A comparison of design criteria of on-site treatment systems available on the french market

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13th IWA
Specialized Conference on Small Water and Wastewater Systems

5th IWA
Specialized Conference on Resources-Oriented Sanitation

2009: REGULATION CHANGED

In France, 5 millions of on-site systems,10% need to be renewed
=> important economic challenge

2009

BEFORE

4 solutions:
- Septic tank + Soil
- Septic tank + Sand filter
  - Horizontal
  - Vertical
- Septic tank + Zeolite filter

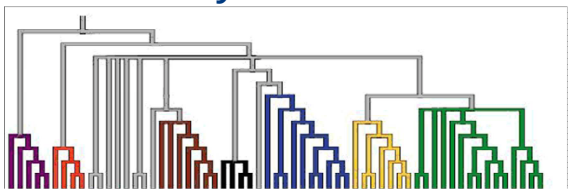
EN NF 12566-3

European Labeling

Technical Approval

CURRENTLY

On-site systems



More than 60 manufacturers
More than 600 technical approvals
3 process families
Sizes range from 3 to 20 PE

HOW TO COMPARE THE SYSTEMS?

We compared on-site system design criteria to WWTP design criteria for each process

Data we taken from technical approvals and user manuals.

2 over the 3 identified families were studied
We identified 44 Attached Growth Systems on fine media (AGS) and 97 Activated Sludge Systems (ASS) at the end of 2014.

For AGS, we compared: size of septic tank, filtration area and daily applied organic load

