Monitoring Criteria for Priority Chemicals Leading to Emission Factors

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Overview

The Water Framework Directive (WFD) 2000/60/EC, requires a coordinated approach to water management in respect of whole river basins with a view to protecting the high-status of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least "good status" in relation to all waters. The EPA-funded ***Monitoring Criteria for Priority Chemicals Leading to Emission Factors*** aims to establish risk factors for priority substances (PS) & priority hazardous substances (PHS), which will assist in defining the monitoring programme in Ireland for WFD. Indicators are applied to monitored WWTP agglomerations to predict the relative risk of elevated PS/PHS loading to receiving waters across agglomerations over time. In Ireland, where the current state of knowledge and data availability (e.g. emission data from individual installations) is insufficient to support high resolution based models the project team have developed a simple, stochastic, risk-based model that can be applied across catchments to predict the relative risk of elevated PS/PHS loading to receiving waters.

Site Selection

Samples were taken from effluent outfalls at ten WWTPs in Co. Dublin and Co. Cork to reflect the broad range of domestic, agricultural and industrial activities occurring in the relevant agglomerations. Table 1 gives a summary of the monitored WWTP characteristics.

Fig.1 Sources of loadings associated with PS/PHS in WWTP

The major factors leading to PS/PHS loading from WWTPs were identified integrated and conceptualised in a basic conceptual model. Then, through a combination of quantitative data collation (e.g. number of discharge licences issued to different types of operations) and qualitative risk assessment (risk ranking), risk databases were compiled for these major sources.

Table 1. Summary description of at the WWTPs in Co. Cork and Co. Dublin monitored during the project

WWTP	Treatment	Capacity PE	Agglom. Population	Receiving waters
Ballincollig, Cork	Secondary	26,000	16,339	Freshwater
Bandon, Cork	Secondary	20,000	6,200	Freshwater
Charleville, Cork	Secondary	15,000	2,984	Freshwater
Clonakilty, Cork	Secondary	6,067	7,500 - 15,000	Estuarine
Fermoy, Cork	Secondary, NR*	20,000	5,800	Freshwater
Mallow, Cork	Secondary, NR*	18,000	7,091	Freshwater
Ringaskiddy, Cork	None	0	14,864	Estuarine
Rosscarbery, Cork	Primary	5,329	800 - 4,500	Coastal
Ringsend, Dublin	Secondary	1,640,000	1,200,000	Estuarine
Swords, Dublin	Secondary, NR*	60,000	50,000	Estuarine

*NR = Nutrient removal

Results

Table 2 - Overall results for eight priority PAHs detected in samples from discharge effluent at 7 Cork WWTPs (2009-2010)

Parameter	Target EQS (µg L^{-1})	LOD (µg L^{-1})	N= 147	Range min	Range max
Naphthalene	1.2	0.0001	147	<LOD	2.00 x 10^{-2}
Anthracene	1 x 10^{-1}	0.0005	132	<LOD	5.79 x 10^{-2}
Fluoranthene	1 x 10^{-1}	0.0001	129	<LOD	5.75 x 10^{-2}
Benzo-b/k-fluoranthene	Σ 3 x 10^{-3}	0.0001	69	<LOD	**4.02 x 10^{-2}**
Benzo-a-pyrene	5 x 10^{-2}	0.0005	51	<LOD	3.03 x 10^{-2}
Indeno-1,2,3cd-pyrene /Benzo-ghi-perylene	Σ 2 x 10^{-3}	0.0001 0.0005	78	<LOD	**4.91 x 10^{-2}**

In Table 2 we can see that EQS exceedances were detected for both benzo-b/k-fluoranthene, and indeno-1,2,3cd-pyrene and benzo-ghi-perylene, with several other PAHs coming close to their standards.

Table 3 - Overall results for eight priority PAHs detected in samples from discharge effluent at 2 Dublin WWTPs (2009-2010)

Parameter	Target EQS (µg L^{-1})	LOD (µg L^{-1})	N= 168	Range min	Range max
Naphthalene	1.2	0.0001	168	<LOD	6.26 x 10^{-2}
Anthracene	1 x 10^{-1}	0.0005	168	<LOD	5.96 x 10^{-2}
Fluoranthene	1 x 10^{-1}	0.0001	168	<LOD	3.42 x 10^{-2}
Benzo-b/k-fluoranthene	Σ 3 x 10^{-3}	0.0001	156	<LOD	2.55 x 10^{-4}
Benzo-a-pyrene	5 x 10^{-2}	0.0005	150	<LOD	1.79 x 10^{-2}
Indeno-1,2,3cd-pyrene /Benzo-ghi-perylene	Σ 2 x 10^{-3}	0.0001 0.0005	153	<LOD	**5.74 x 10^{-2}**

In Table 3 we can see that EQS exceedances were detected for indeno-1,2,3cd-pyrene and benzo-ghi-perylene, with several other PAHs coming close to their standards.

Outlook

Further model development based on comparison with monitoring data is ongoing. This work will enable the project team to make recommendations to the regulatory agencies on future monitoring programmes.

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