embryos; experimental: F2: E1 - 11,3 and E2 - 12,3; F3: E1 - 12,2 and E2 - 12,0 embryos. There were no significant differences in the implantation places and the number of live fetuses in animal groups E1, E2, compared to the control group, but in females F3 they were higher by 13,4%, although no statistically significant difference was found. In females, used 200 mkg Ge/kg b. m. these indexes were in F2 -11,2 ($P<0,001$); F3 – 11,3 embryos ($P<0,001$) on average per group. Pre-implantation mortality in females in control group was the highest: in F2 – 2,0; F3 – 2,0 embryos; while at the animal group E1 F2 was the lowest comparing with control group by 14,5 %; in E2 – by 41,5 %; in females of group E1 F3 - was lower from animals of the control group by 40 %; in E2 – by 70 %. Fetal weight reduction was established concerning animals of the control group in females of generation F2: E1 - by 4,5 %, E2 - by 10 % ($P<0,001$); in animals F3: E2 - by 15,2 % ($P<0,001$). In females of generation F2 and F3 craniocaudal fetus size in both experimental groups were lower than control by F2: E1 - by 3,3 %, E2 - by 5,3 % ($P<0,05$); in animals F3: E1 – by 6,1 % ($P<0,001$); in E2 – by 11,9 % ($P<0,001$).

The obtained results indicate a lack of nanoGe citrate toxic effects on the rats females body and their fetuses in generations F2, F3 in the embryonic period of growth and development used in doses 20 and 200 mkg Ge/kg b. m. An increase in the number of implantation places and living embryos in animals, received 200 mkg Ge/kg b.m. has been established, which is probably due to the antioxidant and antihypoxic properties.

7.Environmental risk assessment/epidemiology

The auditory effects of listening to personal music players in youth

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With the development of technology, listening to music has been massively expanded through personal music players, which are now very easy to access. Especially vulnerable is a group of teenagers and young adults who use these devices to relax and also to attenuate the outside noise.

In our study, we focused on portable music listening habits and their effects on health. We used the authorized "Noise annoyance questionnaire" for subjective evaluation of personal music players (PMP) use as well as the conversion of the subjective assessment of the volume setting and duration of PMP to estimate the exposure dose. With the help of ENT specialist we determined the auditory effect of listening to PMP on a pilot sample of volunteers.

Our study sample included 1,003 students of Comenius University in Bratislava Slovakia (306 males, average age 23 ± 2 years). From the sample, 79% reported listening to music through PMPs in the last week in the average time of 285 minutes. Respondents had their PMP mostly set on volume level 3 (still they could hear the passing car) (39.6%) and 31% of them exceeded 80 dB (lower action value for industry LAV = 80 dB). On a pilot sample of volunteers (n=41) audiometry testing was performed indicating hearing threshold shift (≥16 dB) at higher frequencies in 22% of subjects. Students had hearing impairment at higher frequencies (6000 Hz and 8000 Hz) bilaterally and also at lower frequencies on 1000 Hz on the right ear and 2000 Hz on both ears. Of volunteers who participated in audiometric tests, more than 43% exceeded LAV by listening to PMP and in this group, hearing impairment was found in 28% of probands, and a significant perception hearing impairment in one person. The frequent use of PMPs (mp3 or smartphones) on volume setting above 80 dB may lead to hearing impairment even in the young age. Based on the audiometric examination, we assume that students having their PMP set to higher sound levels have more frequent threshold shifts at higher frequencies, which can lead to serious hearing disorders at older age.

The results showed the importance of exposure from PMP and the need for prevention and intervention. It would be desirable to improve the scientific basis for the management of noise reduction and to monitor the impact on public health.

Theoretical estimates and real associations between daily mortality and PM10 concentrations in the city of Ostrava

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Epidemiological studies from around the World demonstrated the adverse effect of PM10 on human health. It is a serious concern in the city of Ostrava that belongs among the most polluted areas in the Czech Republic and Europe. Many studies and meta-analyses confirm, that increase of short-term PM exposures contributes to increased mortality (total, cardiovascular, cardial and respiratory). The heterogeneity of these studies is considerable and especially smaller studies did not confirm these relationships due to small population size (≤ 1milion) and a short study period (≤ 1 year). The cardiovascular mortality increased by 0.24-1.94% (American studies), by 0.50-0.93% (European studies), by 0.04-0.36% (Asian studies), and mortality for respiratory causes by 1.50-2.14% (American studies), by 0.50-1.41% (European studies), and by 0.06-0.86 % (Asian studies) per 10 µg.m-3 PM10.

The goal of the presented study was to verify the percentage increase of mortality for cardiovascular and respiratory causes, as recommended by the WHO for health risk assessment, at population in Ostrava.

The short-term PM10 concentrations measured over the period 2010-2012 were analysed in this study. A theoretical estimate of mortality was expressed as attributive proportion (AP) based on concentration-response (C-R) function. According the World Health Organization the estimated increase of total mortality reaches 0.6%, cardiovascular mortality 0.9%, and respiratory causes mortality 1.30% per 10 µg.m-3 of short-term PM10 concentrations. The numbers of daily deaths for cardiovascular diseases (I00-I99) and for respiratory diseases (J00-J99) were obtained from the Institute of Health Information and Statistics of the Czech Republic.

The total number of deaths for selected causes (N=5,959) during the study period represented 58% of all deaths in the city of Ostrava. During the period 2010-2012, the number of cardiovascular deaths decreased, in contrary the number of deaths for respiratory causes significantly increased. The highest attributive proportion of respiratory mortality was found in 2010. The highest theoretical increase of total mortality (by 5.4%) was estimated for January 2010, the second highest increase (by 4.3%) was identified in February 2012, while the lowest AP increases were detected in the months May-September in each of the years.

When looking at the real data, the mean daily mortality for cardiovascular and respiratory causes was not significantly related with the PM10 concentrations (% increase -0.82 (95% CI=-1.75-0.12), and -1.07 (95% CI=-3.18-1.1 respectively) and the WHO theoretical estimations were not confirmed. After adjustment for confounding factors, a positive impact of higher temperatures was found for cardiovascular mortality.

The observed relationships between mortality from cardiovascular and respiratory causes and PM10 short-term concentrations did not confirmed the theoretical estimations according the WHO methodology. These results are consistent with the results of other smaller European and American studies.

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Management of industrial toxic wastes in chisinau mun. - emergency risk for population health

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Evaluation of the management system of toxic wastes from the production activity, including small and medium enterprises in Chisinau mun.

The retrospective, analytical study. There were analysed Minutes of the Sanitary Surveillance of Small and Medium Sized Enterprises (f-310) and Statistical Report "Toxic Waste Formation, Use and Neutralization (f-1/e). Period of observation - 1995, 2000, 2005, 2010-2015 years. Analysed indicators: volume of existing wastes at the beginning of the year, volume of industrial toxic wastes (ITW) at the end of the year, ITW dynamics during the year. Data analysis was performed according to traditional statistical methods for small variable selections.

Waste management in the Republic of Moldova remains a difficult and unresolved problem in organizational and legislative terms, although environmental protection is regulated by about 35 legislative acts and over 50 Government Decisions. The current ITW management system is imperfect and among the major shortcomings we can mention the lack of harmless conditions for the long-term accumulation and long-term maintenance of ITW as well as the conditions for processing them. Until now in the RM, the basic principle of the ITW management system remains the class of toxicity. In Chisinau mun, during the period 1995-2015, there was a decrease in the number of large industrial enterprises generating ITW, but there is a significant increase in the number of small and medium enterprises generating ITW, which are not included in the ITW dynamics reporting system. Currently, in Chisinau mun, 2322,6 tons of ITW were accumulated, representing 37,3% of the total accumulated ITW at national level. Also 7374,2 tons of ferrocyanide were stored in Chisinau, which represents 57,3% of the nationally accumulated volume.

Conclusions: 1) The volume of ITW stored at industrial enterprises in Chisinau mun. has been steadily increased during the last 25 years. 2) The accumulated ITW are from class I and II of toxicity. 3) Small and medium-sized enterprises are a new source of toxic wastes production that is not part of the toxic industrial waste management system. 4) Deficiencies in the ITW management system raise this public health issue to emerging risk. 5) It is necessary to carry out in-depth studies on estimation of the risk to the health of population.

The comparison of transgenic and non-transgenic barley plants attacked by Fusarium mold

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Although many genetically modified (GM) crops providing higher yield under adverse conditions or biofortified food have been prepared, the acceptance of biotechnology crops still remains limited. Nevertheless, the potentially beneficial effect of GM crops with increased resistance planted in stressing conditions versus the wild-type species has not been published yet.

We report on GM barley expressing the antifungal peptide limen that improves plant defence system under biotic stress conditions. Transgenic barley was obtained using Agrobacterium-mediated transformation and the production of limen peptide in plant tissues was verified by molecular techniques. Young barley plants were repeatedly exposed to Fusarium oxysporum spores. Increased resistance to the most important pathogen was followed using chlorophyll measurements as indicator of fusariosis. Focusing on the food safety aspect of the use of GM plants, cytotoxicity was compared in extracts from transgenic stressed plants. We found that transgenic barley exhibiting increased resistance and grown under adverse conditions had better potential in terms of food safety than wild-type plants cultivated under the same conditions. This result may contribute to the better acceptance of GM plants by customers.

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Evaluation of the ecotoxicity of selected pharmaceutical residues in the aquatic environment

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Nowadays the problem of pollution of aquatic environment by pharmaceuticals is not enough known. Presence of pharmaceuticals in water, even in small concentration, can carry high consequences for aquatic organisms, disturb biological balance in ecosystem and have an impact on a human health. Biotests in which different organisms are employed as a bioindicators is the one of the water and wastewater quality test methods. The study presents the results of the toxicity tests of water solutions containing selected pharmaceuticals from the group of non-steroidal anti-inflammatory drugs. Three bioassays were used to assess the water toxicity: Phytotestkit (Sorghum saccharatum, Sinapis alba, Lepidium sativum), Daphtoxkit (Daphnia magna) and Microtox (Vibrio fischeri).

