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PRIORITY AREA

HAZARDOUS SUBSTANCES

HELCOM

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MICROPLASTICS IN WASTE WATER, ST. PETERSBURG

PRELIMINARY STUDY ON SYNTHETIC MICROFIBERS AND PARTICLES AT A MUNICIPAL WASTE WATER TREATMENT PLANT

Implemented by Helsinki Region Environmental Services HSY (Main Consultant)

Implemented in cooperation with State Unitary Enterprise "Vodokanal of St. Petersburg"

BACKGROUND

Annual global plastic production exceeds 280 million tonnes and is expected to increase by 4% per year. With growing plastic production, plastic litter in the environment is increasing. This causes an accumulation of plastic litter in various environments, including marine habitats. It is estimated that marine litter consists of 60 – 80% of plastics, most of it being very small (< 5 mm) and termed as microplastics.

Plastic litter in the marine environment causes a threat to wildlife. Animals may ingest or get entangled in plastics. In-

gested plastics can cause internal damage, reduce feeding, disturb the digestive enzyme system or hormone balance and have an impact on reproduction. Plastics can contain harmful additives such as phthalates and flame retardants,

"With growing plastic production, plastic litter in the environment is increasing"

and they may also absorb hydrophobic pollutants, such as PCBs and DDE from the surrounding water. The ingestion of plastics may thus potentially transfer environmental pollutants to marine food webs. Entanglement in plastic litter can drown an animal, reduce its fitness, cause external injuries, or impair its ability to catch food and avoid predators. Plastics may also transport species far away from their origin.

Marine microplastic litter is derived from a variety of sources, such as traffic, industry, fragmentation of larger plastic particles and waste water treatment plants (WWTPs). Processed municipal waste waters contain, for example, synthetic textile fibres from washing of clothes and abrasive plastic fragments from cleaning agents.

The aim of this project was to perform a pilot study on the amount of microplastic litter arriving at the Central WWTP of Vodokanal of St. Petersburg


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with the effluents, and to examine the effect of the purification process. The study was performed in cooperation with the Helsinki Region Environmental services Authority HSY and SUE Vodokanal of St. Petersburg.

OBJECTIVES

The objective of this project was to study the amount of microplastic litter arriving at the Central Waste Water Treatment Plant (WWTP) of St. Petersburg and the effect of the purification process

MAIN OUTCOMES

The results of this study show that the WWTPs may operate as a point source of microplastic litter into the aquatic environment. However, the reduction of the microplastic load is also remarkable in scale.

RECOMMENDATIONS

Due to the preliminary status of this project, results gained in this study are only indicative. In order to evaluate the actual role of WWTPs on the total microplastic load of the marine environment, a more detailed investigation is needed into the amount and types of microplastic litter in waste water and in natural waters. Furthermore, extensive studies of other possible sources are needed.

NEXT STEPS

The procedures and methodology for studying microplastics in waste water were presented to Vodokanal employees for Vodokanal of St. Petersburg to continue microplastic research independently. In addition, all of the equipment acquired for this study was left in the possession of Vodokanal. The results will be presented to relevant HELCOM Groups who will be able to use the results in their work on marine litter. ●

Full report available at
www.helcom.fi


photo: Tehno Terra Ltd.

KALININGRAD-PORT OIL TERMINAL

BASE PROJECT PILOT ACTIVITY TO MINIMISE PREGOLYA RIVER POLLUTION WITH OIL PRODUCTS FROM KALININGRAD PORT OIL TERMINAL

Implemented by LLC TehnoTerra

Supervised by Pöyry Finland Oy and Finnish Environment Institute SYKE

BACKGROUND

Kaliningrad Port Oil Terminal is a HELCOM "hot spot". It is a source of oil pollution to the Baltic Sea through the Pregolya River.

The oil terminal is located on the bank of a navigable canal in the estuary of the Pregolya River. The enterprise dates back to pre-WWII times. The Kaliningrad Port Oil Terminal (KPOT) is currently part of the Kaliningrad Marine Fishing Port.

Previous projects and activities have addressed the issue of pollution of the Pregolya river from the KPOT. Projects such as BALTHAZAR have done inventories of hot spots in Russia.

HELCOM BASE Project (Implementation of the Baltic Sea Action Plan in Russia), 2012-2014, builds on the results of previous projects. With regard to the KPOT, BASE focuses on developing recommendations for remediation of oil-contaminated soil.

OBJECTIVES

• Recommendations for fulfilling the criteria for deletion of the site from the HELCOM Hot Spot list

• Preparation of a pre-feasibility study, including a cost estimate for different remediation and pollution prevention measures

• Agreement on a realistic environmental programme for the oil terminal together with the authorities

The general long-term goal is the reduction of oil products pollution to the Baltic Sea.

