Proposal from JSI for relocation of the MSC-E activities

Agenda item #3.
Geneva, 11.09.2023

Prof. Milena Horvat
Head, Department of Environmental Sciences
Dean, Jožef Stefan international Postgraduate School

www.environment.si, www.mps.si
milena.horvat@ijs.si
1949 – Institute of Physics
1959 – Jožef Stefan Nuclear Institute
1969 – Jožef Stefan Institute

The Mission of the Jožef Stefan Institute:
Creation, spread and transfer of knowledge in the fields of natural, life and engineering sciences to the benefit of the society

Jožef Stefan 1835 – 1893
The Jožef Stefan Institute is named after the distinguished 19th century physicist Jožef Stefan, most famous for his work on the Stefan-Boltzmann law of black-body radiation
Human resources:
- 600 researchers
- 250 support staff and administration
- 200 PhD students

PHYSICS AND NUCLEAR TECHNOLOGY
F1 Theoretical Physics
F2 Low and Medium Energy Physics
F3 Thin Films and Surfaces
F4 Surface Engineering and Optoelectronics
F5 Solid State Physics
F7 Complex Matter
F8 Reactor Physics
F9 Experimental Particle Physics
R4 Nuclear Engineering

CHEMISTRY, BIOCHEMISTRY, NEW MATERIALS
K1 Inorganic Chemistry and Technology
K3 Physical and Organic Chemistry
K5 Electronic Ceramics
K6 Engineering Ceramics
K7 Nanostructured Materials
K8 Synthesis of Materials
K9 Advanced Materials
B1 – B3 Biochemistry

ELECTRONICS AND INFORMATION TECHNOLOGIES
E1 Automation, Biocybernetics and Robotics
E2 Systems and Control
E3 Artificial Intelligence
E5 Open Computer Systems and Networks
E6 Communication Systems
E7 Computer Systems
E8 Knowledge Technologies
E9 Intelligent Systems

O2 Environmental Sciences

Study programmes:
- Nanotechnologies
- Ecotechnologies
- Information and communication technologies
- Sensor technologies
Department of Environmental Sciences

The Department of Environmental Sciences encompasses a broad range of research activities, diverse and varied as the environment itself.
• Environmental pollution research: toxic substances (metals, POPs, contaminants of emerging concern, etc.)

• Cooperation with international bodies and programmes (e.g. UN Environment, Minamata Convention, GEO, EU projects)

• Reinforced modelling activities for toxic metals and POPs

• Close co-operation with other modelling groups dealing with toxic metals and POPs – MIT (USA), Harvard Univ. (USA), ECCC (Canada), Hereon (Germany), CNR-IIA (Italy), OGS (Italy), IQF-CSIC (Spain)
Chemical elements and their species:
Speciation: As, Se, Hg, Cr, Sn, Sb, Pb, Cd, Al, Zn, Fe, Pt, ...

Organic substances: POPs (PCB-ji, PAH, etc..) CECs
(pharmaceuticals, pesticides, Phtalates, PFAS, bisphenols, flame retardants), chemical mixtures (screening, non-target ...)

Nutrients: nitrogen, sulphur, carbon, water cycles

Stable isotopes: $\delta^{2}H$, $\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$, $\delta^{34}S$, and heavy elements (Hg, Sr, Pb, U, etc...)

Nanoparticles: inorganics(metal particles), plastics, etc..

Radionuclides:
Natural: $^{235}U$, $^{234}U$, $^{238}U$, $^{228}Th$, $^{230}Th$, $^{232}Th$, $^{226}Ra$, $^{226}Rn$, $^{210}Po$, $^{210}Pb$, $^{40}K$

Manmade: $^{241}Am$, $^{238}Pu$, $^{239+240}Pu$, $^{137}Cs$, $^{134}Cs$, $^{89/90}Sr$
- Clean laboratories and laboratories for radiochemistry (3000 m² laboratory space, 800 m² office space)