HUMAN BIOMONITORING CAN HELP ASSESS COMBINED EXPOSURE TO CHEMICAL MIXTURES – A CASE STUDY

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Humans and wildlife can be exposed at the same time to an infinite number of different combinations of chemicals via food, consumer products and the environment, which raises concerns for possible impacts on public and environmental health. The risk assessment of chemicals for regulatory purposes does not generally take into account the "real life" exposure to multiple substances, but mainly relies on the assessment of individual substances. If exposure to multiple chemicals is considered in a legislative framework, this is usually limited to chemicals falling within this framework and neglects co-exposure to chemicals that could contribute to a combined effect but that are covered by a different regulatory sector. Human biomonitoring data (HBM) can help understand how much of a chemical/s a person was subjected to in a specific exposure scenario providing a biologically relevant measure of dose. To address this, a specific case study based on HMB data was performed, with the aim to investigate if the combined exposure might pose a health concern related to anti-androgenic effects associated with these compounds. Different cohorts from Denmark were used: 1) Danish pregnant women and 2) children of different age groups. Measurement of urinary concentrations of phthalate metabolites, phenols (such as bisphenol A, triclosan, etc) and parabens were used to calculate Daily Intakes (DIs). Daily Intake estimates were then compared to available Reference Values (RVs, such as tolerable daily intakes (TDIs)) to calculate individual chemical Risk Quotients (RQs). The results will be discussed comparing chemical classes and cohorts. Briefly, the results showed that the group of phthalates seem to be the dominant contributor in both cohorts. Phenols exposure seems to be of low concern in both cohort studies. Parabens data were available only for the pregnant women cohort in the published aggregated data. Parabens represented potentially toxicologically relevant exposure levels in pregnant women, driven by the n-propyl-paraben level, which exceeds its RV. Data indicate higher exposure levels for children for phthalates than for pregnant women, even leading to levels of concern, while for phenols the differences are lower and also overall RQs are far lower. This approach gives a first indication of a potential risk and can steer further efforts of potential concern. The use of HBM data in combined exposure assessments is a very useful tool, as it allows the investigation of true internal exposure levels. However, to accurately predict an estimate intake doses application of HBM data requires biokinetic information, which is not always available, especially for humans. For most of the well-studied compounds in this case study, the relevant biokinetic parameters needed for the calculations could be identified. However, depending on the source they might differ substantially which can lead to big differences in resulting DI estimates. Future work will explore the possibility to apply biokinetic mathematical models, such as physiologically based kinetic models, to estimate intake doses as well as internal exposure taking into account the biokinetic information which will greatly support the use of HBM data in chemical mixture risk assessment

INFLUENCE OF EXPOSURE TO TOBACCO SMOKE AND TRAFFIC-RELATED AIR POLLUTION ON PRESCHOOL CHILDREN WEIGHT

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Background. Preschool children overweight has been inconsistently associated with ambient air pollution. The joint effects of air pollution and tobacco smoke exposure on young children body mass index is unclear. The purpose of this study was to examine the association of maternal tobacco smoking, nitrogen dioxide (NO2) exposure and the risk of overweight in preschool-age children.

Materials and methods. This cross-sectional study included 1489 children (ages 4 to 6) residing in Kaunas, Lithuania, whose mothers were recruited in 2007–2009 to the KANC pregnant women cohort study. Individual data on socio-demographic characteristics, residential environment factors, health behavior, and other covariates we obtained using standardized questionnaires. We used land-use regression (LUR) model to assign individual participants' exposure to ambient NO2. Maternal tobacco smoking during pregnancy was based on self-reported. We used age group and sex-fixed BMI cut-off points according to the Childhood Obesity Working Group of the International Obesity Taskforce guidelines. A multivariate logistic regression was used to investigate exposure associations (as adjusted OR and 95 % CI) with overweight, controlling for potential confounders.

Results. In a univariate analysis, average annual NO2 exposure levels above median slightly increased children overweight, while the unadjusted odds ratios of overweight were statistically significant higher for children exposed to maternal tobacco smoke during pregnancy. The stratified multivariate model showed that, combined exposure to maternal smoking and NO2 exposure was associated with statistically significant increase odds ratios of overweight in preschool children (2.49; 95% CI: 1.05–5.90), after adjustment for important covariates. Conclusions. Our findings strengthen evidence that combined exposure to tobacco smoke and ambient air pollution may have effect on young children physical development.

THE IMPACT OF CONSTRUCTION AND FUNCTIONING OF A NEWLY BUILT SKI SLOPE ON THE QUALITY OF NEARBY SURFACE WATERS

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Construction of new, artificially snowed, ski slopes and the accompanying infrastructure changes the natural environment and exerts pressure on the ecosystems. This study examined impact of the construction and operation of a new ski slope situated in Białka Tatrzańska, southern Poland, with its infrastructure and associated artificial snow production, on the quality of nearby stream waters. The research period covered time before, during and after the construction of the slope. Electrolytic conductivity (EC) and pH were measured onsite, chemical analyzes included determination of Ca2+, Mg2+, Na+, K+, HCO3-, SO42-, Cl- and NO3-, microbiological analysis comprised mesophilic and psychrophilic bacteria, total and fecal coliforms, total and fecal E. coli. As a result of intensive environmental transformations, the examined parameters varied significantly over the study period, as shown by the coefficient of variation. Due to land cover changes, concentrations of all examined parameters increased during the construction of the ski slope leading to ion and bacteria leaching from soil. However, when construction works were finished all bacterial indicators and some chemical parameters returned to the state observed before the construction, most probably due to recovery of vegetation and self-purification of water. Supply of melt water from artificial snow, produced from water containing higher concentrations of ions caused increased pH, EC, Ca2+, Mg2+ and HCO3- in the stream. Providing that the development of ski stations is unavoidable in the considered region, conducting studies assessing the impact of new ski slope construction is important step which should be conducted prior to undertaking such investments.

SURROUNDING GREENNESS, AIR POLLUTION AND GENERAL HEALTH IN PRESCHOOL CHILDREN

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Background and aim. Epidemiologic studies suggest causal links between exposure to traffic-related air pollution and negative effects on children health. There is some evidence that contact with green spaces has positive effect on health; however, the research in young children is sparse. The aim of this study was to examine the association between residential surrounding greenness level, nitrogen dioxide (NO2) exposure, and preschool children health.

Methods. This cross-sectional study included 1 489 children (ages 4 to 6) residents of Kaunas city, Lithuania. We used mother-child pair's questionnaire data to obtain individual participants' characteristic data. We assigned individual exposure to greenness levels as GIS assessed the average of satellite-derived Normalized Difference Vegetation Index (NDVI) within a 100 m buffer of each participant address. Individual exposure to ambient NO2 we assigned using the Land-use regression (LUR) model. We estimated residence exposure of NO2 as continues variables (interquartile range (IQR) and increase per 10 µg/m3) and dichotomized exposure by median. A multivariate logistic regression was used to investigate exposure associations with children health status, controlling for potential confounders.

Results. Poor general health was reported in 14.0% of children aged 4 to 6 years. The annual mean estimated NO2 air concentration was 15.98 µg/m3 (interquartile range (IQR) = 2.76 µg/m3). Poor general health was more prevalent among 4–6-year-old children residing in higher than median NO2 exposure areas to compare with below or equal median (13.3% and 14.6%, accordingly). A 10 µg/m3 increase in NO2 level was association with 24 % (aOR 1.24; 95% CI: 0.69-2.23) increased odds ratios of poor health, after adjustment for covariates. The stratified by environmental exposures multivariate model showed, that low greenness exposure together with higher NO2 level exposure were associated with statistically significant higher adjusted odds ratios for poor health in 4–6-year-old children (aOR 1.72; 95% CI: 1.11-2.66).

Conclusion. The findings of this study demonstrate combined effects of the important role that increased residential greenness and reduced NO2 air pollution even below limit value can play a beneficial role in reducing the risk of young children's poor general health.

ASSOCIATION BETWEEN CITY PARKS NEIGHBOURHOOD AND BIRTH WEIGHT

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Background: there is some evidence that the urban green space, city parks improve physical and mental health and well-being by increasing physical activity, reducing air pollution, noise, and stress. This evidence to a green space would also be able to affect pregnancy outcomes.

Aims: we examined the association between city parks neighbourhood and newborns birth weight. Methods: we conducted a prospective 3416 pregnant women cohort study in kaunas (lithuania). We have selected woman who's during pregnancy were exposed to green space during vegetation period at least for 5 moths (1636), and estimated maternal residence distance from green space classified as a formal park. Women's home locations were mapped using the arcgis 10 geographical information system (gis) and combined with a comprehensive gis database of neighbourhood and green space characteristics. According to the distance from the residents' homes of each respondent to the nearest park, we determined three women groups: residing within 300 m, 300-1000 m and more than 1000 m. The associations between distance from parks and birth weight were analysed by linear regression models with adjustment for body mass index, gestational duration, maternal smoking, education, marital status, parity, and infant sex. We also used the distance from the residents' homes as an exposure continuous variable.

Results: our data shows that newborn who mother resident place was within 300 m from city park mean birth weight was 3454.77±27.14 g, and residence place was >1000 m from city park mean birth weight was 3383.45±37.84 g. Using the distance from the residents' homes as a continuous variable we found slight (2.76 g) but statistically significant (p=0.041) birth weight reduction per every increase in 100 m residential distance from city park.

Conclusions: the findings suggest that city park neighbourhood has positive impact on newborns birth weight.

VARIABILITY OF PARTICULATE MATTER PM10 CONCENTRATION IN KRAKOW, POLAND, DEPENDING ON THE METEOROLOGICAL CONDITIONS

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Abstract: The aim of the study was to characterize the concentration of PM10 suspended particulate matter, in particular the variation in this concentration and its dependence on meteorological conditions – air temperature, atmospheric precipitation, wind speed, and synoptic conditions. Air pollution was assessed using average daily PM10 concentrations obtained from the measurement point of the air monitoring station at Al. Krasińskiego in Krakow; average daily air temperatures, daily sums of atmospheric precipitation, and average daily wind speeds obtained from the Institute of Meteorology and Water Management station; and types of synoptic conditions as defined by Niedźwiedź for the upper Vistula basin. The research period covered the heating seasons in the three-year period 2012-2014, which were defined as January-April and October-December. Models of dependence of the PM10 concentration on meteorological conditions were constructed. The highest PM10 concentration was noted for the Ka, Sa, SWa, SEa and SWc synoptic types. Drops in air temperature, low sums of atmospheric precipitation and low wind speeds contribute to an increase in the concentration of PM10 suspended particulate matter and thus the deterioration of air quality.

