

Slides that can be used during the Mid-term exam (2025)

Applied wastewater engineering

Michael Jon MATTLE

Specific (design) loading rates per population equivalent (PE)

item	specific (design) loading rates (g/PE·d)
COD	120
BOD ₅	60
TSS	70
TKN	11
P _{tot}	1.8

values from DWA (ATV-A 131)

How will the installations for oMP removal be financed?

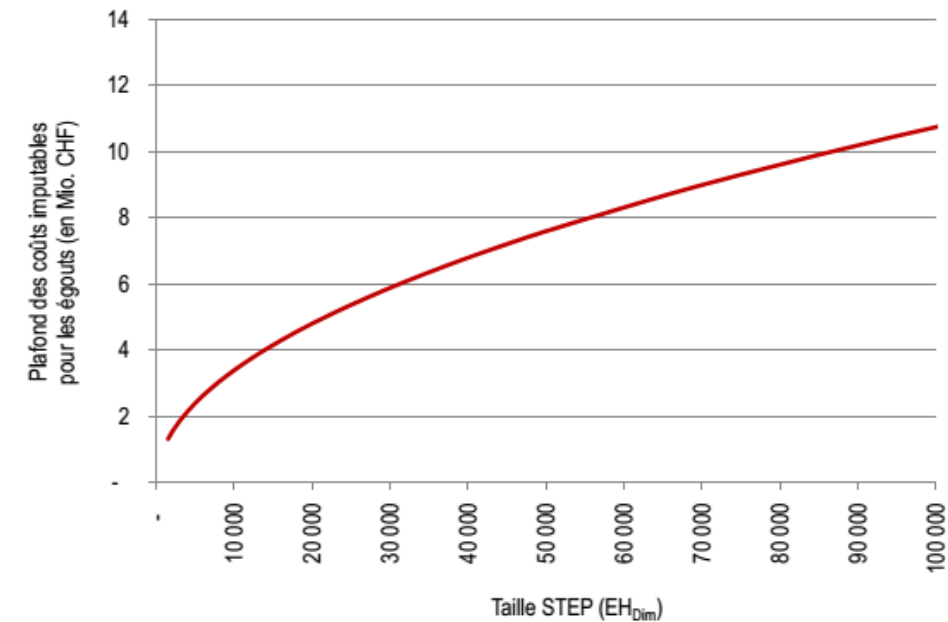
- maximum creditable costs for a sewer system are:

$$= 34'000 \sqrt{\text{size of WWTP}(PE)}$$

Fig. 3 > Plafond des coûts imputables des égouts en fonction de la taille de la STEP

coûts arrondis mathématiquement en milliers de francs.

$$\text{Plafond des coûts imputables des égouts} \\ = 34\,000 \cdot \sqrt{\text{taille STEP (EH}_{DIM})}$$



FOEN: Elimination des composés traces organiques dans les stations d'épuration : Financement des mesures

Current choice of substances to monitor the 80 % removal of oMP

- removal efficiency is computed based on at least six substances
- proportion of substances of group 1 and group 2 has to be 2:1
- total removal efficiency (RE) corresponds to the average of the removal efficiency of each selected substance expressed in percent

	Substance	type of substance
group 1: very easy to remove with advanced oMP treatment	amisulpride	pharmaceutical psychiatric
	carbamazepine	pharmaceutical anticonvulsant
	citalopram	pharmaceutical antidepressant
	clarithromycin	pharmaceutical antibiotic
	diclofenac	pharmaceutical analgesic
	hydrochlorothiazide	pharmaceutical diuretic
	metoprolol	pharmaceutical beta blockers
	venlafaxine	pharmaceutical psychiatric
group 2: easy to remove with advanced oMP treatment	benzotriazole	anti-corrosive agent
	candesartan	pharmaceutical antihypertensive
	irbesartan	pharmaceutical antihypertensive
	4-methylbenzotriazole/ 5-methylbenzotriazole	anti-corrosive agent

- $$RE(\%) = \frac{RE_{substances_1}(\%) + RE_{substances_2}(\%) + \dots + RE_{substances_n}(\%)}{n}$$

oxidation processes

$$\frac{dc_{compound}}{dt} = -k_{compound,oxidant} c_{compound} c_{oxidant}$$

reaction rate constant [$M^{-1}s^{-1}$]

$$\ln \left(\frac{c_{compound,i}}{c_{compound,f}} \right) = k_{compound,oxidant} \underbrace{c_{oxidant} t}_{\text{oxidant dose}}$$

oxidant dose

Ozone injection required

- ozone quantity necessary to achieve the required yield:

$$x \left[\frac{kg_{O_3}}{kg_{DOC,sec. clarified wastewater}} \right] kg_{DOC,sec. clarified wastewater}$$

$$+ 3.43 \left[\frac{kg_{O_3}}{kg_{NO_2^- - N,sec. clarified wastewater}} \right] kg_{NO_2^- - N,sec. clarified wastewater}$$