For ASS, we compared: F/M ratio, clarifier area and sludge storage volume

ATTACHED GROWTH ON FINE MEDIA: 7-8 DIFFERENT MEDIAS

soil

sand

xylit

coconut's shaving

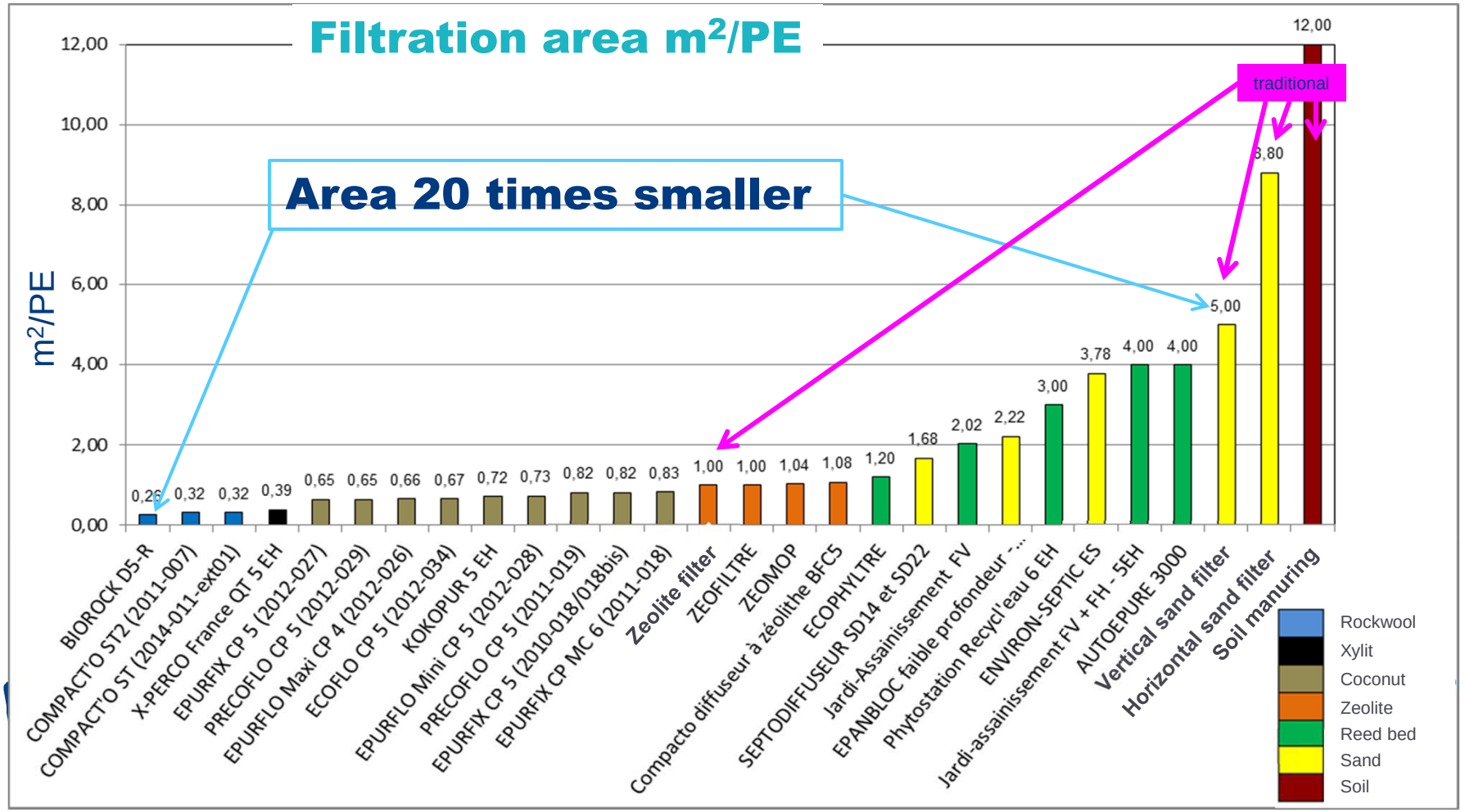
zeolite

Reed bed
gravels + sand or mayennite

rockwool

ATTACHED GROWTH ON FINE MEDIA

Sizing most commonly sold: 4,5 or 6 PE

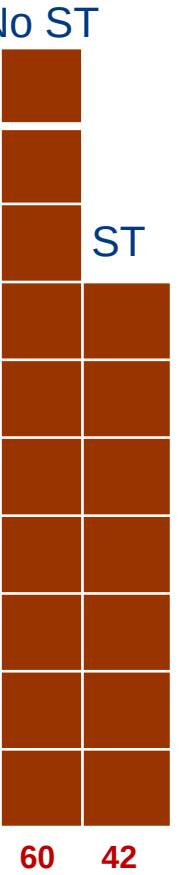


ATTACHED GROWTH ON FINE MEDIA

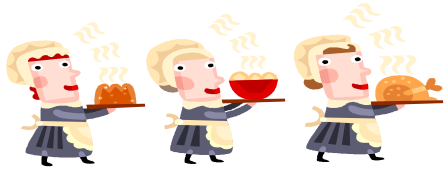
Applied load caculation

- Calculation basis: **1 PE = 60g of BOD_5 per day**
- Removal rate of Septic Tank **= 30% on BOD_5**
- Quantity of theoric delivered pollution on filter :**42 BOD_5 g/day/PE**

$$\text{Applied Surface Load } (BOD_5\ g/m^2/d) = \frac{42}{\text{Filtration area } (m^2/PE)}$$



Oversized systems can accept more pollution



	Sand		Zeolite
Collective Plant Standards	On one filter	On dual filter	On the filter
	25g $BOD_5/m^2/d$	12,5g $BOD_5/m^2/d$	24g $BOD_5/m^2/d$