AIRFLOW CONDITIONS IN VENTILATION CHANNELS IN THE URBAN ENVIRONMENT OF CRACOW (1964 - 2012)

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High-density building is an obstacle to the free flowing of air and significantly reduces its circulation, which causes an increase in the concentration of air pollution. The measure of the city's ventilation is the wind speed, the value which depends particularly on the structure of land use and land cover.
The aim of this work was to study the airflow conditions in ventilation channels in the urban environment of Cracow in the period 1964 - 2012. The research tried to find the answer to the following questions:
- What is the spatial distribution of the aerodynamic roughness length in Cracow?
- What is the value of the aerodynamic roughness length in ventilation channels?
- How do the spatial planning and urban development change the anemological conditions in Cracow?
To evaluation airflow conditions the physical quantity called aerodynamic roughness length was used. The aerodynamic roughness is equivalent to the height at which the mean wind speed theoretically becomes zero. In the urban environment the aerodynamic roughness depends on the height of buildings, industrial structures, groups of the trees, their geometrical shapes, flexibility and density of distribution in urban area.
The material for the work was the Corona satellite image from 1964 and data from the CORINE LC project (Coordination of Information on Environment Land Cover) for 1990, 2000, 2006 and 2012. Based on the supervised classification of the Corona satellite image and CORINE LC data prepared landuse maps for the year 1964, 1990, 2000, 2006 and 2012. The landuse maps were then transformed into the aerodynamic roughness maps by assigning the appropriate roughness values to the respective landuse classes.
Wind speed modeling was done using SAGA GIS software. The digital elevation model (10 m spatial resolution) and correlation relations between the altitude and the average annual wind speed were used to calculate wind speed. In the research, significant attention was paid to the ventilation channels which are a natural air exchange system in Cracow.

Decisions about development in Cracow which had not been thought over earlier led to deterioration of air circulation in the city. The roughness maps and spatial distribution of wind speed presented in the research may prove that. High and chaotic construction is an obstacle for natural air flow and is one of the main reasons of high air pollution in the city (Reports about the environment conditions in malopolskie voivodeship, WIOŚ).

Increasing land roughness in Cracow causes changes of anemological conditions. These changes concern decreasing wind speed and thus weaker air circulation in the city. During the years of the research we can observe upward tendency of roughness.

The changes of roughness influence the wind conditions. In the respective years of the research period the changes of wind speed distribution in Cracow can be observed. Winds of lower speed (1,8 – 1,9 m·s-1) tend to occur more frequently than winds of higher speed (>2,0 m·s-1). Progressive weakness of the winds, which are already very weak in Krakow, will lead to worsening the ventilation conditions of Cracow.
The research shows that the ventilation channels of Krakow must be protected by law. The local development plan could avert excessive, often chaotic and unconsidered development of the channels.

EFFECT OF ZINC ENRICHMENT ON GROWTH AND CHEMICAL COMPOSITION OF WHEAT, LENTILS AND MUSTARD SPROUTS

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Zn is an important element for plants as well as human as a dietary element. In crops like cereals lack of Zinc nutrient was observed. As it is lack in crops also humans consuming it will also have the Zn deficiency. Mainly cereals and legumes are staple foods for people in developing countries. The soil producing crops are of Zn deficiency due to various factors like high soil pH, low organic matter, high amount of fertilizers are responsible. Deficiency of Zn causes several affects on human health leading to severe diseases related to immune system, skin problems, behavioral disorders and many more. Various different methods are used worldwide to provide Zn to plants like spraying, coating, etc. The main aim of the present study was to prepare Zn enriched sprouts of wheat, lentils and mustard through biofortification in germination process. So for this study different concentrations of ZnSO4 solution are used and different parameters are examined.

8. Topics of growing awareness related to environmental health

Impact of physical and social factors on respiratory sickness among schoolchildren in eastern Slovakia

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The air pollution belongs to the most important environmental threats to human health. Particularly sensitive are children, elderly people and patients with chronic conditions. Individual susceptibility is influenced by many factors: age, social status, gender, nutrition, presence of disease, genetic determination, global health status. Children are a focus points in the health protection considering possibilities of early organs and functions impairment. The aim of our study was to evaluate impact of socio-economic factors, air pollution quality, personal anamnesis of allergy and effect of passive smoking on respiratory disease among schoolchildren.

Cross-sectional study of respiratory health included data collection about frequency of respiratory diseases, personal history and socio-economic background in the family. Parents questionnaires collected also data about ETS environmental tobacco smoke, allergy in the family, and reported respiratory morbidity and symptoms in children in last 12 months. Also data about Air pollution Index from the investigated areas were included into analysis. Data were received from 9 rural areas in eastern Slovakia, included totally 1805 filled questionnaires from parents of children 6 – 11 years old. Statistic methods included frequency evaluation and adjusted OR calculations in SPSS program.

Effect of socio-economic determinants on the incidence of respiratory diseases was investigated in the groups of investigated children. We followed diseases symptoms and incidence of respiratory diseases in child within last 12 months. Air pollution effect was derived from the mean concentrations of air pollutants in the selected areas in last 12 months. We confirmed higher amount of upper respiratory infections (URI) in the families with lower socio-economic status (table 1). Statistically significant was mother education, local house heating, father education. Lower respiratory infections (LRI) and their frequency was influenced by air pollution score, parents education, allergy in children and parents (Table 2). Regarding intersexual differences in our study statistically was confirmed significantly higher effect on disease frequency in the group of boys. In this cross-sectional study was confirmed adverse effect of SO2 and PM10 concentrations on disease frequency. Data are confirming also higher effect of SO2 concentrations on upper respiratory tract than NO2 concentration level. NO2 are predominantly entering also to lower respiratory tract and impair lower respiratory system. ETS - environmental tobacco smoke - wasn't confirmed as statistically important factor neither for upper or for lower respiratory diseases. ETS exposure might be influenced by domestic habits where indoor smoking is mostly refused by families living in rural areas.

The outputs of our study confirmed the effect of both - air pollution and socio-economic factors on the frequency of respiratory diseases among schoolchildren living in eastern Slovakia, unfortunately we didn't confirm the effect of passive smoking.

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Nuclear magnetic resonance and X-ray diffraction analysis of Cs adsorption on clay minerals

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The Fukushima Daiichi Nuclear Power Station suffered a meltdown as a result of the Tohoku earthquake that occurred on March 11, 2011, in Japan. The accident released several kinds of radioactive elements such as 90Sr, 134Cs, 137Cs, and 131I into the environment. Human exposure to 137Cs is a health risk because of its long half-life. Most of 137Cs is stabilized in the soil, while small quantities are absorbed by plants such as rice. In order to avoid internal exposure, it is important to understand the mechanism underlying its transfer from the soil to plants.

We have performed solid-state nuclear magnetic resonance (NMR) and X-ray diffraction (XRD) experiments to study Cs+ ions adsorbed by clay minerals to analyze their local structure. The XRD pattern indicated that the interplanar spacing of the clay crystals has expanded after absorbing water and Cs+. The NMR spectra have also shown that several kinds of peaks corresponding to the clays (illite, pyrophyllite and montmorillonite) after immersion in CsCl aqueous solution; the peak at -30 ppm is assigned to Cs+ on the clay surface while that at -100 ppm is assigned to Cs+ in the silicate sheet in the clay crystal. This result is consistent with the fact that Cs+ with a smaller coordination number yields a small field shift in the NMR spectra. Moreover, after immersion in KCl aqueous solution, these peaks disappear in the NMR spectra, thereby indicating that our assignment is reasonable. This is because Cs+ on the clay surface and in the silicate sheet is easily subject to ion-exchange by K+. We believe that our findings will contribute to a better understanding of the pathway through which Cs+ transfers from the soil to plants and also to the recovery of the agriculture in Fukushima.

Mineral elements of tissues of females F1 rats and their offspring for the effects of various doses of Ge citrate

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Currently, the compounds of Ge are being studied and used in the biology, medicine and veterinary since they have a wide range of biological effects. In Ukraine, by the method of nanotechnology, an environmentally safe citrate Ge has been obtained, which has a number of advantages compared not only with the mineral salts of this element, but also with its organic compounds. However, the age, genital and organ-tissue features of various doses of germanium citrate on the content of other trace elements have not been clarified. The purpose of these studies was to determine the effect of the level of receipt of various doses of germanium citrate, obtained by methods of nanotechnology and chemical synthesis in the body of pregnant female rats F1, on the content in organs and tissues, as well as their embryos Ge, Zn, Cu and Mg.

The physiological, spectroscopic and statistical methods with the atomic emission spectroscopy with and inductively coupled plasma have been used to detect Ge, Zn, Cu and Mg in the liver, heart, kidneys, lungs and muscles of female F1 rats and their embryos. The animals of experimental groups, in contrast to the control group, during growth, puberty and pregnancy, were discharged with water of nanogermanium citrate (NGeCit) at the following doses (μg Ge/kg body weight): experimental group 1 (D1) — 20; D2 — 200 and germanium citrate chemically synthesized (GeCitCS) D3 - 2000. The female tissue samples of female F1 rats and their offspring were obtained at the 20th day of pregnancy during the determination of the feto- and embryotoxicity of the applied doses of germanium citrate.

The results of the study of the influence of NGeCit on the content of trace elements in the tissues of pregnant female rats of the first generation indicate a significantly lower Mg level in the liver and heart of all experimental groups, as well as in the muscles of the D1 and D3 groups. While in the kidneys of the groups D1, D2 and D3, the level of Mg was set to be higher ($P < 0,01$; $P < 0,001$). Characteristically, the level of Zn similar to Mg in the heart and femoral muscle of animals in experimental groups is believed to decrease, and in the kidneys — it increased. The effect of germanium citrate on the content of Zn in liver was established, in particular, the release of 20 μg of NGeCit resulted in its decrease ($P < 0,001$), while 200 μg of GeCitCS — growth ($P < 0,001$). Also, a possible decrease in the Cu content in the liver, heart and femoral muscle of the female D1, D2 and D3 groups was noted, and in the kidneys – of the D1 group. However, the administration of a higher dose of germicide citrate (200 μg) resulted in a probable increase in the Cu content in the kidneys of these animals, both in the action of both NGeCit in D2 and in the D3 group of GeCitCS. It should be noted that the prolonged release of rats germanium citrate in different quantities caused a decrease ($P < 0,001$) of its content in most of the tissues under study, which may indicate the inhibitory effect of this compound on the transformation of germanium in the body from the feed. However, the water intake of 2000 μg of GeCitCS resulted in an increase in the Ge content in the heart and 200 μg of NGeCit in the kidneys, which may indicate a difference in the effect of this dose.