- Isotope ratio mass spectrometry
  - EA-IRMS, GC-C-IRMS, DI-IRMS, Py-IRMS, MC-ICP-MS

- Mass spectrometry
  - UPLC-qTOF-MS/MS, ICP-MS, ICP-MS QQQ, LA-ICP-MS, LC-ICP-MS, GC-ICP-MS, SP-ICP-MS, GC(IT)MS, GC-MSD, LC-MS/MS, GC-MS/MS, Orbitrap

- Spectrophotometry
  - HG-AFS, CV-AFS

- Nuclear methods
  - TRIGA MARK II nuclear reactor, alpha, beta and gamma counting, NAA

- Access to equipment: JSI departments & infrastructure (microscopy, NMR center, etc..)
• JSI is a member of **SLING (National Supercomputing Consortium)**:
  o Over 10 supercomputing/HPC systems
  o EuroHPC membership and competence centre

• **NSC Supercomputer Cluster (JSI, Ljubljana)**
  2880 cores, 0.2 PFLOPS

• **ARNES National Cluster (Ljubljana)**
  4500 cores, 0.5 PFLOPS

• **EuroHPC VEGA (IZUM, Maribor)**
  122000 cores, 6.9 PFLOPS
International cooperation - current

**MSCA:**
- DN GMOS-Train and FoodTranet
- IF: STROMASS

**RI:**
- EIRENE and MetroFood

**URBANOME, GREENER, THEROS, PARC, DanubeHazard, AgroServ, Biosymo, SECURE, INQUIRE, EARLY WARNING...**

**Widening:** SurfBio, MERFish, TunTwin, Mass twin, ERAChair Isofood, etc.

**PianoForte, C-CINCH, EURAD**
Policy relevant activities

- EU Mercury Position Paper, 2001
- Effectiveness evaluation - Minamata Convention
- WHO; Stockholm Convention
- WGE ICP-Vegetation (lichens/mosses)

Runkel et al., 2022
J SI – Current mercury related international cooperation

Health related studies
Mercury remediation and removal from coal use and waste
Hg in contaminated sites
GMOS - Global Mercury Observing System (atmosphere, water, soil, biota)
MSC-E activities
Main tasks according to the mandate

- Development and updates of the chemical transport model for HMs and POPs
- Research activities aimed at improvement of the modelling tools
- Operational model assessment of HM and POP pollution levels and transboundary transport
  - Preparation of input data for modelling (emissions, wind resuspension, meteorological fields, chemical reactants, etc.)
  - Conducting model simulations (global and regional)
  - Quality assurance and quality control of modelling results
- Annual reporting (status report, country reports, website)
- Outreach activities, cooperation with international bodies and experts
Available resources

- JSI computer resources:
- JSI data storage and network infrastructure
- Chemical transport models:
  - GLEMOS open source v2.2.2 (https://github.com/glemos-model)
  - GEOS-Chem v14.1.1 (https://geoschem.github.io/)
**Pilot simulations**

- **Simulated pollutants:** Hg and B(a)P
- **HPC cluster:** ARNES (Ljubljana)
- **Model:** GLEMOS open source (v2.2.2)
- **Emissions:** 2021 (EMEP submission 2023)

**Hg\(^0\) air concentration (June 2021)**

**B(a)P air concentration (June 2021)**
Contribution to EMEP workplan 2024

- Operational modelling of heavy metals (Cd, Pb, Hg) and POP (PAHs)
- **Contribution to TFMM activities:**
  - Investigate monitoring of chemicals of emerging concern (CEC) (1.1.1.2)
- **Contribution to TF HTAP activities:**
  - Multi-model evaluation and attribution of Hg pollution trends (1.1.4.3)
  - Model intercomparison of multi-pollutant impacts of fires (1.1.4.4)
- **Contribution to Minamata Convention’s effectiveness evaluation** (1.3.4)
Thank you for your attention

Prof. Milena Horvat
Head, Department of Environmental Sciences
Dean, Jožef Stefan international Postgraduate School

www.environment.si, www.mps.si
milena.horvat@ijs.si