Assessment of levels of persistent organic pollutants in municipal wastewater sludge

Terms of Reference

Background

The Government of Latvia is on its way of implementing the Stockholm Convention on Persistent Organic Pollutants (POPs) ratified by the Government of Latvia on December 15, 2004. The Convention requires signatory countries to elaborate National Implementation Plan (NIP), a road map document describing how Convention requirements and obligations will be implemented. The National Implementation Plan for Latvia has been developed within activities of UNDP/GEF Enabling Activity project "Preparation of the POPs National Implementation Plan within the framework of Stockholm Convention". The NIP has been adopted at the Cabinet of Ministers on March 31, 2005.

National implementation plan acknowledges there is insufficient knowledge on levels of POPs in various environment compartments as well as in humans. In particular, there is lack of information on fluxes of POPs into environment from waste streams which are generally acknowledged sources of POPs. Wastewater is one of potential sources of POPs influxes.

The need for information obtaining on POPs in wastewater sludge is determined in the action plan of the POPs National Implementation Plan. The section related to POPs monitoring in the National Implementation Plan (NIP) envisages the necessity for carrying out dioxin and PCB analyses in soils where the wastewater sludge has been used as fertiliser (section 8.5). Further, the National Implementation Plan specifies the need for improving the knowledge about the POPs levels in sediments, sludge and discharges from wastewater systems of Latvia's largest wastewater treatment plants.

Initial study on POPs levels in wastewater sludge has been carried out in 2005 as a part of POPs Enabling Activity project. 10 municipal wastewater treatment plants in largest towns have been sampled and analysed for POPs in the sludge. Outcomes of the study show elevated levels of PAH (polycyclic aromatic hydrocarbons) and AOX (adsorbable halogens) in particular sites. Levels of other POPs of particular interest, such as dioxins and PCBs were at measurable concentrations, but still rather low when compared to EU proposed sludge quality standard. One of conclusions from the study stresses the need for further, regular monitoring of POPs in wastewater in order to assess the magnitude of POPs fluxes and evaluate the trend.

Aims and objectives of the study

The aim of the study is to improve knowledge about POPs levels in sludge from municipal wastewater treatment plants in largest cities in Latvia. The information is very important since municipal wastewater sludge is frequently being used in agriculture. Latvian legislation currently does not require sludge monitoring for hazardous, organic toxic substances, such as POPs, which, due to their resistance to degradation and bioaccumulation phenomena, may be incorporated in food chain and eventually may pose a risk to human health.

The data about the POPs in wastewater sludge would provide valuable information to the professionals and decision makers and strengthen the existing informational basis. The information would allow assessing the potential threats that might arise from using of sludge in agriculture. Repeated POPs analysis in largest towns will help evaluating trends of POPs levels in wastewater in a country scale.

The scope of the study

The scope of the study includes following activities:

- development of list of sampling sites/wastewater treatment plants;
- establishing the sampling scheme;
- sampling;
- analytical testing of samples;
- evaluation of results of analyses and preparation of the report

Development of list of sampling sites

The scope of the study shall predominantly include municipal wastewater treatment plants in cities that have been included in previous study, e.g.: Rīga, Liepāja, Daugavpils, Rēzekne, Cēsis, Dobele, Saldus, Tukums and Valmiera. Inclusion of additional municipal WWTPs located in towns with significant industrial influence (Jelgava, Jēkabpils, Ventspils) shall be considered.