MAIN OUTCOMES

In addition to building on previous projects and existing information, new screening activities were performed to determine the level of oil contamination on the premises of the Kaliningrad Port Oil Terminal and the adjacent water area of the Pregolya River.

These screening activities produced the following outcomes:

• A map of distribution of soil contamination with oil products by depth and in layout was created

• The thickness of the contaminated layer of the soil was determined

• Sites of the highest thickness of the free oil product plume in the soil were defined in order to design a remediation project of the territory

The statutory and legal framework of the facility's environmental activities was also determined.

RECOMMENDATIONS

Based on the screening results, the following remediation options were selected to minimize discharge of oil into the Pregolya River:

1) improve recovery of free oil phase by installing new oil pumping wells along the pier that was found to be the critical area of oil leakage to the River

2) in three of the four waste water discharge channels from the site to the River the concentration of oil in water exceeds the maximum allowed concentration of 0,05 mg/l by 2 to 14 fold. Water treatment will be improved by implementing physical, chemical and biological treatment processes that aim to cut discharges of oil to the allowed level.

NEXT STEPS

Should the Kaliningrad Marine Fishing Port (of which the Kaliningrad Port Oil Terminal forms a part) implement the Environmental Management Plan fully, a more than 50-fold reduction in oil pollution from the oil terminal to the Pregolya River could be expected. This result would allow for the removal of the site from the HELCOM Hot Spots list. ●

Full report available at
www.helcom.fi

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PHARMA-CEUTICALS IN WASTE WATER, ST. PETERSBURG

PILOT ACTIVITY TO IDENTIFY SOURCES AND FLOW PATTERNS OF PHARMACEUTICALS IN ST. PETERSBURG TO THE BALTIC SEA

Implemented by Institution of Russian Academy of Sciences Saint-Petersburg Scientific-Research Centre for Ecological Safety (SRCES RAS) (Main Consultant)

Support provided by Envieno, Finland (EU Expert)

BACKGROUND

Building on the results achieved in the BALTHAZAR project, the BASE project has further contributed to identifying the most important sources and necessary measures for HELCOM's priority substances and the development of pilot projects aiming at practical results.

This also includes further work to identify sources, substance flows and release patterns of hazardous substances to the Baltic Sea.

St. Petersburg, with its population of over five million in 2013, is the largest megapolis on the Baltic Sea. It is also the largest single point of sales, consumption, excretion and, presumably, release of pharmaceutical substances into the Baltic Sea environment.

This study was the first of its kind to be carried out in St. Petersburg. Its aim was to analyse the load of pharmaceuticals entering and passing through the city's sewage system.

A comprehensive sampling and chemical analysis campaign was carried out.

"Waste water treatment processes currently in use cannot remove all anti-inflammatory drugs"

Initially, just two pharmaceutical substances were to be analysed: Diclofenac (DCF) and Ethinylestradiol (EE2). These two compounds are known to be present in the natural waters and are also known to cause harmful effects on the ecosystem. They are currently being developed by HELCOM as pre-core indicators.

After initial sampling and an analysis of the pharmaceutical sales statistics the focus, however, shifted to a more diverse set of some 20 different pharmaceuticals and to the naturally produced human estrogens: Estron (E1), Estradiol (E2) and Estriol (E3).

OBJECTIVES

The overall aim of the project was to analyse the load of pharmaceuticals entering and passing through the city's sewage system. Other objectives:

- Input to waste management strategies.
- Input to the HELCOM Ministerial Meeting in 2013, with regard to the effectiveness of treatment at WWTPs.

MAIN OUTCOMES

- Screening activities in WWTPs (inflow/outflow) and receiving water bodies.
- Evaluation of the efficiency of treatment methods at municipal waste water treatment plans with regard to Diclofenac, an anti-inflammatory drug. It was found that the concentration of Diclofenac was often higher after treatment than in unpurified sewage water. This phenomenon can be explained by the liberation of Diclofenac during the waste water treatment process.
- Assessment of potential sources and flows of pharmaceuticals.
- Evaluation of consumer use patterns and other sectors' use (e.g. industry, hospitals and pharmacies).
- Contribution to the flagship project 'Make the Baltic Sea Region a Lead in Sustainable Management for Pharmaceuticals' under Priority Area 9 of the EU Strategy for the Baltic Sea Region (Hazardous Substances).

RECOMMENDATIONS

The project results clearly indicate that the waste water treatment processes currently in use cannot remove all anti-inflammatory drugs from waste water and much ends up in the sea with a probably negative effect on living organisms. Therefore, an improvement of technology is the first step to take. Secondly, consuming less pharmaceuticals or substituting persistent substances with greener pharmaceuticals should be aimed at. ●

Full report available at
www.helcom.fi

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