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ScorePP

Summary of 2nd annual Progress Report

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Source Control Options for Reducing Emissions of Priority Pollutants (ScorePP)

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Abstract (max. 200 words)

The overall aim of the ScorePP project is to develop comprehensive and appropriate source control strategies that authorities, cities, water utilities and the chemical industry can employ to reduce emissions of priority pollutants (PPs) from urban areas into the receiving water environment.

This report is a summary of the 2nd annual Progress Report, describing the scientific objectives of the ScorePP project and the main results achieved within the first two years of the project, which are (*i)* an innovative "Emission String" approach to manage data about PP sources, their resulting PP loads and the available mitigation options, (*ii*) the completion of WP3, "Source characteristics of PPs", in which an Internet database with Emission Strings was built, and almost completion of (*iii*) WP4, "Limiting release of PPs" in which information about substitution, minimising release from products, legislation and voluntary use reductions were collected and analysed and (*iv*) WP5 "Treatment options", in which stormwater best management practices (BMPs), household wastewater and greywater systems and end-of-pipe wastewater treatment plants were so far investigated. Future challenges include connecting the data management system with the modelling efforts, the socio-economic scenario analyses and preparation of comprehensive emission control strategies.

Acknowledgement

The presented results have been obtained within the framework of the project ScorePP - "Source Control Options for Reducing Emissions of Priority Pollutants", contract no. 037036, a project coordinated by Department of Environmental Engineering, Technical University of Denmark within the Energy, Environment and Sustainable Development section of the European Community's Sixth Framework Programme for Research, Technological Development and Demonstration.

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1. Introduction

The European Commission (EC) has, in connection with the Water Framework Directive (WFD), identified a list of 33 priority substances (PSs) for which environmental quality standards and emission control measures have to be established (EC, 2001). The list was developed through a negotiation process and involved the use of scientific data on a range of properties of each substance including pollutant load, toxicity, persistence and liability to accumulate in the environment. Within this list a total of 11 substances have been identified as being particularly hazardous, and these priority hazardous substances (PHSs) are subject to a complete cessation or phasing-out of discharges, emissions or losses within an appropriate time scale not exceeding 20 years. The overall list is under constant review and it is anticipated that certain of the 'possibly hazardous' substances will be "upgraded" to a PHS status and that several emerging pollutants will also be added to the list at a future date. As a first example, the EC has recently approved a set of environmental quality standards (EQS) (EC, 2008), which in addition to the 33 PSs identified in the WFD includes 15 extra compounds and "upgrades" 9 chemicals (anthracene, endosulfan, 4-nonylphenol, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, inideno(1,2,3-cd)pyrene and tributyltin-cation) from PS to PHS status (i.e. there are now 48/20 substances/PHSs to consider). Furthermore, 13 substances or substance groups are subject to review for possible identification as PS or PHS.

The complete cessation or significant reduction of PS/PHS emissions is a big challenge for the European Union (EU), and there are numerous scientific and practical questions remaining. For example: is it more feasible to control the substances via enhancing end-of-pipe treatment technologies or to control them at source via a combination of substitution, voluntary use reductions and/or legislation?

2. The scorePP idea

The ScorePP project (Source Control Options for Reducing Emissions of Priority Pollutants) is a European 'Specific Targeted Research Project' that aims to develop comprehensive and appropriate source control strategies that authorities, cities, water utilities and the chemical industry can employ to reduce emissions of priority pollutants (PPs) from urban areas into the receiving water environment. PPs in this context refer specifically to the above mentioned PSs/PHSs; this list may however be expanded to include emerging pollutants or reduced if appropriate model compounds can be identified, depending on the local context (i.e. sources of pollution, existing monitoring activities and legislation).

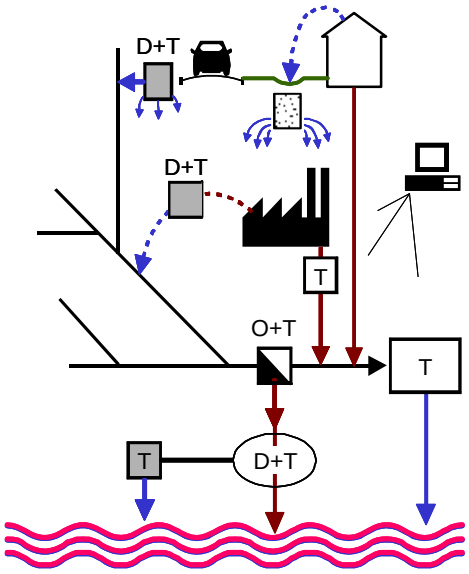
A substantial proportion of the total load of PPs entering receiving waters is discharged from urban areas and this is therefore the primary focus of the ScorePP project. Agricultural, industrial and other potential sources (e.g. leachate from landfill sites) located outside urban areas will only be included if specifically required within the case studies investigated in the project. This does not imply that the project consortium considers urban pollution more important than rural; it merely reflects the focus of the project around which expertise is gathered and the work plan has been developed.