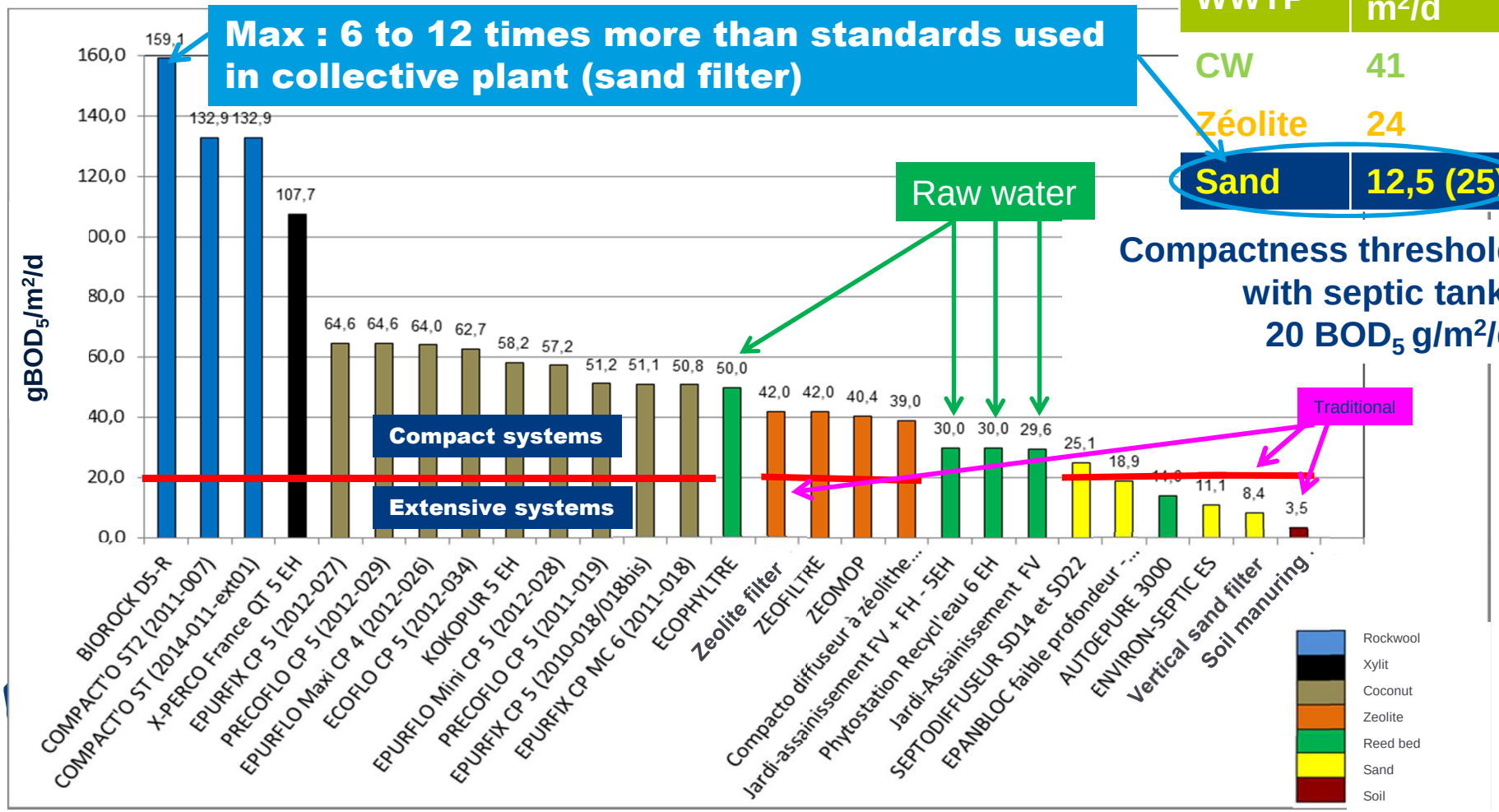
ATTACHED GROWTH ON FINE MEDIA

Sizing most commonly sold: 4,5 or 6 PE

Daily applied organic load

Max : 6 to 12 times more than standards used in collective plant (sand filter)

Standards WWTP	BOD_5 g/ m^2/d
CW	41
Zéolite	24
Sand	12,5 (25)



