CLEAR newsletter november 2010

The overall aim of the CLEAR project is to investigate possible impact of climate change on reproductive health in Arctic and European populations.

The present newsletter includes a presentation of part of the onging studies in the project. Specifically the newsletter includes a description of the current work performed on evaluation of the influence of climate change on contaminant distribution in the environment and human populations based on modellig changes in contaminant distribution due to climate changes. The newsletter also includes a description of the ongoing data collection in Greenland, Poland and Ukraine as part of a follow up study aiming to evaluate effects of prenatal exposure to specific chemicals and metals on later childhood growth and development. Progress and future plans in other parts of the project will be presented in subsequent newsletters.

Climate change and contaminant distribution modelling

The main objective of the EU FP7 project CLEAR is to investigate the potential impact of global climate change on exposure to environmental contaminants and related reproductive health concerns in Arctic (Greenland) and European communities. Chemicals being studied by the CLEAR consortium include historic-use contaminants such as PCBs, DDT, HCB and several metals (lead, cadmium, mercury) as well as more contemporary-use chemicals including brominated flame retardants (PBDEs), phthalate esters (e.g. DEHP, DINP), bisphenol A and perfluorinated surfactants (PFOA, PFOS).

The presence of contaminants in remote regions due to production and use in industrialized regions is a function of emission strength (i.e. how much is released and where) and the potential to undergo long-range transport in either the atmosphere or in the ocean (i.e. transport efficiency). Chemicals with relatively low transport efficiency can still be present in remote regions at elevated levels if emission strength is relatively high. Long-range transport potential (LRTP) is determined by physical-chemical properties such as partitioning coefficients (e.g. air-soil, air-water) and degradation half-lives. As an illustrative example, the LRTP of a group of different chemicals is assessed using the OECD Published P_{OV} and LRTP Screening Tool. LRTP is estimated here using the Characteristic Travel Distance in air and water, a model output which represents the distance travelled from a source location at which the concentration of the chemical is reduced to 37% of the original level.

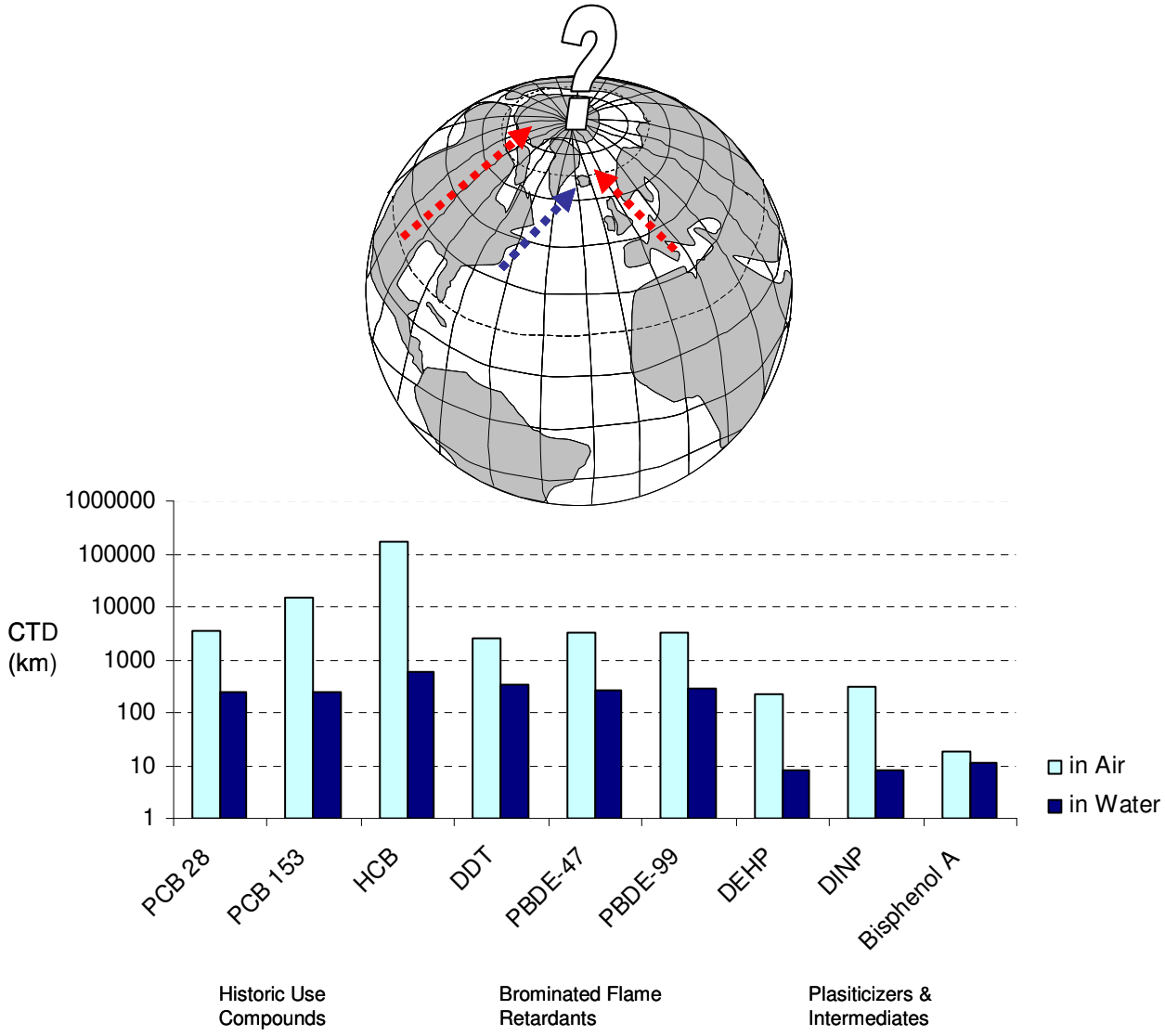

Figure 1. Characteristic travel distance (CTD, km) in air and water for some of the chemicals being studied in the CLEAR project.