The Figure below illustrates the physical system considered in the ScorePP project, exemplified with a combined sewer system including both upstream (source control) and downstream (end-of-pipe treatment) mitigation options. In addition to the shown point discharges (treatment plants and combined sewer overflows) there are diffuse discharges from e.g. building drains and unknown pipe networks and overland flow (D: Detention, O: Overflow, T: Treatment).

Limiting release through:
- Substitution
- Minimising release from produtcs
- Legislation and regulations
- Voluntary use reductions

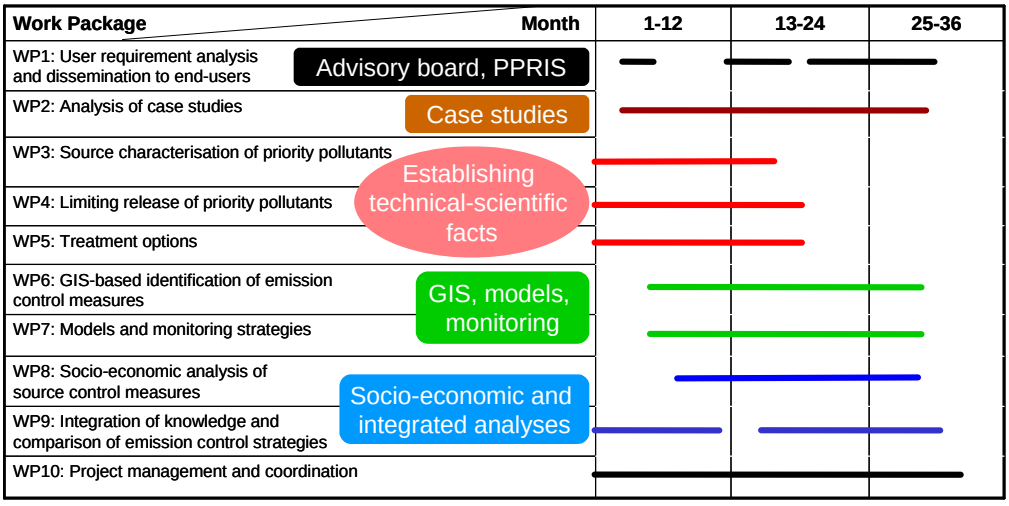
Treatment options:
- Stormwater BMPs
- Household treatment & reuse of WW
- On-site industrial treatment
- WWTPs
- Sludge disposal

Sinks:
- Primary: Surface water (WFD)
- Secondary: Sediments, soils/gr.water, humans, ...



3. Main scientific objectives

The overall work plan for the ScorePP project illustrating the 10 work packages (WPs), their temporal evolution and (in enlarged text bubbles) their grouping according to the nature of the work is illustrated in the next Figure. The WPs specifically address a range of identified objectives and follow in a logical sequence. The primary scientific objectives of the ScorePP project are, in brief, to identify the sources of PPs in urban areas (WP3), identify appropriate strategies for limiting the release of PPs from their sources (WP4) and for their removal via treatment (WP5), connect and visualise pollution sources, paths and loads using GIS technology (WP6), develop dynamic source-and-flux models for quantifying the fate of PPs within the urban drainage and wastewater system and optimising monitoring programmes (WP7), and benchmark the different emission control strategies and determine their socio-economic impacts on a societal scale (WP8).



It is appreciated that some of the emission control measures may be potentially controversial as they depend on the full participation of the chemical industry, water utilities and/or other stakeholders involved in urban spatial planning, with potential economic and social (as well as environmental) impacts and implications. Three further scientific objectives are therefore defined as follows: evaluate the usefulness of the developed approaches, technologies and emission control strategies in a number of case study cities (WP2), interact with the most important stakeholders and communicate the results of the project to a wide audience (WP1) and finally, integrate and condense the developed knowledge and experiences into appropriate and cost-efficient emission control strategies for semi-hypothetical case city archetypes representing PP emission states in different geographic and socio-economic contexts throughout Europe (WP9).

The WPs are connected group-wise according to the nature of the work, as shown by the text bubbles in the Figure. Stockholm (Sweden) and St. Malo (France) are the two case cities selected for detailed study on PP occurrence and fate in wastewater treatment plants and stormwater treatment facilities. The advantage of these two case cities is the in depth knowledge of infrastructure and close connection with the municipalities from two of the project partners; City of Stockholm and Anjou Recherche.

