International Union of Pure and Applied Chemistry

A member of the International Council of Scientific Unions

Division of Chemistry and the Environment (DCE - VI)

Report of Activities

January 2004 – June 2005

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1. HIGHLIGHTS

1.1 Terms of Reference

Through its internationally recognized membership and project teams, the Division of Chemistry and the Environment (DCE) will provide unbiased and timely authoritative reviews on the behavior of chemical compounds in food and the environment. The DCE will undertake both fundamental and applied evaluations that contribute to solving environmental problems and enhancing the quality of food on a global scale (revised May-2004).

1.2 Organization

The Division Committee is currently comprised of 10 TM's, 7 AM's, and 6 NR's. The 7th AM was a new position added during 2004 to accommodate a closer working relationship with IOCD. A new Division President assumed responsibilities during 2004. Several of the newly elected members for the 2004-2005 biennium are from outside the IUPAC family and have brought fresh perspectives. The work of the Division Committee is assisted by the efforts of several sub-committees, which help identify new priority project areas, stimulate proposals and recruit potential project leaders, and facilitate external communication encompassing the broad areas of environmental and food chemistry:

- Food Chemistry (Chair: Dr. Patrick Dysseler)
- Biophysico-Chemical Processes in Environmental Systems (Chair: Prof. Nicola Senesi)
- Chemistry of Environmental Compartments (Chair: Dr. Yehuda Senesi)
- Crop Protection Chemistry (Dr. Ken Racke)

Unfortunately Dr. Dysseler has been hospitalised with a serious illness for a significant portion of this reporting period.

1.3 Projects

Projects sponsored by the DCE generally fall into three broad categories. First, state-of-the-art **authoritative reviews** of a particular area of environmental chemistry are developed and published in book form. To this end, the Division has a long-standing working partnership with Wiley Press. Second, **technical evaluations** focus on critical assessment and development of specific recommendations for an area of environmental chemistry so as to assist and influence research and

public policy. Primary areas of emphasis include definitions, methodologies, and regulations. Third, **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 both regional workshops and international congresses that maintain a high level of IUPAC involvement and serve to highlight ongoing and completed IUPAC projects.

During the period of this report the Division completed 8 projects and terminated 1 moribund project. From a total of 13 submitted project proposals, 7 new projects have been accepted and funded by the Division, including 3 with interdivisional participation. This brings the total number of active projects to 22 as of June 2005 (see section 5).

1.4 Collaboration

The Division has maintained historically strong collaboration with a number of external bodies including several Codex committees, FAO, International Standard Organization (ISO), Intergovernmental Forum on Chemical Safety (IFCS), and ICSU Scientific Committee on Problems of the Environment (SCOPE). The Division has recently moved to increase collaboration with the WHO International Program on Chemical Safety (IPCS), Association of Official Analytical Chemists International (AOAC), International Organization for Chemistry in Development (IOCD), and International Union of Soil Sciences (IUSS). Within IUPAC, DCE has recently cultivated increased collaboration with the Analytical Chemistry Division (V), and as a result two interdivisional projects have recently been initiated.

2. PROJECT ACTIVITIES

Examples of some of the project activities of DCE during the reporting period are provided below in relation to several of the long-range goals established by IUPAC. This is only a sampling, but should provide insight into the project areas of greatest involvement for the Division.

2.1 IUPAC will provide leadership as a worldwide scientific organization that objectively addresses global issues involving the chemical sciences.

- ***Impact of Transgenic Crops on the Use of Agrochemicals and the Environment*** (2001-24-2-600). This topic area is of the utmost interest with respect to current scientific, regulatory, political and public perception issues surrounding transgenic crops and provides an opportunity for IUPAC to take important leadership roles in promoting the importance of chemistry in molecular biology.
- ***Remediation Technologies for Removal of Arsenic from Water and Wastewater*** (2003-017-2-600). The impetus for this project is the already apparent toxicity of water supplies in several regions through natural arsenic contamination affecting the health of millions of residents. There is an urgent need to reduce arsenic levels in drinking water supplies and, in some areas, irrigation waters. Although several technologies have been proposed, there has not been sufficient in-depth evaluation especially for routine treatment of large volumes of water, and agreement on assessment criteria is also lacking. This project is addressing these important issues and includes collaboration with WHO and other IUPAC initiatives in this area.