As shown in Figure 1., the Characteristic travel distance of the chemicals of interest to CLEAR vary widely, for example from greater than 100 000 km in air for HCB (a chemical known to be globally distributed in the atmosphere at near-uniform levels) to less than 20 km for bisphenol A. HCB is far more resistant to degradation in the air (half-life > 10 000 h) compared to bisphenol A (half-life < 10 h), a main contributing factor to these results. The majority of chemicals included here are more efficiently transported in the atmosphere compared to the ocean (which is partly related to wind speeds >> current velocities). This result implies that the more influential part of global climate changes would be those related to transfer of these contaminants into the atmosphere (e.g. higher temperature = enhanced volatilization from primary and secondary sources) and to the efficiency of transport once in

the atmosphere to remote regions (e.g. circulation patterns, precipitation rate). Perfluorinated surfactants (not shown here) are transported very efficiently via ocean currents in comparison to contaminants like PCBs and PBDEs and may therefore be more sensitive to other parts of climate change. Potential changes in emission patterns (e.g. due to regulatory action) are also important considerations with respect to changes in exposure in the long-term.

While chemicals like bisphenol A and phthalate esters may not be transported very efficiently from industrialized to remote regions in the environment, these compounds may be present in various consumer goods and household items shipped to and used in northern communities. Interestingly, preliminary results indicates that the levels of these compounds in samples from Greenland were similar to or even higher than those found in European samples. Substantial exposure to brominated flame retardants, which are used to impregnate fabrics, furniture and electronics may also result from the import of these consumer goods in addition to exposure resulting from consumption of traditional food items. Hence, lifestyle choices (and any changes) may be a more important determinant of exposure for some compounds in comparison to any changes related to long-range transport under global climate change. The shift in diet away from traditional sources (e.g. Arctic cod, seal, beluga) to imported food items may also be a key consideration, potentially reducing exposure to some compounds (e.g. PCBs) but increasing exposure to others (e.g. bisphenol A).

In the coming months, work for the CLEAR project related to global climate change and contaminant transport will focus on compiling emission and climate change scenarios, development and/or modification of chemical transport and bioaccumulation models and then priority-setting with respect to the compounds and time-horizons most relevant to other CLEAR consortium partners.

Collection of follow-up data on child growth and development

Prenatal exposure to environmental chemicals have been linked with numerous adverse effects such as low birth weight, obesity in childhood, reduced motor skills, altered neuropsychological development and the mental disorder Attention Deficit Hyperactivity Disorder (ADHD). However, existing studies are of limited size and conclusive evidence on the effects on child growth and development after foetal exposure to environmental chemicals can not be derived form existing studies.

In the present study we have access to a cohort of almost 1500 pregnant women from Greenland, Poland and Ukraine established in 2002-2003 as part of the former EU FP5 project INUENDO. The sons and daughters resulting of these pregnancies will be contacted together with their mothers and invited to participate in a questionnaire-based interview on their childrens health status, habits and behavior in 2010-2011. We already know how their parents were exposed to certain organochlorine compounds from the environment during pregnancy as part of the former project. Several additional maternal exposures during pregnancy including phthalates, PFOS/PFOA, and the heavy metals mercury, lead and cadmium will be measured on stored blood samples as part of the present project.

Families from Greenland - one of the source populations.

In order to study the potential impact of maternal exposure to these chemicals on health of their children, we developed a questionnaire containing a set of almost 80 questions that will help us to understand potential delayed response on child health and development after exposure in the fetal period. The questionnaire includes information on the children's cognitive and motoric development and information on growth of the children is collected together with information on a number of common diseases in childhood.

The Polish team undertaking interviews and data analyses

The questionnaire was developed in an English version, which serves as a reference and translated into 3 languages: Greenlandic, Polish and Russian to be used in the data collecting centers. As quality assurance for this step, the back-translation was performed by independent translators. Interviews are going to be performed by one or a few interviewers per country who were trained to assure standardization of the collected data.

By default the questionnaire information is obtained by face-to-face interview at the residence (Greenland and Poland) or at a clinic (Ukraine), but to reach people living at remote places in Greenland or the other regions telephone interviews are also possible at second priority.
In Poland and partly in Greenland questions will be typed in to a portable computer directly during the interview to minimize the risk of errors during type in. When this is not possible double-typing in of questionnaires will be performed. The questionnaires will be typed in with a support of special software (EpiData), to assure possibility of merging of datasets from the three study populations.

In addition to the questionnaire data collected all included children will be measured for weight and height and waist and hip circumference. In addition a saliva swap from the mouth is taken form children from Poland and Greenland to allow for analysis of genes suspected to be related to vulnerability to chemical exposures.

The Ukrainian research Team at Kharkov National Medical University.