The investigations of trace elements content in the tissues of the embryos of the rats indicate the dose-dependent effect of germanium citrate, obtained by the method of nanotechnology and chemical synthesis. The increase in the level of Mg in the liver tissues of animals of the D3 group, as well as in the heart in the D2 and D3 groups, has been noted, whereas in muscle their content is likely to decrease. The low content of Zn in the liver, heart and lungs was determined for the action of 200 μg of citrate Ge and only in the heart for 2000 μg. The prolonged release of 200 μg of Ge citrate in female rats caused a decrease in Cu content in all investigated embryonic tissues. Characteristically, with the action of 2000 μg Ge, the content of Cu in the tissues of embryos was significantly increased in the heart and muscles, whereas in the lungs it was decreased. The release of germanium citrate to females caused an increase in the Ge content in the liver of the offspring D2 and D3 groups, but its level decreased in the tissues of the heart and lungs, as well as in the muscles of D2 group.

The prolonged release of the first generation of rats in the period of their pregnancy with different doses of germanium citrate, obtained by methods of nanotechnology and chemical synthesis, caused a probable decrease in the content of Ge, Zn, Cu and Mg in liver, heart and muscle tissues, against the background of higher content of Zn in the liver, and Ge in the heart — for the action of 2000 μg. In kidney tissues, the higher level of Mg and Zn was found in all experimental groups, Cu at 200 and 2000 μg, and Ge in the D2 group only.

In the case of female rats, the low content of Zn and Cu was set up in all investigated tissues of animals of group D2, except for Zn in muscles, Ge in the heart, lungs and muscles, and Mg in muscles, against the background of an increase in the level of Ge — in the liver and Mg — in the heart. The probable increase in Mg content in the liver and heart, Cu in the heart and muscle, and Ge in the liver was noted, however, the content of Ge in the heart and lungs decreased, Zn in the heart, Cu in the lungs, and Mg in the muscles for the action of 2000 μg Ge.

THE IMPACT OF THE DANUBE RIVER POLLUTION ON BIOMARKERS RESPONSE IN THE LIVER AND GILLS OF COMMON BREAM ABRAMIS BRAMA (L., 1758)

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The Danube, the second largest river in Europe, is of great importance for all the countries in the basin for production of drinking water, water supply for domestic, agricultural and industrial purposes. Along the stream, the river receives incompletely treated or untreated wastewaters, which deteriorates its quality. Measurements of physico-chemical, chemical and microbiological parameters are considered the basis of monitoring because they cover a wide spectrum of information for proper water management. However, aquatic ecosystems are often exposed to different pollutants which may exhibit harmful effects on different levels of biological organization. Fish are widely used bioindicators in ecogenotoxicological studies, because of their position in the aquatic trophic chain and importance in human diet.

This research was conducted on the Danube River locality Višnjica, situated on the right river bank (1162 rkm), one of the main hotspots of fecal pollution. Discharge of the largest waste water collector in the capital of Serbia, Belgrade, which receives domestic and industrial waste, is situated a few km upstream of the sampling site. Sampling was performed in February, April, August and November 2014, with the aim to evaluate the impact of seasonal variation on water quality parameters and response of biomarkers in the common bream (Abramis brama). Water quality was assessed by using basic physico-chemical parameters and microbiological indicators of fecal pollution. In gills and liver of bream, metal and metalloid concentrations were assessed as an accumulation biomarker, comet assay was applied to assess DNA damage as a biomarker of exposure, while histopathological analysis was performed as a biomarker of effect.

According to number of Escherichia coli and enterococci critical and excessive level of fecal pollution was present on the site, indicating the presence of high amounts of untreated waste waters. During the entire period gills had higher concentrations of metals and metalloids in comparison to the liver. Both tissues showed the highest metal accumulation and the highest level of DNA damage in August, which may be attributed to increased activity and feeding during summer, but also to low flow rate and water level which may increase pollutant concentrations in the river. The highest level of histopathological alterations in the gills was recorded in November and in liver in April, probably due to higher level of precipitation during these months and introduction of pollutants through the urban and agricultural runoff. In terms of elements concentrations and DNA damage gills were more affected, while in terms of histopathological alterations liver had higher level of histopathological alterations. These results showed that urban wastewaters have a high potential in inducing genotoxic and histopathological effects in fish, and highlighted the urgent need for implementation of wastewater treatment facilities.

APPLICATION OF IN VITRO AND IN SITU BIOASSAYS FOR EVALUATION OF WATER GENOTOXIC POTENTIAL

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Human activity has the great negative impact on water quality. As a consequence, deterioration of freshwater ecosystems has the effect on whole wildlife. Some of the pollutants which are realised into water could interact with DNA molecule and lead to DNA damage. The Velika Morava River is one of the larger tributaries of the Danube River. The major ecological problem of the Velika Morava River basin is discharging of municipal and industrial wastewaters.

The aim of our study was the evaluation of genotoxic potential of the Velika Morava River basin. For this purpose, we employed battery of in vitro and in situ bioassays. From 9 selected sites the water samples and blood samples of Alburnus alburnus were collected. Within in vitro approach, the genotoxicity of water samples was tested using the SOS/umuC test on Salmonella thyphimurium TA1535/pSK1002 and alkaline comet assay on the HepG2 cell line. On the other hand, in situ approach included the alkaline and Fpg modified comet assay and the micronucleus test on bleak (A. alburnus) erythrocytes.

The obtained results indicated differences of in vitro and in situ tests to evaluate genotoxic potential. The effects of genotoxicity were evident only in tests performed in situ, which is not surprising considering constant exposure of collected organisms to environmental stress. Differential sensitivity was found also within in situ tests where the alkaline comet assay showed the highest potential in distinguishing between sites. So, in accordance with results, we could conclude that application of the battery of in vitro and in situ bioassays is appropriate for assessment of genotoxic potential.

THE MUTATIONAL SIGNATURE OF AFLATOXIN B1 INDUCED HEPATOCELLULAR CARCINOMA IN RAT

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Human dietary exposure to mycotoxin, Aflatoxin B1 (AFB1), contributes low birth weight, malnutrition, and hepatocellular carcinoma (HCC). In human AFB1 induced HCC, the genetic mutation signature is a p53 codon 249 G>C transition resulting an argine to serine substitution. The human AFB1 induced HCC mechanism is complicated by the heterogeneity of comorbidities, human exposures, disease etiologies, and stage of disease progression. The rat model is sensitive to AFB1 induced HCC and allows for the controlled study of AFB1 induced carcinogenesis for whole genome sequencing (WGS) analysis.
Four week old male F344 rats were received a partial hepacetomy of the caudate lobe recovery prior to gavage with 20 µg AFB1 in 100 µL DMSO once daily for 5 consecutive days a week over 12 weeks for a total exposure of 1200 µg AFB1. Rats were anesthetized via isofluorane and euthanized by exanguation at 10 months of age (6 months following cessation of dosing).

At euthanization, the liver was weighed and tumors were described (lobe and size), excised, a segment was taken for histopathology, and the remaining tumor was snap frozen in liquid nitrogen. DNA was isolated from hepetectamized, never-exposed liver, and a tumor from the same rat. Four different rats, 2 of those with two tumors each, all exhibiting a solid or cystic HCC tumor sub-phenotype, were utilized. Sequence alignment was to the reference brown Norway rat, the hepetectamized lobe DNA was additionally aligned as an internal control to eliminate false positive mutations.

All rats survived until the 10 month terminal time point. HCC tumors developed in 10/10 of the AFB1 exposed rats, while no tumors were detected in the DMSO vehicle control rats. Bioinformatic analysis included quality control of a read depth of ≥ 10 and an allele frequency of ≥ 10%. Only mutations that affected protein coding were selected for the current analysis. At a frequency of 3/6 tumors, 1972 genes contained at least one mutation. Those mutations occurred across many pathways, with the Wnt pathway containing the greatest number of mutated genes, 37. At a frequency of 6/6 tumors, 10 genes contained at least one mutation: Ngfr, Rxfp2, Wdr66, Msx2, Slc 39a12, Cccdc138, Loc682102, Rgs20, Flrt2, and Polrmt. Specific point mutations occurred with the highest frequency in 3/6 tumors and included: Cacna1e, Gabrb1, AABR07017902.1, Ankrd22, Ust5r, AABR07061022.5, Grid2, RGD1304694, Daam2, and Lancl3. Cacna1e (voltage-dependent r-type calcium channel subunit alpha-1e) and AABR07017902.1 (uncharacterized protein: clusters to developmental pluripotency-associated protein 3) are being further investigated as they contain four G>T and three A>G point mutations, respectively.

In conclusion, the WGS analysis of AFB1 induced rat HCC provides a novel controlled system to study AFB1 induced carcinogenesis. Ongoing work includes a higher throughput platform to determine mutational frequency in a larger sample size and the effect of intervention on the mutational profile.