4. Main results achieved

The main results achieved during the project's first two years are summarised below.

Data requirement analysis and definition of common data structures (Task 9.3): An innovative approach to manage data about sources (cf. WP3), their resulting PP loads and the available mitigation options, including substitution, legislation and industrial treatment techniques (cf. WP4 and WP5), has been prepared by applying the CAS# as the central chemical identifier with the NACE economic activity classifications and NOSE-P emission source classifications. A GIS is further integrated into the database enabling the visualising of i) sources to PPs in the urban context and ii) potential mitigation options for reducing the releases of PPs.

Source Characteristics of Priority Pollutants (WP3): The first aim was to construct a database that is able to support the consortium in the other tasks and work packages with basic information regarding the PPs. Each PP is identified with its CAS# and basic information regarding inherent properties, environmental fate, risk classifications and observations in the environment have been compiled for 67 chemicals and chemical groups, related to the WFD. The database is constructed in MS Access, and within the database there are several forms to handle chemicals, properties, data sources and data entries. In order to retrieve data from the database, an add-on program is used to generate a report in MS Excel based on the data in the database. Data on all properties for one chemical or data on all chemicals for one property are examples of the kind of reports that may be generated from the database. The second aim was to compile data on potential PP sources, their dynamics in and releases to the technosphere. In close collaboration with task 9.3 an Internet based database was constructed which is building on the concept of emission strings (ESs). An ES describes a particular emission source by identifying the particular PP being emitted (CAS#), the (economic) activity resulting in the emission (NACE) and the specific emission process (NOSE) during which the PP release takes place. Additionally an urban structure descriptor is added to the ES to be able to visualise the PP source using GIS. The ES is further extended with knowledge about the particular release pattern, viz. the daily, weekly and yearly variation in potential release. Finally, knowledge about the particular ES's release factor is given. 26 PPs were selected representing the whole range of compounds on the WFD and information was compiled for about 900 potential sources to said PP-releases in the urban environment. The initially developed MS Access database with inherent properties is incorporated in the Internet based database for easy sharing of data among the other work packages embraced by the Internet based database, having the CAS# as the central chemical identifier.

Limiting release of PPs (WP4): Great effort has been put into compiling and analysing information about substitution, minimising releases from products, legislation and voluntary use reduction Several reports have been produced, including frameworks for substitution and best and beyond available technologies, evaluation of the efficiency of legislative and industrial voluntary initiatives.

Treatment options (WP5): Limited, if any, field monitoring data exists on the behaviour PPs in stormwater Best Management Practices (BMPs). To address this identified knowledge gap, a theoretical approach to predicting the behaviour of PPs within BMPs, and hence the provision of an assessment of their removal potentials, has been developed. This methodology involves identifying the primary removal processes within 15 BMPs and categorising their relative importance. Physico-chemical data and, where this is missing, expert judgement are used to assess the potential for 52 WFD PPs (an extended list including a range of representative group members) to be removed by the identified processes. These two sets of information are then combined to generate a single overall unit value representing the potential for each BMP to remove a particular pollutant. Ranking these values in descending order enables a pollutant-specific BMP treatment 'order of preference' to be established. This report describes the methodology and presents the results of its application to the extended list of WFD PPs. Available field data on fate and behaviour in WWTPs have been compared with three modelled approaches. Knowledge has been established on conventional WWTPs (activated sludge) and on removals using alternative technologies.

An attempt to incorporate the obtained knowledge on treatment options and initiatives to limit the release of PPs has been undertaken. Several discussion on how to do comparative assessment and feasibility analysis to select the most appropriate mitigation options for reducing the environmental releases of PPs have been performed, latest on one of the consortium's Advisory Board meetings. Current work concerns how to choose and which criteria to choose in order to select the most optimal set of mitigation options.

Future challenges are to connect this data management system with the modelling efforts, both with respect to detailed catchment and treatment unit models (cf. WP7) as well as the socio-economic scenario analyses performed in WP8, and with the preparation of emission control strategies in the case city studies.

5. Contractors involved, Coordinator and public website

The project partners include Technical University of Denmark (Denmark), Middlesex University (UK), Ghent University (Belgium), Anjou Recherche (France), ENVICAT Consulting (Belgium), University of Ljubljana (Slovenia), Desenvolupament i Societat Estudis (Spain), City of Stockholm (Sweden) and Université Laval (Canada).

Further information may be found at the project's public website or by contacting the project Coordinator.

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