TRANSPORT AND FATE OF PCDDS/PCDFS AND POPS IN THE ENVIRONMENT

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This session is comprised of approximately 25 presentations covering all aspects of the distribution, occurrences, transport and fate of PCDDs/PCDFs and other semivolatile organics , including a number of Persistent Organics Pollutants (POPs) in the environment. The session is divided in two parts; the first of these consists of ten oral presentations and the second consists of a companion session comprised of fifteen poster format presentations. A wide variety of established and emerging topics will be covered by a truly international team of experts. Presenters from ten countries will participate in the program including Belgium, Japan, Norway, Korea, Germany, Russia, Italy, Sweden , China and the United States.

It has been well established that the most significant influence on the regional and global transport of PCDDs/PCDFs and POPs is their fate and transport in the atmosphere. Six of the ten presentations selected for the oral session format will focus on the many facets of this critical topic. Alexei Konoplev (Russia) will examine the parameters that govern the migration of PCDDs/PCDFs in the atmosphere. Estimation of gas/particle distribution in the atmosphere, and the kinetics of accumulation by plant leafs will be derived from the physico-chemical properties of POPs. Isamu Ogura (Japan) and his colleagues employ actual ambient PCDDs/PCDFs field data in derivation of the critical factors governing the atmospheric behavior of these compounds. Particle/vapor distribution data, particle size analyses and both dry and wet deposition data were collected as a means of deriving gas /particle partition coefficients, particle size distribution , washout ratios and dry deposition velocities for PCDDs/PCDFs in the atmosphere. These factors in turn provide valuable inputs for conducting computerized environmental model simulations. Kurokawa Yoichi (Japan) and his colleagues evaluate the deposition velocities and transfer patterns of PCDDs/PCDFs to leaves from gas and particle bound PCDDs/PCDFs directly deposited on the leave surfaces. The transfer of PCDDs/PCDFS from fly ash to the leaf surface were also examined. The authors corroborate the findings of previous researchers concluding that the deposition velocities of particle bound PCDDs/PCDFs are much slower than the velocities of lower chlorinated isomers. The latter are offered as more appropriate biomonitors for atmospheric PCDD/PCDFs. Actual data on the distribution of PCDDs/PCDFs on fractionated fly ash samples is presented by Yoon-Seok Chang in the Transport and Fate poster session. Homologue patterns and concentration data expressed on both a mass (ng/g) and TEQ basis are provided for Cl4-Cl8 PCDDs/PCDFs with respect to particle size. Results for a total of six fractions are provided. Nobutoshi Ohtsuka (Japan) examines the photodegradation of PCDDs through use of a semi-empirical molecular orbital (MO) model in concert with laboratory experimental data. In contrast to the majority of prior photodegradation research , which focused on TCDDs, the current presentation attempts to examine the entire complement of 75 PCDDs isomers. The Cl-H photochemical substitution reactivity for PCDDs are derived using the semi-empirical MO method. PCDDs formed during laboratory irradiation (employing UV) of OCDD were identified and compared with results derived via calculation.

Previous research on the distribution and occurrences of POPs in the atmosphere has focused on traditional vectors such as gas phase and particle associated transport as well as dry and wet deposition events. Roland Kallenborn (Norway) and his colleagues provide much needed data on POPs levels in fog water, as well as ambient air collected at two Norwegian locations. The authors findings included a predominance of medium chlorinated PCBs in ambient air and fog samples collected at the Bear Island. These findings suggested the strong influences associated with seabirds (eg guano or droppings) vicinal to the sampling site. A companion poster presentation by these same authors examines POPs in snow and meltwater samples at the Bear Island site. Jong-Kuk Kim (Korea) presents the results of a comprehensive ambient monitoring program for PCDDs/PCDFs conducted at a number of locations throughout Korea. Results are provided for twenty-one samples collected in small, medium and large urban settings on the basis of pg/M3 and TEQ . The gas and particle phase distribution of PCDDs/PCDFs in a number of these samples was examined in the derivation of partitioning coefficients (Kp) specifc to residential, commercial and industrial settings. The authors confirm through a comprehensive field monitoring program that higher chlorinated PCDDs/PCDFs are primarily particle associated in the atmosphere and accordingly are transported through the environment on this basis. A companion poster presentation presented by Jong-Kuk Kim examines PCDDs/PCDFs concentrations in the flue gases of a paper mill incinerator and a hospital incinerator. Ambient air samples and soils collected in the vicinity of each of these sources are also analyzed in an attempt to address the fate of the PCDDs/PCDFs in the process emissions as well as the likely sources of PCDDs/PCDFS found in the environmental samples. Marjory Desmedt (Belgium) and her colleagues present results for PCDDs/PCDFs measured in deposition samples collected in a number of Belgian industrial, urban and background settings. Reference or regulatory guide values for the deposition of PCDDs/PCDFs are derived and presented.

The persistence and atmospheric transport of POPs and their potential impacts on the health and environment of the global community represents a formidable challenge to all of the nations of the world. The fate and transport of these compounds in the atmosphere is governed by a complex set of processes that can best be addressed by atmospheric models. Eduardo Olgauer (USA) examines the global distribution of hexachlorobenzene, a POP, using GLOBE a 3-dimensional radiative-dynamical-chemical model that simultaneously computes atmospheric circulation and pollutant chemistry and transport. This presentation represents a landmark application of 3-dimensional modeling for an application historically studied using box and/or fugacity models characterized with simplified treatments of atmospheric transport processes. The authors findings included : 1) increases in HCB concentrations as latitude increased in either hemisphere and 2) HCB concentrations vary inversely with OH- radical concentrations and temperature. Based upon large uncertainty in emissions factors and perhaps missing sources in the existing HCB global inventory the authors recommend better characterization of HCB emissions and global atmospheric concentration trends. Refinements to improve the model simulation are also suggested. Two poster presentations provide session attendees with additional valuable information on evaluating the atmospheric transport potential and fate of POPs in the environment, The first of these presented by Jingwen Chen (China) and his German cohorts examines the development of Quantitative Structure-Property Relationships (QSPR) models for predicting POP behavior based upon published or empirically derived Koa values (octanol-air partition coefficient). The second of these POP topical posters, presented by KS Kumar (Japan) and his Italian and American

colleagues, again addresses QSPR approaches and multicriteria decision-making to derive data that is experimentally unavailable. The result of their efforts is a QSPR model that allows for a rapid pre-screening of existing and new chemicals to establish their tendency for long-range transport, based simply on what is known about the molecular structure of the compound.