9. Social, political and economic impacts and considerations related to environmental stressors

Nutrition and lifestyle risk factors in the sample of Slovak adolescents

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Nutritional parameters include those reflecting the changes in body size, composition or function. Bad eating habits, inadequate physical activity and unhealthy lifestyle are the most common risk factors affecting the nutritional status, resulting in overweight and obesity. This study is a part of the Y.A.B.S. study (The Youth and Parents Risk Factor Behavior Survey in Slovakia), which originates from studies The Behavioral Risk Factor Surveillance System (BRFSS) and The Youth Risk Behavior Surveillance System (YRBSS), originally designed by CDC, Atlanta, USA. The sample consists of 506 students (185 boys, 321 girls), aged 15-19 years, attending secondary schools in Bratislava. Questionnaires were distributed in 798 students, with 64% response rate. The survey was anonymous and voluntary, approved by Ethical Committee of Faculty of Medicine Comenius University and Faculty Hospital. The aim of the study was to evaluate lifestyle factors, eating habits and daily regimen, considering the prevalence of overweight and obesity in the sample. The prevalence of overweight and obesity in the sample was 18% (27.9% for boys and 11.4% for girls). Compared to non-obese, overweight or obese students used to skip food during school break more frequently (52.3% vs. 30%, $p<0.001$), they had significantly lower daily consumption of vegetable (32.7% vs. 48.6%, $p<0.05$) and higher number of them spent more than 5 hours/day watching TV (10.3% vs. 4.7%, $p<0.05$). Sedentary activities made a dominant part of the day in the whole sample (8 hours of sedentary activities vs. 4.6 hours of physical activities). Almost 37% of students were not doing sports at all. The common reason was lack of interest and motivation. Students spent approximately 3-5 hours/day using PC or tablet, the interest in watching TV is decreasing. The associations among nutritional habits and the occurrence of overweight and obesity were confirmed in our study. However, the whole sample reported lack of physical activities and lower interest in doing sports. This data will be paired with parental survey to obtain more detailed analysis and evaluation of behavioral factors.

Does being socially vulnerable affect the retention on opioid substitute treatment?

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Opioid substitute treatment (OST), helped millions of persons to recover from opioid addiction, redeem their family and social life, having steady jobs, decreased criminal behavior as well as reduce the level of HIV, HCV and HBV infections, improved HIV treatment outcome and in general decreased mortality. Long term retention in OST is one of the desirable achievements for opioid addicted patients and therefore risk factors for retention are widely studied.

We conducted retrospective cohort study. Patients involved in OST in 2014-2015 were followed till 1st of July of 2017. The data about patients' (exposure variables) age, Hepatitis C and HIV status and social status are routinely entered into the electronic database. Exposure variable those (in univariate logistic regression analysis) showed evidence of association with the (outcome) retention, at P<0.005 level, were entered into the multivariable logistic regression model. Retention was checked at different time points: at 3, 6, 9 and 12 months. People those scored less than 70,000 were regarded as socially vulnerable.

The final cohort included 469 OST patients. Patients above 40 years old and being socially vulnerable showed strong evidence of association with retention at all time points. AOR for ≥40 year old patient at 3, 6, 9 and 12 month retention respectively were 1.57 (95%CI 1.02 – 2.43), 1.52 (95%CI 1.03 – 2.23), 1.72 (95%CI 1.19 – 2,51) and 2.16 (95%CI 1.47 – 3.16). AOR for socially vulnerable patients at 3, 6, 9 and 12 month retention respectively were 4.64 (95%CI 1.06 – 20.3), 3.33(95%CI1.21 – 9.18), 3.51 (95%CI 1.37 – 9.04) and 4.49 (95%CI 1.83 – 11.0). HIV status showed evidence of association with 3, 6 and 9 month retention (AOR respectively were 0.32 (95%CI 0.13 – 0.78), 0.66 (95%CI 0.44 – 0.95) and 0.35 (95%CI 0.14 – 0.89)) and Hepatitis C status with 6 and 12 month retention (AOR respectively were 0.66 (95%CI 0.44 – 0.97) and 0.58 (95%CI 0.39 – 0.85).

Socially vulnerable and older patients remain longer in OST while patients with HIV and Hepatitis C have relatively short retention compared to patients without these diseases.

A SIMPLE METHOD TO PREDICT 137CS CONCENTRATION IN BROWN RICE UNDER LOW EXCHANGEABLE POTASSIUM CONTENT IN EACH PADDY FIELD

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Radiocesium (134Cs and 137Cs) were released into the environment because of the accident at Fukushima Daiichi Nuclear Power Plant owned by Tokyo Electric Power Company on 11 March 2011. Potassium (K) fertilizer has been applied to farm lands in the contaminated area to increase soil exchangeable K content (ExK) and prevent radiocesium uptake by crops since 2012. Brown rice exceeding the standard limit (100 Bq kg-1)has not been identified since 2015 due to the additional K application as well as the radiocesium physical decay and fixation to clay minerals. If the additional K application is withdrawn in future, which will lead the decrease in ExK. There is concern that radiocesium concentration in brown rice will increase without sufficient K application. The decreasing rate of ExK, and the relationship between ExK and radiocesium concentration in brown rice depend on soil physicochemical properties and radiocesium concentration. We previously showed that rice cultivation in a large pot (ϕ234×297mm) decreased ExK faster than that in a paddy field and could estimate the risk to exceed the standard limitation value under low K application. By applying this method, we examined a simplified pot experiment to estimate the risk for each paddy field.

The experiments were conducted in two paddy fields in Fukushima Prefecture: Field A was the Mottled Gley Lowland soils and clayey, and 137Cs concentration in soil was 3500 Bq kg-1. Field B was the Haplic Brown Lowland soils and clay-loamy, and 137Cs concentration in soil was 1600 Bq kg-1. Rice seedling was transplanted in a small pot (ϕ113×140mm) filled with each paddy field soil and the pot was placed into each paddy field. Brown rice and soil inside and outside of the pot were sampled at the harvest with three replications.

ExK was significantly lower in field A than in field B both inside (5.7±0.2 and 16.5±1.0 mg-K2O/100g in field A and B, respectively) and outside (8.8±0.8 and 13.1±0.9 mg-K2O/100g) of the pot. Cultivation in a pot significantly decreased ExK in field A while the difference between inside and outside was not significant in field B, suggesting that decreasing rate of ExK was faster in field A than in field B. The 137Cs concentration in brown rice was significantly higher in field A than in field B both inside (88.1±2.9 and 3.5±0.2 Bq kg-1) and outside (24.5±3.4 and 1.4±0.3 Bq kg-1) of the pot. Cultivation in a pot significantly increased 137Cs concentration in brown rice both in field A and B.

Rice has been cultivated without K fertilizer in the neighboring paddy field of field A for 4 years. The 137Cs concentration in brown rice and ExK at harvest was around 80 Bq kg-1 and 4.2 mg-K2O/100g, respectively, in the neighboring field. This suggested that 137Cs concentration in brown rice and ExK with continuous low K application was simulated by the pot cultivation in field A. The present study could not reveal the risk for field B.

CYBERSECURITY AND ETHIC IN MEDICAL RESEARCH DATA USE

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The impact of cyber revolution on the society brings into attention the right to protection of personal data within information and communication technologies. Some particular aspects of ethical nature have to be mentioned related to medical research, as long as in the European Union, there is an increasing need for a common attitude on ethics within scientific research, including the public health research. Like other sciences, medical research is generating increasingly large datasets. Information technology specialists mention both storage and transfer as main challenges in medical data protection, but anyway, the capacity to secure data on computers is not strong enough to ensure the security of existing data sets. The (2017) cyber attacks on health care system from several countries worldwide showed one more time the vulnerability of systems. Accordingly to this, there is a common opinion that often the financial shortness of the public healthcare systems is the main cause of the cybersecurity lack. The present paper aims to discuss several aspects:

Is cybersecurity a challenge in the use of medical research data of human subjects? How much is cybersecurity a matter of ethics in medical research?

How safe are the generated data in large public health international studies in their process of storage and transfer?

Would we be afraid of cyber attacks in the field of medical research?

Ethic and cybersecurity are parts of the actual medical world challenges, both for protecting the privacy of human subjects and the results of research (intellectual property), highlighting the need for improving coordination among multiple actors. In this regard, one of the targets is to develop cyber deterrence capacities in all countries, and to maintain cooperation in order to reduce the risks. There is real progress regarding data protection in the medical research field, but another problem is rising and asks for solutions: the transfer of health data in cross-border research (especially to United States), from the EU strict requirements point of view.

In conclusion, cybersecurity is a basic need of ethics in medical research and practical fields, which is expected to cover the international arena.

POTENTIAL OF URBAN COMUNNITY GARDENS IN KRAKÓW – A SURVEY STUDY

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The dominant part of the population lives in cities. Rapid urbanization results in vast environmental pollution and disconnection of the society from the biosphere and food cultivation. This leads to the expansion of civilization diseases, social exclusion and lower social trust. The need to re-connect “homo urbanicus” with nature points to solving problems that urbanization brings. The concept of community gardens is one of the solutions – a bottom-up initiative of city residents, established and cared for by locals to encourage the sense of community and grow own food. Community gardening has become recognized in many parts of the world as the best way to build civic engagement through gardening, provide biodiversity and sustainable city landscape, benefit from neighborhood reinforcement and social cohesion, promote healthy lifestyle and empower education [1].

The online questionnaire was developed in partnership with Ambasada Krakowian to examine the opinion of Kraków citizens about community gardens. Answers revealed that most of the respondents (70.9%) had never before met with the idea of community gardens, although they were convinced that these types of gardens were vital for the city of Kraków (72%). The findings suggest that people see multiple benefits from community gardening: direct contact with nature (79.6%), integration with neighbors (51.3%), congenial space for social events (48.7%). The results showed that participants are not ready to become a manager of such an enterprise (only 15% see their role as a leader), but would be a member (57%) or supporter (57.5%) of the garden. The analysis also focused on challenges related to establishing the garden and its management. Answers showed that 64% of respondents expected help (plants and gardening tools). We can conclude that there is an increasing demand for community gardens in Kraków and the social atmosphere is conducive to creating such places with the assistance of city authorities.

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IMPACT OF AMBIENT AIR POLLUTION AND SOCIAL FACTORS ON RESPIRATORY FUNCTION AMONG SCHOOLCHILDREN IN EASTERN SLOVAKIA

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Introduction: The air pollution belongs to the most important environmental threat to human health. Particularly sensitive are children, elderly people and patients with chronic conditions. Children are a focus points in the health protection considering possibilities of early organs and functions impairment. Individual susceptibility is influenced by many factors: age, nutrition, presence of disease, genetic determination, global health status and socio-demographic status. Our hypotheses have been designed in support to confirm air quality and its impact on respiratory function together with socio-economic status of the children and their families. Project focuses on research for the understanding of air pollution and the processes, which determine the impact of pollutants on human respiratory health.

