Devising a Risk Index for Priority Substance Emissions from WWTPs

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Background

A review was used to identify the major factors leading to priority substances (PS) & priority hazardous substances (PHS) loading from WWTPs, integrated and conceptualised into a basic conceptual model. The focus is on readily-available data relevant to major PS/PHS risk factors identified by conceptual modelling, developing appropriate indicators. Databases were compiled for Local Authority and EPA licensed discharges, and agglomeration traffic. Results from these databases were integrated into the risk model for agglomeration PS/PHS loading, combined with basic WWTP (e.g. capacity and treatment level) and agglomeration (e.g. population and area) data, and finally expressed as elevated risk in a national context following normalisation procedures.

Model Development

The Conceptual modelling of PS/PHs loading is comprised of key risk indicators applicable under Dry Weather Flow (DWF) and Wet Weather Flow (WWF) conditions. Loading to the environment from each WWTP under DWF can be expressed as DWF domestic loading (population size) plus DWF licensed (commercial and industrial) loading, multiplied by a WWTP transfer factor (inverse of WWTP removal efficiency). Under WWF, environmental loading can be expressed as a function of DWF loading, plus WWF Domestic loading, plus WWF licensed loading, plus WWF traffic loading, all multiplied by the WWTP transfer factor.

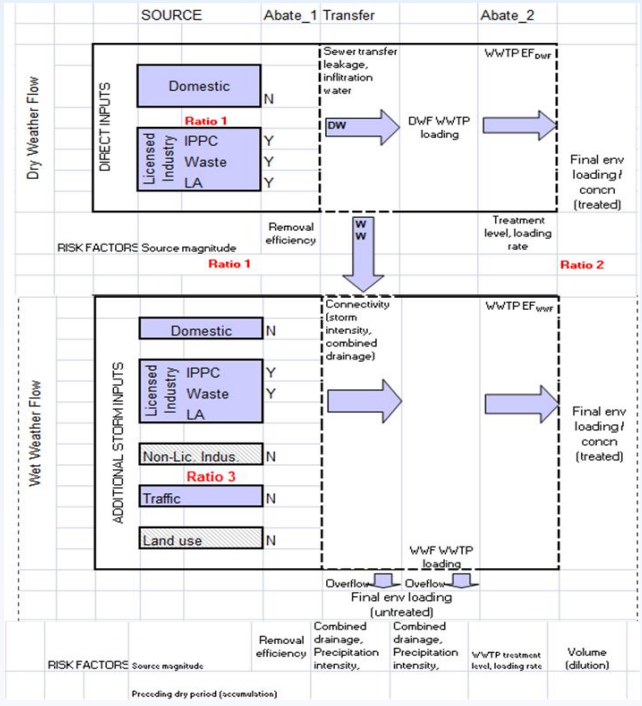

Fig 1. Schematic diagram of Model Conceptualisation

Three critical factors were derived from available WWTP operational data to estimate the equivalent level of treatment achieved by each WWTP under dry-weather flow (DWF) and wet weather flow (WWF) conditions: (i) level of treatment under normal operating conditions; (ii) DWF load factor; and (iii) WWF load factor. A basic risk ranking scheme was derived based on the type and scale of licensed activity discharging into the sewer network. Additional information contained in EPA licences, including whether or not sites discharged into the sewer network, and surface water management practices, were used to refine these risk factors, which were derived for both direct sewer inputs (DWF and WWF) and indirect surface-runoff inputs (WWF only).

Table 1. Basic risk scale used in the model for all loading factors

Risk ranking	Description (High possibility of…)
0	No loading
1	Ligh loading
2	Significant loading
3	Substantial loading
4	Heavy loading

Typical loading risk factors for each PS/ PHS group from Licensed industry

			DIRECT INPUT				RUNOFF RISK			
			PAH	VOC	HM	Pest.	PAH	VOC	HM	Pest.
INDUSTRY	IPPC	NATIONAL								
	Chemicals	97	2	4	2	2	1	1	1	0
	Food & Drink	95	2	1	2	0	1	1	1	0
	Metals	34	2	2	4	0	1	1	1	0
	Minerals Fibre Glass	6	2	2	4	0	1	1	1	0
	Power Generation	23	NA	NA	NA	NA	4	3	3	0
	Surface Coatings	86	2	4	2	0	1	1	1	0
	Wood Paper Textiles	65	NA	NA	NA	NA	3	3	2	0
	Fossil Fuel	3	NA	NA	NA	NA	4	3	3	0
INDUSTRY										
	Hazardous Waste	18	3	3	3	3	2	2	2	2
	Integrated Waste Mar	12	2	2	2	1	2	2	2	2
	Landfill	76	4	4	4	4	NA	NA	NA	NA
	Materials Recovery F	7	2	2	2	1	2	2	2	2
	Waste Transfer Facili	61	3	3	3	3	2	2	2	2

Risk factor for PS loading from traffic

Three key national datasets were identified that could be used to derive a traffic risk factor for catchment PS/PHS loading: (i) National Roads Authority (NRA) traffic count data for major national roads; (ii) breakdown of vehicle km travelled (VKM) by different vehicle classes on different road types (NRA, 2003); & (iii) recent data on VKM by vehicle type (CSO, 2009).

TRAFFIC	CSO, 2008	MVKT	VKT CAR-EQ
TRAFFIC	Private Cars	31,173	31,173,000,000
	Goods Vehicles	7,745	23,235,000,000
	PSV (Small)	1,135	1,135,000,000
	Others	3,738	11,214,000,000
		NAT TOTAL	66,757,000,000

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