- ***International Workshop "Fats, Oils and Oilseeds Analysis and Production" Tunis, Tunisia, December 2004*** (2002-011-2-600). Organized by IUPAC and AOCS in cooperation with the Tunisian Office National de l'Huile (ONH), the American Soybean Association (ASA), and the Internatíonal Olive Oil Council (IOOC). This workshop continued a series supported by IUPAC, the last in Brasil in 2000. The analytical sessions provided support for the oil refining/oil processing sessions. Tunisian oil experts were included in the program and served as a focus for developing nations to obtain information critical to upgrading their food processing systems.
- ***International Workshop "Crop protection chemistry in Latin America", San Jose, Costa Rica, February 2005*** (2003-013-1-600) Organized by IUPAC in cooperation with the Costa Rica Ministry of Agriculture, the University of Costa Rica, and the agrochemical industry association CropLife Latin America. This workshop continued a series supported by IUPAC-DCE, the last in Korea in 2003. Major topics included pesticide environmental fate and impacts, analysis and monitoring of residues, risk assessment, and regulation. It served as a focus for regional efforts to improve their research and regulatory systems in these areas.
- ***XI International IUPAC Symposium on Mycotoxins and Phycotoxins, Maryland, USA, May 2004.*** This symposium was only the latest in a long-standing series that has become the premiere forum for exchange of research results and methodologies related to these important naturally occurring toxins. The traditional strength of IUPAC as related to the chemistry aspects of these biotoxins has been an important factor in the success of this series. The next symposium is now being planned for Istanbul, Turkey in 2007.
- ***"Environmental Chemistry & Green Chemistry" - Symposium at 40th IUPAC Chemistry Congress, Beijing, August 2005.*** The Division has taken leadership in organising this session, along with Professor Xiaoba Xu (China). DCE will provide 6 of the 10 plenary speakers giving overview lectures on environmental research of international significance.

2.2 IUPAC will facilitate the advancement of research in the chemical sciences through the tools that it provides for international standardization and scientific discussion.

- ***Standardization of Analytical Approaches and Analytical Capacity-Building in Africa*** (2004-017-1-500). This is a cooperative project with the IUPAC Analytical Chemistry Division, the International Organization for Chemical Sciences in Development (IOCD), and the Association of Official Analytical Chemists International (AOAC). Uganda and Kenya are the initial focus, with Nigeria, South Africa, and Mozambique of future interest in conjunction with an ongoing World Bank project. The project aims to build regional analytical laboratory capabilities in relation to monitoring and enforcement of international trade standards. Key activities will involve lectureships, local workshops, visiting scientist apprenticeships, and laboratory equipment procurement initiatives.
- ***Glossary of Atmospheric Chemistry*** (2003-030-1-600) and ***Glossary of Pesticide Chemistry*** (2004-002-1-600). These two projects are approaching completion and are providing authoritative updates of existing IUPAC recommended definitions. Both printed and internet-based versions are envisioned. Collaboration with WHO-IPCS and OECD is being pursued to enable the broadest possible acceptance of the revised IUPAC recommendations.
- ***Terminology and Measurement Techniques of Starch Components*** (2004-022-3-400). This recently approved project will provide internationally needed guidance on the terminology for these very important food components of the complex carbohydrate class. Starches present a

number of difficult issues relating to both terminology and methods for determination which are of importance to nutrition, food quality and international trade.

- **Wiley-IUPAC book series *"Analytical and Physical- Chemistry of Environmental Systems"*** Professor Nicola Sensi provides the impetus at the Divisional level for the continuing publication of this series of multi-chapter critical-reviews (Series Editors, J. Buffle and H. Van Leeuwen). No. 9 in the series "*Physicochemical Kinetics and Transport at Chemical-Biological Membranes*" was published in 2004. Two current projects are producing volumes No. 10 and 11: "*Biophysico-Chemistry of Fractal Structures and Processes in Environmental Systems*" (2003-014-2-600) and "*Environmental Colloids: Behaviour, Structure & Characterisation*" (2004-015-1-600). A related project is producing another book to be published by Wiley but not in the above series: "Biophysico-chemical process of heavy metals and metalloids in soil environments" (2004-003-2-600). The highest academic standards are being maintained in these books through the careful selection of the chapter authors and thorough review and editing procedures. This ensures the credibility of IUPAC remains in these areas of environemental physico-biological chemistry.

2.3 IUPAC will foster communication among individual chemists and scientific organizations, with special emphasis on the needs of chemists in developing countries.

- ***Development of Simplified Methods for Ecological Risk Assessment of Pesticides*** (2004-011-1-600). This project addresses a critical gap that now exists between the highly sophisticated and resource-intensive approaches to risk assessment practiced in some developed countries with the unreliable or non-scientific consideration of exposure and risk that plagues many developing countries. A project team consisting of leading government, industry, and academic modellers and risk assessment experts has been assembled to make rapid progress.
- ***Standardization of Analytical Approaches and Analytical Capacity-Building in Africa*** (2004-017-1-500). See above.
- ***Regional Pesticide Chemistry Workshops.*** During the past 15 years DCE has sponsored a series of regional workshops focused on broadening the adoption of harmonized, international approaches to pesticide research and regulation in developing countries. The workshops create a forum where IUPAC project outcomes as well as recommendations from other international bodies can be discussed and applied within the context of local environmental problem areas. Following successful sessions in China, Thailand, Taiwan, Brazil and Korea, the *IUPAC-University of Costa Rica Workshop on Crop Protection Chemistry in Latin America* (2003-013-1-600) was held in San Jose during February 2005 and had a similar impact on the Central American and Andean regions.
- ***Regional Workshops on Fats, Oils, Oilseeds Analysis and Production*** The first such IUPAC workshop on this topic occurred in Brazil during 2000 (1999-042-1-600). The second workshop, in what hopefully will become a standing series, was held in Tunis, Tunisia during December 2004 (2002-011-2-600) and was targeted at the important vegetable oil-exporting region of North Africa.