Material and methods: Cross sectional study investigated 1530 children in age 6 – 10 years - as health determinants of air pollution exposure were evaluated pulmonary function: FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in 1 second) MMEF (Mid Expiratory Flow) and PEFR (peak expiratory Flow). The investigated group of children lived in air polluted areas in the vicinity of metallurgy complex in eastern Slovakia - Košice. Parents of subjects also filled personal questionnaires with SES status, habits in the family, smoking, indoor heating, demographic factors including location of permanent residence. Pulmonary functions were adjusted for sex, body weight, body height and age of the child. Air pollutants were selected as a mean of measurement from central net state monitoring in the selected areas - in last 6 months before pulmonary test screening.

Results: Average ambient air pollutants confirmed statistically significant results between FVC parameter and all measured air pollutants. Similar results and relationship were confirmed in parameter MMEF and PEFR. There were no differences between boys and girls, despite some studies confirmed pollution levels effect expressed more in boys, the other studies confirmed evident adverse effect on pulmonary function more in the group of girl. Age, gender, anthropometric parameters were directly correlated for pulmonary function tests. Educational status of parents, ETS, home allergens were confirmed as statistically significant factors for pulmonary functions decrease. We didn't confirm statistical effect of local heating and physical exercise on pulmonary function.

Conclusions. The results of the study confirmed effect of air pollution and socioeconomic factors on selected pulmonary function of schoolchildren in the vicinity of steel work factory in eastern Slovakia

MANAGEMENT OF WOOD FROM SITE CLEARING AND STORM DEBRIS

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The U.S. EPA Superfund (contaminated sites cleanup) program has increased its focus on the environmental footprint of cleanups through U.S. EPA's Greener Cleanups policy and Superfund's Green Remediation Strategy. The Greener Cleanups policy and Green Remediation Strategy have grappled with the issue of wood generated during cleanup activities. In addition, natural disasters can generate large amounts of vegetative and woody debris that present challenges in post-generation management. Hurricane Sandy, for example, generated more than 168,000 cubic yards of woody debris in New York City alone. Research focusing on organics management from municipal solid waste (MSW) and wood management from construction and demolition (C&D) is available; however, there is no product that is strictly dedicated to land-clearing and site cleanup. The objective of this project was to develop a decision-makers guide to assist in evaluating a variety of wood management options considering multiple criteria including life-cycle assessment (LCA) information/data from existing literature to help decision-makers identify tradeoffs between options.

10.Environmental and health benefits of renewable energy sources

The effect of lignocellulosic biochar physical-chemical properties on its wettability: theoretical aspects

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Wettability of biochar has controversial nature. Although naturally biochar is hydrophobic, some studies have shown, that it can retain high amounts of water in repellent sandy soils. It is known, that wettability of biochar is highly related with surface physical (surface area, porosity) and chemical (surface functional groups, elemental composition) properties. Surface functional groups (particularly acid oxygen-containing functional groups, such as carboxyl, hydroxyl) affect not only the affinity of water to biochar, but also the adsorption of pollutants (organic and inorganic) from water. It was shown, that oxidative surface functional groups increase biochar hydrophilicity. Formation of biochar physical and chemical properties are highly affected by the temperature of the pyrolysis and the feedstock for the production of biochar. For instance, biochar from wood has higher surface area and pore volume in the moderate pyrolysis temperature (440°C) compared to other types of feedstocks, therefore theoretically such biochar made from such lignocellulosic feedstock will have higher affinity to water compared to other types of biochar. However, temperature of pyrolysis has magnificant effect on this process, since when it tendentiously rise, surface area and microporosity grow also, but the amount of functional groups decrease. According to literature review it can be stated, that biochar made in higher pyrolysis temperature (>500 °C) is more hydrophilic and this could be explained by its higher surface area, either by decomposition of alkyl groups and particles shrinkage in higher temperatures, therefore pores become empty and more available for the sorbtion of water.

SUITABILITY MIXTURE OF BIOMASS ASH AND MUNICIPAL SEWAGE SLUDGE FOR RECLAMATION

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The suitability of mineral and organic waste for reclamation of post-industrial areas, waste landfills, slag heaps, dumping grounds appears to be substantiated on account of the content of macroelements and microelements. Application of bottom ash and municipal sewage sludge leads to improvement of soil properties and provides plants with indispensable nutrients.

The aim of the conducted research was to determine the effect of botttom ash, sewage sludge and their mixtures on yielding and chemical composition of a plant mixture and on the basic physicochemical properties of soil. The research was conducted under laboratory conditions and under conditions of a field experiment, and then the fertilizing value of these wastes in the environmental aspect was determined.

It was established that, as compared with the municipal sewage sludge, the biomass ash applied in the experiments had a higher content of macroelements and microelements. The content of heavy metals in the studied waste did not exceed the limits that condition their use in agriculture and reclamation. Application of only the bottom ash decreased the amount of yield in relation to the control, whereas application of a mixture of biomass ash and sewage sludge (treatment MB I) at a dose of 50 Mg DM · ha-1 increased the plant mixture yield as compared with the control. Application of only the municipal sewage sludge also decreased the plant mixture yield.

The waste applied to soil increased the content of Cr, Cd, Pb, Cu and Zn in the plant mixture. The level of heavy metal content in the plant mixture did not exclude this biomass from being used for fodder or reclamation purposes, and other (e.g. compost, biomass combustion). The combustion waste reduced the heavy metal uptake by the plant mixture. It was established that the highest dose of ash-sediment mixtures increased the heavy metal uptake by the plant mixture.

The plant biomass extracted Cr, Ni, Cd and Pb to the greatest extent from municipal sewage sludge, and Cu and Zn – from hard coal. It was established that, from the analyzed heavy metals, Ni was extracted in the highest amount (18.7%), followed by Zn (17.7%), Cd (13.2%), Cr (9.4%), Cu (9.1%) and Pb – in the smallest amount (6.2%).

The addition of combustion waste, sewage sludge and their mixtures improved soil chemical properties. The mixtures increased the content of base cations, and the content of organic carbon, total nitrogen and available P, K, and Mg in soil. Waste applied to the soil also increased the content of heavy metals in the soil. Introduction of waste did not cause exceedance of acceptable heavy metal content in cultivable and post-industrial soils. Heterogeneity of wastes and their non-homogeneity suggest that each batch intended to be used in environmental management should be bioassayed and undergo chemical tests.

Keywords: coal ash, biomass ash, municipal sewage sludge, heavy metals, yielding, content, uptake, balance

ROOT COLONIZATION BY ARBUSCULAR MYCORRHIZAL FUNGI IN MISCANTHUS SEED-BASED HYBRIDS CULTIVATED ON HEAVY METALS CONTAMINATED ARABLE LAND

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The widespread terrestrial symbiosis formed between plant roots and arbuscular mycorrhizal fungi (AMF) is involving 80% of vascular plants in almost all ecosystems [1].

In literature, many authors emphasize that presence of AMF in the roots of perennial crops growing on heavy metal contaminated soils enhanced phytostabilization process, through the ability to immobilization metals within or near the root zone [2]. The objective of the presented study, was to compare arbuscular mycorrhizal fungi (AMF) root colonization of novel, stress tolerant seed-based Miscanthus hybrids with the standard genotype

M. x giganteus (MxG). All analyzed plants were cultivated on arable land, contaminated with Pb, Cd and Zn. After the growing season (October) root material was sampled in order to estimate the AMF colonization level. For the estimation of mycorrhizal development, the roots were prepared according to a modified method of Philips and Hayman (1970) [3]. The comparison of AMF colonization was conducted according to Trouvelot et. al. (1986) [4] method. In all examined Miscanthus plants the structures characteristic for arbuscular mycorrhiza were found. Moreover, all tested roots were characterized for mycorrhizal colonization levels using following parameters: mycorrhizal frequency (F%), relative mycorrhizal intensity (M%) and relative abundance of arbuscules (A%). The obtained results were analyzed using Mycocalc software [5]. Among tested seed-based Miscanthus hybrids, the highest level AMF colonization was found for GNT5 genotype roots. Whereas the lowest value was found for GNT34 genotype roots. It indicates the lowest tendency of this hybrid to develop mycorrhizal structures on heavy metal contaminated soils.

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49. Iryna Kovalchuk
50. Olga Sushko
51. Ewa Muszyńska
52. Iskra Ruslana
53. Agnieszka Baran
54. Izabela Mądro
55. Anna Gąsienica
56. Magdalena Szara
57. Kotyk Bohdan
58. Dvylyuk Ivanna
59. Anicenta Bubak
60. Agnieszka Gruszecka-Kosowska
61. Barbara Filipek-Mazur
62. Shtapenko Oksana
63. Krisa Camargo
64. John McKernan
65. Alina Wiszniewska
66. Elzbieta Mierzejewska
67. Marcin Niemiec
68. Lesia Danyliuk
69. Jovana Jovanović
70. Margareta Kračun-Kolarević
71. Paulina Supel
72. Yevhen Dzen
73. Magdalena Zabochnicka-Świątek
74. Tatyana Stefanovska
75. Artem Medkov
76. Jan Černý
77. Diana Nebeská
78. Yuriy Chayka
79. Yuriy Chayka
80. Anush Budumyan
81. Uilana Tesarivska
82. Alexandra Filova
83. Hana Slachtova
84. Deleu Raisa
85. Katerina Rehorova
86. Anna Gąsienica
87. Alicia Paini
88. Inga Petraviciene
89. Anna Lenart-Boroń
90. Sandra Andrusaityte
91. Asta Danileviciute
92. Agnieszka Ziernicka-Wojtaszek

