



International Union of Pure and Applied Chemistry
A member of the International Council of Scientific Unions
Division VI, Chemistry and the Environment
Report to Council 2017 – Submitted by Petr S. Fedotov, President

I. Highlights and Executive Summary

Through its internationally recognized membership and project teams, Division VI – Chemistry and the Environment (DCE), provides unbiased and timely authoritative reviews on the behavior of chemical compounds in food and the environment. The DCE undertakes both fundamental and applied evaluations that contribute to solving environmental problems and enhancing the quality of food on a global scale.

An integral part of the Division activities is related to subcommittees.

- *The Subcommittee on Chemical and Biophysical Processes in the Environment* was established in 2014. It combines the activities of the previously existing division subcommittees on Biophysico-Chemical Processes in Environmental Systems and on Chemistry of Environmental Compartments. The subcommittee deals with topics regarding the distribution and environmental fate of chemicals (inorganic and organic compounds, nanomaterials), chemical and biophysical processes in environmental compartments (e.g., in soil and aquatic ecosystems), and interactions with organisms (bioavailability). Main outcomes from IUPAC projects are review papers, technical reports or books on certain topics. Recent examples are a book on the *biophysico-chemical processes and toxicity of engineered nanoparticles*, a review paper on the *consideration of bioavailability for the risk assessment of metal species in waters*, or a *guidance paper on substance-related environmental monitoring strategies regarding soils and waters*. A new way of dissemination is the operation of project websites, e.g., <http://www.metal-bioavailability.org/> on the bioavailability of metals. Another website on an e-waste related project is currently under progress.
- *The Subcommittee on Crop Protection Chemistry* provides authoritative views regarding environmental and human health aspects of crop protection chemistry through its projects and outreach activities. Outreach activities help move IUPAC project outcomes outside the small circle of specialists and into the broader scientific and regulatory arena, with a strong emphasis on technology transfer to developing countries. These outreach activities include periodic workshops focused on a specific set of regional issues related to crop protection chemistry and a quadrennial international congress of pesticide chemistry which serves to highlight state-of-the-art scientific advances and regulatory approaches.

Division VI has made progress on a number of important projects over 2016-2017 and initiated ten new projects, five of these projects are interdivisional. Division VI has also announced a special call for proposals with rolling 3 months deadline till September 2017 https://www.iupac.org/cms/wp-content/uploads/2016/09/IUPAC-DCE-Call-for-Proposals_sept-2016.pdf

Division VI has established cooperation with the Division of Chemistry and the Environment (DCE) of the European Association of Chemical and Molecular Sciences (EuCheMS) the Organisation for Economic Co-operation and Development (OECD). Three special symposia will be organized by Division VI at IUPAC World Chemistry Congress in Brazil. Besides, Division VI has announced Environmental Chemistry Poster Award sponsored by the division
<https://www.iupac.org/cms/wp-content/uploads/2017/01/IUPAC-DCE-WCC-Poster-Prize-2017.pdf>

II. Plans and priorities for the remainder of this biennium, and beyond

A special attention will be paid to interdivisional multidisciplinary projects. Project # 2016-015-2-600 (Perminova) "Developing Database on Molecular Compositions of Natural Organic Matter and Humic Substances as Measured by High Resolution Mass Spectrometry" supported by Divisions III, V, and VI can be an example. In general, close cooperation with IUPAC divisions and committees is of primary importance.

We are also planning to enhance cooperation with the Division of Chemistry and the Environment (DCE) of the European Association of Chemical and Molecular Sciences (EuCheMS) as well as with the Organisation for Economic Co-operation and Development (OECD).

Division VI is organizing a series of special events at the IUPAC World Chemistry Congress in Brazil including 3 symposia:

- Fate of Pesticides in Latin American Environments;
- E-waste- an emerging global challenge;
- Global Environmental Challenges of Nanomaterials .

The Division plans to improve system of critical assessment of ongoing projects. Project progress reports will be published annually on the Division web-sites and projects progress will be evaluated at Division meetings.

III. An overall report of Division/Committee activities and achievements during 2016-2017 biennium

Division VI has made progress on a number of important projects over 2016-2017 and initiated ten new projects, five of these projects are interdivisional. Division VI has also announced a special call for proposal, deadline is September 2017.

Selected Accomplishments and Outcomes according to the Goals and Objectives of IUPAC.

a. IUPAC provides scientific expertise to address critical world needs.

The following projects have been addressing the above

- i. Quantitative Review and Analysis of Pesticide Sorption and Its Effect on Degradation in Relation to Soil and Climate Project No. 2010-018-2-600 (Chen): This project while still underway has generated an ACS Symposium Series Book "Non-First Order Degradation and Time-Dependent Sorption of Organic*

Chemicals in Soil”

(<http://pubs.acs.org/isbn/9780841229785>).

- ii. Book entitled “Climate Change. 2nd Edition. Observed Impacts on Planet Earth” has been published as an outcome of Project No. 2014-023-2-600 (Letcher) The book presents a multi-disciplinary overview of the Earth's changing climate, including models of climate change, geological history, and further engineering aspects.
<http://store.elsevier.com/Climate-Change/isbn-9780444635242/>
- iii. Project No. 2014-031-3-600 (Purchase) “The environmental and health challenges of e-waste and its management: an emerging 21st century global concern” is underway. It aims to bring together global expertise to a) examine current research on the chemical nature of e-waste and its global distribution; b) evaluate its environmental and health impact of e-waste and related risk management tools and models; c) identify short-comings in present regulations and management strategies as well as future challenges; and d) develop a set of specific recommendations for management approaches that are science-based and globally informed.
- iv. Project No. 2014-026-3-600 (Obare) - Chemical speciation of anthropogenic nanoparticles. The objective of this project is to develop guidelines and provide a framework for understanding the chemical speciation of nanoparticles and the associated environmental health and safety issues.
- v. Project No. 2015-048-1-600 (Unsworth and Lalah) - Ecological Risk Assessment Workshop for East Africa. The objective of this project was to conduct a focused workshop on Ecological Risk Assessment for scientists, students and government officials who were attending the 3rd International Conference on Innovation and Technology for Development in Nairobi, Kenya on February 23-25, 2016.