3. FUTURE OPPORTUNITIES AND DIRECTION

To remain effective and maintain relevance, the Division will need to pay attention to both current strengths and weaknesses of the IUPAC approach, and seek a way forward that takes advantage of

the opportunities while avoiding looming threats. The Division Committee recently took the first steps toward development of a long-range Division activities plan in alignment with the IUPAC long-range goals.

One immediate outcome of the long-range planning exercise involves a move to reinvigorate the area of food chemistry. Through past mergers of Commissions with divergent interests (oils and fats standardized methods vs. food-borne mycotoxin chemistry) and subsequent disbandment of the hybridized Food Chemistry Commission, the current level of expertise for food chemistry available to IUPAC has been depleted and food chemistry-related project activities have been reduced. A new sub-committee has organized a half-day workshop in Beijing to reexamine the IUPAC approach to food chemistry and chart a new direction which brings to bear the traditional strengths of the Union with contemporary issues and problems related to food chemistry.

4. PUBLICATIONS (January-2004 to June-2005)

Anklam, E.; Stroka, J. "Collaborative Trial Tests for Method Validation: Lessons to be Learned." *Chem. Int.*, (**2004**) 26:7-9.

Cantrill, R.; Dysseler, P. "Report on the IUPAC-AOCS Workshop on Fats, Oils, and Oilseeds Analysis and Production." *Chem. Int.* (**2005**) 27 (in press).

Carazo, E.; Racke, K.D. (eds.) *Proceedings of the IUPAC-UCR-MAG Internat Workshop on Crop Protection Chemistry in Latin America.* University of Costa Rica, San Jose, (**2005**) 217 pages.

Hamilton, D.J.; Ambrus, A.; Dieterle, R.; Felsot, A.; Harris, C.; Petersen, P.; Racke, K.; Wong, S., Gonzalez, R.; Tanaka, K. ; Earl, M.; Roberts, G.; Bhula, R. "Pesticide Residues in Food: Acute Dietary Exposure." *Pest Manag. Sci.* (**2004**), 60:311-339.

Koester, W.; Van Leeuwen, H. (eds.) *Physicochemical Kinetics and Transport at Chemical-Biological Membranes*, Series on Analytical and Physical Chemistry of Environmental Systems, Vol. 9, John Wiley & Sons, New York (**2004**) 576 pages

Racke, K.D. "Pesticide Science - Harmonization of Data Requirements and Evaluation. Report on Workshop " *Chem. Int.* (**2004**) 26:18-20.

Slanina, S.; Zhang, Y. "Aerosols: Connection between Regional Climate Change and Air Quality." *Pure Appl. Chem.* (**2004**) 76:1241-1253.

Zhang, Y.; Zhu, X.; Slanina, S.; Shao, M.; Zeng, L.; Hu, M.; Bergin, M.; Salmon, L. "Aerosol Pollution in Some Chinese Cities." *Pure Appl. Chem.* (**2004**) 76:1227-1239.

5. ACTIVE PROJECTS (as of June-2005)

630/24/95 - Solute movement in soils with potential rapid by-pass transport (report nearing publication)

1999-014-2-600 - Airborne and remote monitoring of water quality: evaluation of remote sensing techniques for water quality control in surface water bodies

1999-041-1-600 - Bioavailability of xenobiotics in the soil environment (report nearing publication)

2001-022-1-600 - Global availability of information on agrochemicals

2001-023-1-600 - Agrochemical spray drift: assessment and mitigation (report nearing publication)

2001-024-2-600 - Impact of transgenic crops on the use of agrochemicals and the environment

2001-026-1-600 - Use of reference soils for testing fate and effects of chemicals

2001-039-1-600 - Pest management for small-area crops: a cooperative global approach

2002-013-2-600 - Determination of trace elements in oils and fats by inductively coupled plasma optical emission spectroscopy (ICP-OES) - evaluation of a method by collaborative study

*2003-011-3-600 - A critical compendium of pesticide physical chemistry data

2003-013-1-600 - Crop protection chemistry in Latin America: Harmonized approaches for environmental assessment and regulation

2003-014-2-600 - Bio-physical chemistry of fractal structures and processes in environmental systems

2003-017-2-600 - Remediation technologies for the removal of arsenic from water and wastewater

2003-030-1-600 - Glossary of atmospheric chemistry

2003-058-1-600 - Air pollution models in environmental management and assessment

2004-002-1-600 - Glossary of terms related to pesticides

2004-003-3-600 - Biophysico-chemical processes of heavy metals and metalloids in soil environments

*2004-005-1-500 - Comparable pH measurements by metrological traceability.

2004-011-1-600 - Development of simplified methods and tools for ecological risk assessment of pesticides

2004-015-1-600 - Environmental colloids: behavior, structure and characterization

*2004-017-1-500 - Standardization of analytical approaches and analytical capacity-building in Africa

*2004-022-1-600 - Terminology and measurement techniques of starch components

* Interdivisional project