93. Jakub Wojkowski
94. Patel Jesal
95. Kvetoslava Rimarova
96. Yomei Tokuda
97. Khrabko M.I
98. Jovana Kostić-Vuković
99. Jelena Djordjevic
100. Erin Madeen
101. Diana Vondrova
102. Ekaterine Ruadze
103. Shigeto Fujimura
104. Sorin Gurzau
105. Bożena Szewczyk-Taranek
106. Kvetoslava Rimarova
107. John McKernan
108. Luiza Usevičiūtė
109. Jacek Antonkiewicz
110. Alicja Szada-Borzyszkowska
111. Svitlana Romanko
112. Alan J M Baker
113. Adam Grochowalski
114. Souhail Al-Abed
115. Angela M Gutierrez
116. Steven Chow
117. Vladimir Bencko
118. John McKernan
119. Anna Ostręga
120. Anna Gąsienica
121. Serhii V. Klimov
122. Krystyna Ciarkowska
123. Ewa Oleńska
124. Raina M Maier
125. Shao Lin
126. Kelly Pennell
127. Mohammadyousef Roghani
128. Yi Lu
129. Anicenta Bubak
130. Sandra Andrusaityte
131. Tomášková Hana
132. Edita Baltrėnaitė
133. Ziqiang Lin
134. Dmitri Iunac
135. Wayne R. Lawrence
136. Stanislaw Gawronski
137. Michael S. Bloom
138. Oleg Sergeyev
139. Peter Rudnai

140. Antoni Stasch
141. Mateusz Malinowski
142. Maciej Gliniak
143. Marcin Jewiarz
144. Hubert Latala
145. Stanisław Femielec
146. Jan W. Dobrowolski
147. Margaret A. Reams
148. Ekaterine Ruadze
149. Jana Babjakova
150. Amalia Hambartsumyan
151. Omair Khan
152. R. Zimmerman

Preconference workshop

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Chemical Mixtures and Epidemiologic Fundamentals for Risk Assessment Applications

Workshop Leaders:
Dr. Michael Wright; Dr. Glenn Rice
National Center for Environmental Assessment
Office and Research and Development/US Environmental Protection Agency, USA

Description:

Risk management options are increasingly being considered early in the risk assessment process to help scope the considerations and bound the inherent complexities related to potential exposures, risk and future clean-up decisions (including acceptable pollutant levels) related to contaminated sites. Exposure and health effects data in human populations can be used qualitatively and/or quantitatively in the different phases of risk assessments and can often help illuminate concerns regarding source or non-point source pollution or contaminated sites. The workshop will discuss the challenges in interpreting and using these types of information and provide instruction on identifying and addressing challenges and limitations related to human data. This workshop will discuss the basic information on human health risk assessments and highlight the potential uses and challenges with integrating epidemiological data that may be integral to some assessments, including those assessments addressing health risks posed by exposures to chemical mixtures.

Contaminated sites can often have various chemical and non-chemical stressors that should be evaluated for protection of human health and the environment. While the dose-response quantification and derivation of reference values in human health assessments are often on single chemicals, many sites usually have several in combination. Thus, another focus of this training will be to introduce some methods and procedures to address chemical mixtures at a site. The information in this workshop will provide some background material on practical and methodological considerations that are be applicable to a broad array of contaminated sites in both Europe and the United States. The risk information developed presented in this workshop will also illustrate the types of data to be communicated to the public through risk communication.

The workshop will have 2 sessions.

The first part (Epidemiological Fundamentals) of the training will address the fundamental principles related to epidemiology, as well as practical methods and data requirements for establishing causality and integrating epidemiological data into risk assessments. Participants will be introduced to elements of epidemiologic study design and the interpretation of common measures of association. Discussions will focus on identifying strengths and limitations of different types of human data, evaluating causality and integrating epidemiological data into risk assessments

The second part (Chemical Mixtures and Risk Assessment) of the training will be divided into two sections. The first section will summarize the human health risk assessment paradigm, including key concepts in exposure assessment and dose response assessment with discussion of approaches for developing reference values for non-cancer effects and oral slope factors for carcinogens. Because contaminated sites often have many inorganic and organic chemicals that humans can be exposed to at the same time, the second session will include an overview of human health risk assessment methods that can be used to estimate health risks associated with chemical mixtures. Both component methods and whole mixture methods that can be used to evaluate the risk posed by such exposures will be introduced. The last part of the workshop will focus on a practical exercise on risk assessment considerations and quantification for a hypothetical site contaminated with chemical mixtures.

Workshop Goals:

1. Become a more intelligent consumer of epidemiological information

2. Gain an understanding of basic human health risk assessment, including the

development of dose-response data

3. Gain an appreciation of chemical mixtures risk assessment methods

Session 1

Epidemiologic Fundamentals for Risk Assessment Application: Presenter Dr. Michael Wright

- Epidemiology Study Designs and Measures of Disease and Association
- Causality – Epidemiological and Statistical Inference
- Methodological Considerations (Explanations of observed Data)
    - o Internal and External Validity (Confounding and other Types of Biases)
    - o Exposure Assessment and Disease Clusters
- Effect Measure Modification

Session 2

Basic Principles of Human Health Risk Assessment and Chemical Mixtures Risk

Assessment: Presenter Dr. Glenn Rice

- Risk Concepts
- Risk Assessment Paradigm Overview
    - Exposure Assessment
    - Dose-Response Assessment
    - Risk Characterization
- Chemical Mixtures Risk Assess
    - Component Methods
    - Whole Mixture Methods

Case Study: Hypothetical site contaminated with arsenic and PCBs

Many former industrial sites in the US, Europe and Asia are contaminated with multiple contaminants including arsenic and polychlorinated biphenyls (PCBs). For this case, a hypothetical waste site with elevated levels of both contaminants will serve as an example. The example will address the use of arsenic and PCB soil concentration data to estimate exposures; the development of oral cancer slope factors for both chemicals; and the use of response addition to estimate cancer risks posed by such mixtures.

Chemical Mixtures and Epidemiology Workshop Agenda
Sunday, June 10, 2018
10:00 a.m. – 3:30 p.m.

10:00 – 10:05 a.m. Introduction/Workshop Goals

10:05 – 10:40 a.m. Epidemiology Study Designs and Measures of Disease and Association

10:40 – 10:55 a.m. Causality – Epidemiological and Statistical Inference

10:55 – 11:05 a.m. Exposure Assessment & Disease Clusters

11:05– 11:40 a.m. Methodological Considerations: Confounding and other Biases

11:40– 11:50 a.m. Effect Measure Modification

11:50 a.m. – 12:00 p.m. Questions

12:00 – 1:00 p.m. Lunch Break

1:00 – 1:45 p.m. Risk Assessment Essentials

1:45 – 2:30 p.m. Chemical Mixtures Risk Assessment

2:30– 2:45 p.m. Break

2:45 – 3:15 p.m. Case Study

3:15 – 3:30 p.m. Questions and Wrap-up

Sustainable remediation and rehabilitation of contaminated sites workshop, CEECHE 2018

Workshop Leader:

Dr. Souhail Al-Abed

Office and Research and Development/US Environmental Protection Agency, USA

Description:

We will present in this workshop scientific, engineering information and case studies on sustainable and innovative remediation technologies used in contaminated sites in Europe and the United States. One of the most important tasks to be performed to remediate contaminated sites is to find the proper technology to be implemented in each matrix (soil, water, etc.). Remedial actions need to provide a clear identification of the contaminants of concern (COCs) and in which matrix they are present. The next step is to link the COCs with a suitable remediation technology providing the best cost-benefit. Successful remediation has to be sustainable by relying on less energy consumption and capitalize on available and innovative material to extract, immobilize and degrade COCs. Our case studies will present experimental designs and results based scientific principles applied to contaminated sites with metals and organic by the identification of patterns of decision-making, applications and achieved results, and by evaluating the lessons learned from successfully remediated sites. Overall, this workshop will be a very useful forum to present success stories on mediation technology selection beneficial to environmental researchers in eastern Europe and worldwide.

The workshop will have three sessions. Here is the description for each session.

Session 1

Phytoremediation of Metal-Contaminated Sites with a Focus on Mine Waste Sites Raina M. Maier, University of Arizona

Phytoremediation is an emerging technology for the remediation of metal-contaminted sites, in particular mine tailings (Mendez and Maier, 2008a and 2008b). This is a global issue for which conventional remediation technologies are costly. There are two approaches to phytoremediation of mine tailings, phytoextraction and phytostabilization. Phytoextraction involves translocation of heavy metals from mine tailings to the plant shoot biomass followed by plant harvest, while phytostabilization focuses on establishing a vegetative cap that does not shoot accumulate metals but rather immobilizes metals within the tailings. Phytoextraction is currently limited by low rates of metal removal which is a combination of low biomass production and insufficiently high metal uptake into plant tissue. Phytostabilization is currently limited by a lack of knowledge of the minimum amendments required (e.g., compost, irrigation) to support long-term plant establishment. Both strategies will be discussed within the context of two specific climate types: temperate and arid. In temperate environments, mine tailings are a source of metal leachates and acid mine drainage that contaminate nearby waterways. Mine tailings in arid regions are subject to wind dispersion and water erosion. Case study examples of 2 phytoremediation within each of these environments will be presented. Current research suggests that phytoextraction, due to high implementation costs and long time frames, will be limited to sites that have high land values and for which metal removal is required. Phytostabilization, due to lower costs and easier implementation, will be a more commonly used approach. Complete restoration of metal-contaminated sites is an unlikely outcome for either approach.

Part 1: A generalized approach to phytoremediation:

• Step 1: Characterize selected contaminated and off-site site physical/chemical/biological characteristics to determine the site stress level

• Step 2: Identify native plants in off-site areas that thrive in the local environment

• Step 3: Evaluate plant cover (%) in off-site areas to help define reclamation success

• Step 4: If site stress level is low to moderate can likely proceed with phytoremediation

• Step 5: If site stress is moderate to high it is recommended to perform preliminary greenhouse pot studies

• Step 6: Evaluating phytoremediation success

Part 2: Case Study 1: Boston Mill Mine tailings site (a moderately stressed site)

Part 3: Case Study 2: Iron King Mine and Humboldt Smelter Superfund site (a highly stressed site) Part 4: Case Study 3: To be defined with organizing committee

References

Mendez, M.O., and R.M. Maier. 2008a. Phytoremediation of mine tailings in temperate and arid environments. Rev. Environ. Sci. Biotechnol. 7:47-59. Mendez, M.O., and R.M. Maier. 2008b. Phytostabilization of mine tailings in arid and semiarid environments – an emerging remediation technology. Environ. Health Perspec. 116:278-283.

Session 2

Phytoremediation of soils and groundwater contaminated with organics with a focus on plants and their associated bacteria as partners in remediation: general considerations and examples from the field.