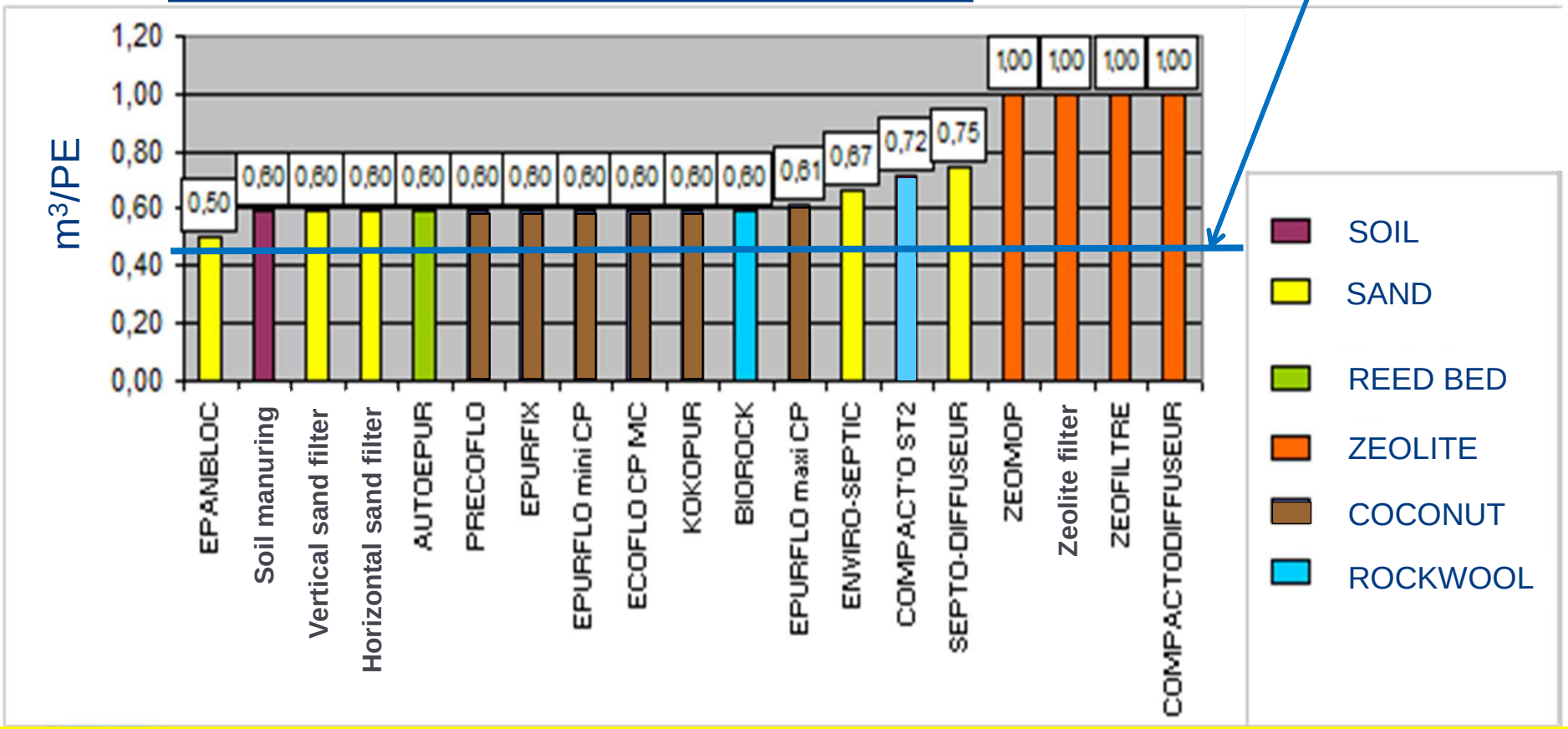
Compactness threshold with septic tank: 20 BOD_5 g/m^2/d

ATTACHED GROWTH ON FINE MEDIA

Primary sludge storage capacity

Sizing most commonly sold: 4,5 or 6 PE

Standard in Collective sanitation: 0.450m³/PE



It is larger than the technical minimum used in collective sanitation

ACTIVATED SLUDGE & SBR

Information to be remembered

In the water line:

- F/M ratio range from 0.025 to 0.34 BOD_5 kg /VSS kg/d (standard in collective plant 0.1 BOD_5 kg/VSS kg/d)
- 66% of systems are well designed
- SBR are generally oversized
- In clarifier, water uprise velocity range from 0.15 to 1.47 m/h
- 33% of systems have a water uprise velocity over 0.6 m/h (standard WWTP)

In the sludge line:

- Sludge storage volume range from 0.125 to 0.56 m^3/PE
- 66% of systems have a smaller volume than in collective plant (0.45 m^3/PE)

	AGS	ASS
Water line	Research of compactness	Well design
Sludge line	Well design	Too small
Consequences	Renewal of media due to clogging	Frequent emptying operations of sludge storage tank

In these 2 cases, customers should provide for added costs

Next step is to carry out the same work on biofilm systems

Currently in-situ measurements are in progress to confirm this theorical analysis

For more informations:

Boutin C., Dubois V. et Lassablière C. (2013). **Comparaison théorique de dispositifs d'ANC, les filières par « cultures fixées sur supports fins »** autorisées au 1er novembre 2013. Rapport ONEMA. 104p.

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FPR: Molle P, Liénard A., Boutin C., Merlin G., et Iwema A. (2004) **Traitement des eaux usées domestiques par marais artificiels : état de l'art et performances des filtres plantés de roseaux en France**. *Ingénieries EAT*, n° spécial 2004, pp23-32

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