Items *ii,iii, iv,v* in particular are multidisciplinary projects addressing critical global issues.

IV. Additional materials

- a. New projects initiated in 2016-2017:
 - i. 2015-025-4-800 (McEwen) – InChI extension for mixture composition.
Interdivisional project, in cooperation with Division VIII
 - ii. 2016-004-1-500 (Filella) - Solubility in energy and waste issues of emerging concern.
Interdivisional project, in cooperation with Division V
 - iii. 2015-010-3-600 (Keen) - Standardization of electrical energy per order (EEO) reporting for UV/H₂O₂ reactors.
 - iv. 2016-025-1-600 (Carazo) - Ecological Risk Assessment Workshop for Central America.
 - v. 2016-016-2-600 (Kookana) - Guidance for Industry and Regulators on Assessment of the Environmental Fate and Risks of Nano-enabled Pesticides.
Interdivisional project, in cooperation with COCI
 - vi. 2016-019-2-600 (Terzano) - Trace elements analysis of environmental samples with X-rays: from synchrotron to lab and from lab to synchrotron.
 - vii. 2016-015-2-600 (Perminova) - Developing Database on Molecular Compositions of Natural Organic Matter and Humic Substances as Measured

by High Resolution Mass Spectrometry.

Interdivisional project, in cooperation with Divisions III and V

- viii. 2017-004-1-600 (Chung) – “Water and Environmental Analysis”, a special symposium to be organized at the Conference on High Performance Liquid Phase Separations and Related Techniques (HPLC2017).
- ix. 2016-047-1-600 (Xing) - “Multi-scale Biogeochemical Processes in Soil Ecosystems: Critical Reactions and Resilience to Climate Changes”, part IUPAC-Wiley Book Series (edited by Nicola Senesi and Baoshan Xing): Biophysico-Chemical Processes in Environmental Systems
- x. 2016-035-1 (Purchase, Obare) - Development of Three Technical Symposia on Environmental Chemistry at the 46th IUPAC World Chemistry Congress, Sao Paulo 2017

b. Selected publications

- i. Farenhorst, A., Li, R., Jahan, M., Tun, H.M., Mi, R., Amarakoon, I., Kumar, A., Khafipour, E. (2017). Bacteria in drinking water sources of a First Nation reserve in Canada. *Sci. Total Environ.*, 575, 813-819.
- ii. Amarakoon, I., Farenhorst, A., Rose, K., Claeys, A., Ascef, B. (2016). 17 β -Estradiol mineralization in human waste products and soil in the presence and the absence of antimicrobials. *J. Environ. Sci. Health, Part B*, 51(10), 655-660
- iii. Fernando, D.M., Tun, N.M., Poole, J., Patidar, R., Li, R., Mi, R., Amarawansa, G., Dilantha R., Khafipour, E., Farenhorst, A., Kumar, A. (2016). Identification of antibiotic resistance genes in source and drinking water samples from a First Nation Community in Canada. *Appl. Environmen. Microbiol.*, 82 (15):4767-4775.
- iv. Singh, B., Farenhorst, A., McQueen, R.D.A. Malley, D.F. (2016). Near-infrared spectroscopy as a tool for generating sorption input parameters for pesticide fate modeling. *Soil Sc. Soc. Am. J.*, 80, 604-612.
- v. Munira, S., Farenhorst, A., Flaten, D., Grant, C. (2016). Phosphate fertilizer impacts on glyphosate sorption by soil, *Chemosphere*, 153, 471-477.
- vi. Unsworth, J., Corsi, C., Van Emon, J., Farenhorst, A., Hamilton, D., Howard, C., Hunter, R., Jenkins, J., Kleter, G., Kookana, R., Lalah, J., Leggett, M., Miglioranza, K., Miyagawa, H., Peranginangin, N., Rubin, B., Saha, B., Shakil, N. (2016). Developing Global Leaders for Research, Regulation and Stewardship of Crop Protection Chemistry in the 21st Century. *J. Agric. Food Chem.*, 64 (1), 52–60.
- vii. Farenhorst, A., Andronak, L.A., McQueen, R.D.A. (2015). Bulk deposition of pesticides in a Canadian city: Part 1. Glyphosate and other agricultural pesticides. *Water, Air, Soil Pollut.*, 226:1-11 (DOI 10.1007/s11270-015-2343-4).
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- models. In W. Chen, A. Sabljic, S.A. Cryer, R.S. Kookana (Eds.). Non-first order degradation and time-dependent sorption of organic chemicals in soil (Chapter 14, pp. 255-274). Washington DC: Am. Chem. Soc. Publ.
- xi. Kookana, R.S., Ahmad, R., Farenhorst, A. (2015). Sorption of pesticides and its dependence on soil properties: chemometrics approach for estimating sorption. In W. Chen, A. Sabljic, S.A. Cryer, R.S. Kookana (Eds.). Non-first order degradation and time-dependent sorption of organic chemicals in soil (Chapter 12, pp. 221-240). Washington DC: Am. Chem. Soc. Publ.
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