Jaco Vangronsveld, Centre for Environmental Sciences, Hasselt University, Belgium

Phytoremediation is a promising technology for remediation of contaminated soils and (ground)waters: driven by solar energy, plants are able to ‘pump’ contaminations to their rhizosphere and even take them up. In the rhizosphere and during its transport throughout the plant, the present plant-associated micro-organisms can degrade organic contaminants. 3 Despite a number of successful field applications, phytoremediation is not yet routinely applied due to some constraints. At first, plants should tolerate the occurring contaminant levels. Further, the degradation capacity of the plant-associated micro-organisms must be high enough to prevent phytotoxicity and evapotranspiration of the contaminants to the atmosphere. To solve these constraints, a diversity of interesting traits of plant-associated bacteria can be exploited. Plants indeed are colonised by microorganisms (both bacteria and fungi) in cell densities that are far greater than the number of plant cells. Plants have complex interactions with these microbes for numerous physiological functions. Microbial mediated functions that are important to enhance beneficial outcome include nutrient cycling, organic matter mineralisation, plant-growth promotion, disease resistance, and defence against abiotic stresses. An essential supportive role played by plant-associated microbiota involves the degradation and detoxification of xenobiotic compounds. As soil microorganisms are the primary agents for the mineralisation of organic compounds and nutrient cycling, they may also convert contaminants to stable and/or less toxic products. This activity may be greater in the plant rhizosphere because plants provide microbial

habitats and nutrients that are rapidly utilised by the microbes for growth. Microorganisms residing inside plant tissues (endophytes), or on aerial plant parts (phyllosphere) can help to stabilise and/or transform contaminants that have been translocated, which may reduce toxicity and the extent of volatilisation of pollutants to the environment.

Biodegradative microorganisms have to compete for resources with other inhabitants of the plant niche, and biodegradation can be independent of effects on plant growth. For each individual field case, many aspects of the plant-microbiome interactions should be thoroughly investigated and optimised to achieve the desired outcome. Successful application of phytoremediation was demonstrated in several field cases (BTEX, diesel and TCE contamination). On these sites, poplar trees were planted in the contamination plume and groundwater concentrations and possible evapotranspiration to the atmosphere were monitored. To explore if and how the plant-associated bacteria assist their host to better tolerate and to degrade the contaminants and to prevent evapotranspiration of the original contaminants and their degradation intermediates, soil, rhizosphere, roots and shoots of hybrid poplars were sampled in order to isolate bacteria able to grow in the presence of and to biodegrade BTEX, diesel and TCE. All cultivable bacteria were tested for their capacity to produce various plant growth promoting traits. Strains with the highest degradation rates were selected for genome sequencing (Ion Torrent). The availability/uptake of many organics can be stimulated by bacteria producing e.g. surfactants, siderophores and organic acids. Bacteria equipped with the appropriate degradation pathway(s) can strongly improve the degradation efficiency. On a TCE-contaminated site, poplar trees were in situ inoculated with TCE-degrading endophytes. Three months later, a 90%-reduced TCE evapotranspiration was observed. Further investigations revealed that this reduction was not only achieved by an enrichment of the inoculated strain, but also by of transfer of the degradation genes from the inoculated strain to strains from the natural abundant community. 4

Field Case 1: BTEX contaminated groundwater on the site of a car producing factory

Field Case 2: Diesel contamination on the site of a car producing factory

Field Case 3: TCE contaminated groundwater on the site of a container producing factory

References:

Vangronsveld, J., Herzig, R., Weyens, N., Boulet, J., Adriaensen, K., Ruttens, A., Thewys, T., Vassilev, A., Meers, E., Nehnevajova, E., van der Lelie, D., Mench, M. (2009) Phytoremediation of contaminated soils and groundwater: lessons from the field. Environmental Science and Pollution Research, 16, 765–794.

Barac, T., Weyens, N., Oeyen, L., Taghavi, S., van der Lelie, D., Dubin, D., Spliet, M., Vangronsveld, J. (2009) Application of poplar and its associated microorganisms for the in situ remediation of a BTEX contaminated groundwater plume. International Journal of Phytoremediation, 11, 416-42

Weyens N, van der Lelie D, Artois T, Smeets K, Taghavi S, Newman L, Carleer R, Vangronsveld J (2009) Bioaugmentation with engineered endophytic bacteria improves contaminant fate in phytoremediation. Environmental Science and Technology, 43: 9413-9418

Thijs, S; Sillen, W; Rineau, F; Weyens, N; Vangronsveld, J. (2016) Towards an Enhanced Understanding of Plant-Microbiome Interactions to Improve Phytoremediation: Engineering the Metaorganism. FRONTIERS IN MICROBIOLOGY Volume: 7 Article Number: 341. DOI: 10.3389/fmicb.2016.00341

Gkorezis, P; Daghio, M; Franzetti, A; Van Hamme, J; Sillen, W; Vangronsveld, J. (2016) The Interaction between Plants and Bacteria in the Remediation of Petroleum Hydrocarbons: An Environmental Perspective. FRONTIERS IN MICROBIOLOGY Volume: 7 Article Number: 1836. DOI: 10.3389/fmicb.2016.01836

Thijs, S; Sillen, W; Weyens, N; Vangronsveld, J. Phytoremediation: State-of-the-art and a key role for the plant microbiome in future trends and research prospects (2017) INTERNATIONAL JOURNAL OF PHYTOREMEDIATION, 19(1), p. 23-38. DOI: 10.1080/15226514.2016.1216076

Session 3

Innovative and sustainable use of materials to aid in the remediation technologies of contaminated water and sediments

Souhail Al-Abed, Ph.D. Office of Research and Development/Environmental Protection Agency, USA

Background

The beneficial use of materials is a key component of Sustainable Materials Management, which uses the best environmental practices of materials management to ensure resources for the future generations. The BU of industrial materials reduces the use of raw materials, bringing down the cost of the purchase of those materials; but also, reduces the energy consumption because the raw material doesn't need to be produced or transported. At the same time, the premise is that the final product will hold similar or better quality than the conventional raw material used for the application. Hence, the resource optimization contributes to the protection of the environment while not reducing the quality of the produced goods. This principle of beneficial use of materials has been applied to the remediation technologies used to treat contaminated water and sediments to improve their sustainability and to reduce the cost of their application. In several cases, the materials to be used come from the same region where the application will be held, avoiding the use of transportation and reducing carbon foot prints.

Case studies:

1. Use of waste materials in mining-impacted water remediation.
   Bioremediation of mining-impacted water often is carried out in anaerobic bioreactors, where the sulfates are reduced to sulfides in a microbially-induced reaction, causing metal precipitation. The bacteria used to induce this reaction uses a substrate as carbon donors and as housing for their growth. The substrate is typically composed of cheap materials available around the mine sites: wood chips, sawdust, hay, limestone, etc. One of the promising materials used in substrate is crushed crab shells, which had shown effective in removing metals and sulfates in high rates (Al-Abed et al. 2017)
2. Titanium nanomaterials used for arsenic adsorption.
   The use of titanium dioxide nanoparticles (amorphous and crystalline) to remove arsenic from contaminated water has been proven as effective (Jegadeesan et al. 2010). The cost of the TiO2 is usually high because of the cost of the titanium. The beneficial use of titanium waste materials to generate the nanoparticles could increase the financial and energy gain of this water remediation technology.
3. The use of reactive activated carbon (RAC) impregnated with palladized iron nanoparticles to remove PCBs from sediments.

PCBs present in contaminated sediments are sequestrated and dechlorinated with the use of the palladized iron nanoparticles in a RAC (Choi et al. 2015). The source of iron to be used in this applications can be scrap metal or other waste, while the source of activated carbon could be walnut shells, coconut shells, bagasse, or other wastes.

References

Al-Abed, S.R., Pinto, P.X., McKernan, J., Feld-Cook, E. and Lomnicki, S.M. (2017) Mechanisms and effectivity of sulfate reducing bioreactors using a chitinous substrate in treating mining influenced water. Chemical Engineering Journal 323, 270-277.

Choi, H., Lawal, W. and Al-Abed, S.R. (2015) Desorption, partitioning, and dechlorination characteristics of PCBs in sediments in interaction with reactive activated carbon. Journal of Hazardous Materials 287, 118-125. 6

Jegadeesan, G., Al-Abed, S.R., Sundaram, V., Choi, H., Scheckel, K.G. and Dionysiou, D.D. (2010) Arsenic sorption on TiO2 nanoparticles: Size and crystallinity effects. Water Research 44(3), 965-973.

How Risk Characterization and Risk Management Fit Together – Communication, Resources, and Tools

June 10 Afternoon Session 2:20 – 4:00 pm

The CEECHE afternoon workshop session will bring together the "Health" and the "Remediation" workshop participants to synthesize and integrate the morning's workshop concepts across disciplines. The session will start with a high-level overview connecting the major points of the morning break-out workshops. Participants will gain a basic understanding of how risk characterization is used to inform cleanups as well as what goes into the risk characterization determination. The session will conclude with an interactive panel discussion from experts in risk communication, policy, and clinical applications with a focus on tools and resources that are available for communities or field practitioners.

"How Risk Characterization and Risk Management Fit Together – Communication, Resources, and Tools"

2:20 pm Introduction to Session, Heather Henry, NIEHS, Moderator

2:30 pm Linking Risk Characterization to Risk Management, Kelly Pennell, University of Kentucky

2:45 pm Panel Discussion – "Perspectives on Communicating Risk"

- Raina Maier, Professor, University of Arizona, USA
- Eugen Gurzau – Professor, Environmental Health Center, Romania
- Jaco Vangronsveld – Professor, Centre for Environmental Sciences, Hasselt University, Belgium
- Stan Gawronski – Professor, Biotechnology and Landscape Architecture, Warsaw University of Life Science, Poland

3:45 pm Conclusions/Wrap Up, Heather Henry

4:00 pm Workshop Adjourns and CEECHE Registration Opens

Audience: Participants of Workshops 1 and 2:

Workshop 1 - Chemical Mixtures and Epidemiologic Fundamentals for Risk Assessment Applications
Workshop 2 - Sustainable Remediation and Rehabilitation of Contaminated Sites