The list of additional sampling sites and subsequently the number of sludge samples shall be discussed with project management before undertaking the

Establishment of sampling scheme

The sampled sludge shall be tested for the following persistent organic pollutants of concern:

- **Dioxins:** polychlorinated dibenzodioxins (PCDD) and dibenzofurans (PCDD/F) - 7 PCDD congeners and 10 PCDF congeners according to the US EPA 1613 method. The concentrations shall be provided for each of individual congener and total concentrations shall be calculated in pg of I-TEQ and pg of WHO TEQ per gram of dry weight;

- **Polychlorinated biphenyls – PCBs** (CAS Nr. 1336-36-3) – 7 indicator PCBs and dioxin like PCBs:
    - Non-ortho PCBs: PCB 77, PCB 81, PCB 126, PCB 169;
    - Mono-ortho PCBs: PCB 105, PCB 114, PCB 118, PCB 123, PCB 156, PCB 157, PCB 167, PCB 189;
    - Di-ortho PCBs: PCB 170, PCB 180;
    - Non-coplanar PCBs: PCB 28, PCB 52, PCB 101, PCB 138, PCB 153.
- **Polycyclic aromatic hydrocarbons** (PAHs), EPA list (Acenaphtene, Acenaphtylene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Chrysene, Indeno(1,2,3-cd)pyrene, Naphtalene, Phenanthrene, Pyrene, PAH sum);
- **Brominated persistent organic pollutants** – decabromodiphenylether (DecaDBE, CAS Nr. 1163-19-5), and its metabolites - octabromodiphenylether (OctaDBE) (CAS Nr. 32536-52-0) and pentabromodiphenylether (PentaDBE) (CAS Nr. 32534-81-9)

Levels of total adsorbable halogens (AOX) or extractable organic halogens (EOX) (preferably) in all samples shall be determined.

The Consultant shall evaluate the possibility of complementing the above list with other new POPs substances proposed by the Stockholm Convention POPs Review Committee, for instance, chlordecone, hexabromobiphenyl, pentachlorbenzene, perfluorooctane sulfonate, short chained paraffins and others that might be relevant to Latvia. If necessary the list may be adjusted so that other substances of concern are included. In that case the reasoning shall be provided to project staff and included in the evaluation report.

Sampling

Sludge sampling shall be done in accordance with general sampling practices of solid environment samples. In addition, sludge sampling shall be done in accordance with requirements set in the national legislation and relevant EU legislation (Council Directive 86/278/EEC of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture), if applicable.

The Consultant will be responsible for collection and temporary storing (until delivery to laboratory for testing) of all collected wastewater sludge samples. The Consultant is required to obtain 0.5 l of wet sludge sample from each sampling site. The sample shall be stored in glass jar, hermetically sealed.

It is anticipated there will be one sample per each waste water treatment plant, with exception for Riga Wastewater treatment plant where at least two sludge samples shall be obtained.

Analytical testing of wastewater sludge samples

The laboratory carrying out analysis of sludge samples shall be accredited and conforming to the EN ISO 17025. Accreditation shall be valid for EU Countries, carried out on the basis of internationally recognized criteria and rules, contained in international standards and normative documents applicable to accreditation, Council Regulation (EEC) No1836/93 (EMAS), respective Methodological Instructions for Accreditation (MIA) and EA, ILAC and IAF documents.

Evaluation of results and reporting

Upon completion of study and receiving testing results, a report shall be compiled consisting of following principal components:

- description of the problem and summary of results of earlier studies;
- description of selection of sampling sites/wastewater treatment plants and methodology, description of sampling scheme;
- a short description of sampling process;
- analysis of obtained results, including comparison of results with other studies in Latvia and other Baltic states, relevant similar studies in other European countries;
- Conclusions.

Timeframe

Development of list of sampling sites/wastewater treatment plants – 1 day
Development of sampling scheme – 1-3 days;
Sampling – depending on number of samples – 10-15 days
Analytical testing of samples – 20 days
Evaluation of results and reporting – 5 days

The study shall commence on December 1, 2008 and shall be completed by March 1, 2009.

Organizational arrangements and responsibilities

UNDP Latvia and the implementation institution of UNDP/GEF project "Environmentally Sound Disposal of PCBs containing equipment and waste in Latvia" will be responsible for overall coordination and management of the study, including selection of Consultant and selection of laboratory for carrying out analytical testing of sludge samples.

The consultant shall be responsible for final preparation of a list of sampling sites, specifying the sampling scheme, sampling of wastewater sludge samples and evaluation of testing results and preparation of report.