

## **Background Document**

# **Derivation of secondary measure costs Biofiltration**

**Prepared in the framework of EGTEI**

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## Technique : Biofiltration (VOC)

The purpose of this document is to explain how costs (investment and operating costs) for biofilters have been derived.

### 1 Investments

The cost curve "Investment vs. flow rate" has been obtained from industrial cases :

Equation :

$$I = 45,424 \times FR^{0,808}$$

I : investment (€)

FR : flow rate (m<sup>3</sup>/h)

To take the auxiliary expenditures into account, a factor of 1,85 is applied to this investment [1]. This factor accounts for instrumentation, freight, foundation and supports, handling and erection, electrical, piping, insulation for ductwork, painting, engineering, construction and field expenses, contractor fees, start-up, performance test and contingencies.

$$I_{total} = I \times 1,85$$

### 2 Operating costs

#### 2.1 Fixed operating costs

##### 2.1.1 Insurance and Taxes (C1)

In the documents we take 3% [2] of the total investment ( $I_{total}$ ) each year.

$$C1 \text{ [€/y]} = k1 \times I_{total}$$

With  $k1 = 0,03$

##### 2.1.2 Reparation and Maintenance (C2)

This cost takes into account labour and materials to repair and maintain the device. This is very difficult to estimate.

In the documents we take 2% [2] of the total investment ( $I_{total}$ ) each year.

$$C2 \text{ [€/y]} = k2 \times I_{total}$$

With  $k2 = 0,02$

##### 2.1.3 Total fixed operating costs

$$OC^{fix} \text{ [€/y]} = C1 + C2 \text{ (= 5% in our documents)}$$

These costs are just applied to secondary measures.

## 2.2 Variable operating costs

**Table 2.2.1 :** Variable costs considered in the background documents (country specific)

Parameters	Default costs
Electricity [€/kWh]	0,0686 [3]
Wages [€/h]	25,9 [2]

Three components are taken into account :

### 2.2.1 Electricity costs (C3)

$$C3 \text{ [€/y]} = 5.10^{-7} \times FR \times N \times \Delta p \times C^e$$

FR : flow rate [m<sup>3</sup>/h]

N : annual operating hours [h/year]

$\Delta p$  : back pressure [Pa] ( $\Delta p = 3\,000$  Pa)

$C^e$  : electricity cost [€/kWh]

### 2.2.2 Labour costs (C4)

$$C4 \text{ [€/y]} = k3 \times N \times C^w$$

N : annual operating hours [h/year]

$C^w$  : wage cost [€/h]

$k3 = 0,0625$

### 2.2.3 Micro-organisms costs (C5)

$$C5 \text{ [€/y]} = 0,1849 \times FR$$

FR : flow rate [m<sup>3</sup>/h]

### 2.2.4 Total variable operating costs

$$OC^{var} \text{ [€/y]} = C3 + C4 + C5$$

## 3 Bibliography

[1] EPA Air pollution Control Cost Manual. EPA-452-02-001. January 2002.

[2] R. BOUSCAREN, N. ALLEMAND, Q.C. DANG. Etude de l'impact économique du projet de directive sur la limitation des émissions de solvants organiques en France. CITEPA. Juin 1995.

[3] Energie Plus n° 257. 15 Décembre 2000. Energy costs for the small Industry.