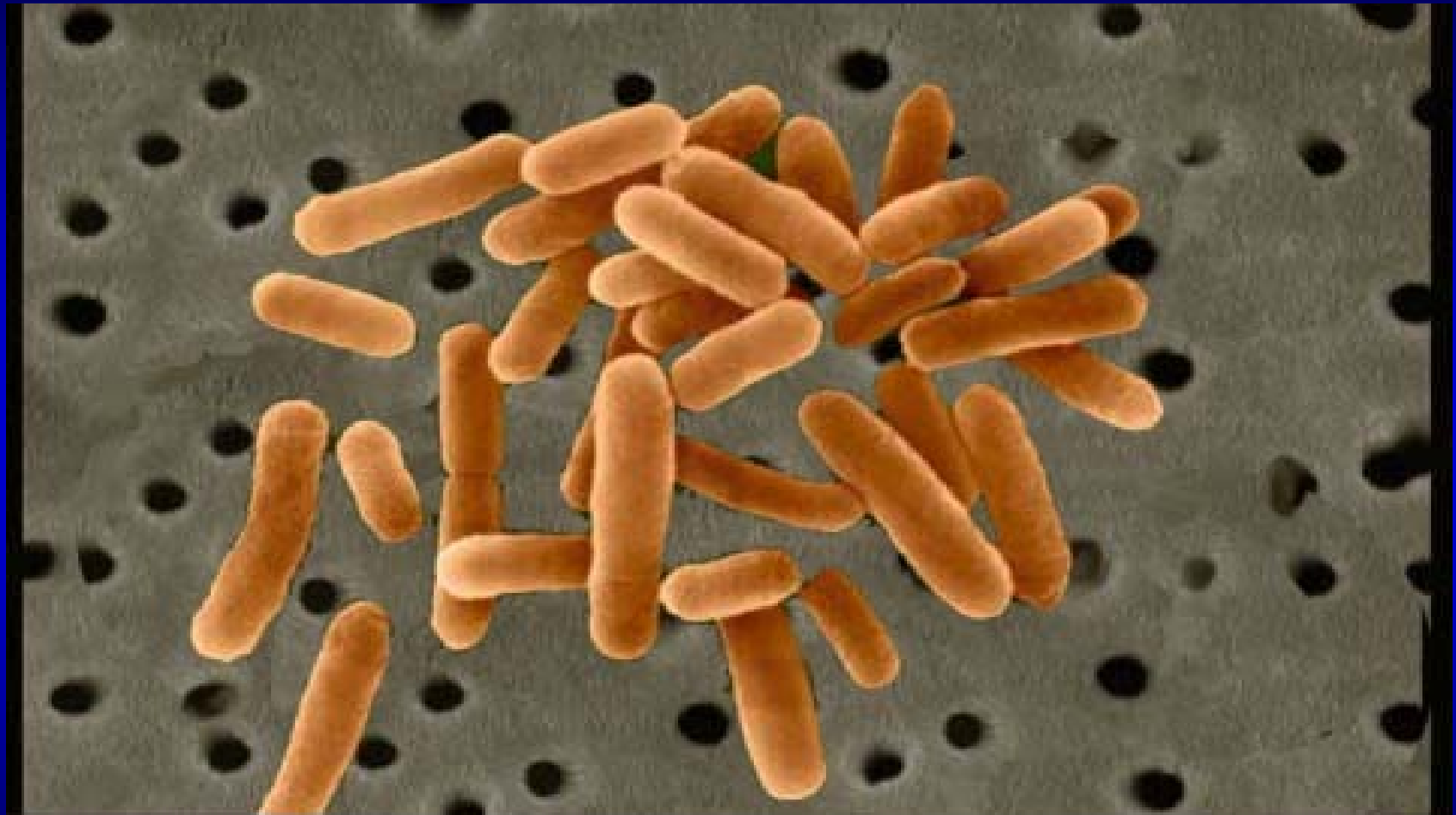


**Microfiltrated water  
from hospital showers :  
disposable versus resterilisable microfilters**

**A.Ragon, M. Zerrouki, C. Hindennach, V. Cantoni,  
J-P.Mussetta, A.Delaby, E.Tehhani, B.Lascola,**

**University hospitals of Marseille - France**

# Waterborne nosocomial infection : Legionella Pneumophilia



***Legionella Pneumophilia***

—| 1  $\mu\text{m}$

Size: 0.5 - 0.7 microns

**Problem : Colonization by Legionella  
of sanitary hot water networks**

**How to prevent the risk of Legionellosis ?**

**Solutions :**

- \* Clean the water network**
- \* Chemical disinfection**
- \* Thermic disinfection**
- \* Microfiltration**

## **2 types of 0,2 µm microfiltration are now available**

- \* Resterilisable microfilter**
- \* Single use microfilter**

**Resterilisable / Single use**

- is it safer ?**
- is it cheaper ?**

**University hospitals of Marseille : 3800 Beds**

**387 showers equipped with  
0,2  $\mu\text{m}$  resterilisable microfilters**

**2000 microfilters / year**

**Sterilisation of 2 m<sup>3</sup>/day of microfilters**

**Steam sterilisation**

**90 cycles at 125°C – 20 minutes**

**How to guarantee  
that the drying and sterilisation process  
respect the integrity  
of the 0,2  $\mu\text{m}$  microfilter membrane ?**

**How to certify the absence of LP  
from the showers ?**

# Technical Guide for water in hospitals

## Ministry of Health - March 2005

### \* Resterilisable 0,2 µm microfilter

*« After some sterilisations, micro-organisms can go through the microfilter membrane »*

*« The hospital must guarantee the permanent quality of the microfilters with integrity tests like bubble point or diffusion test »*

# Physical tests : Bubble point + Diffusion test

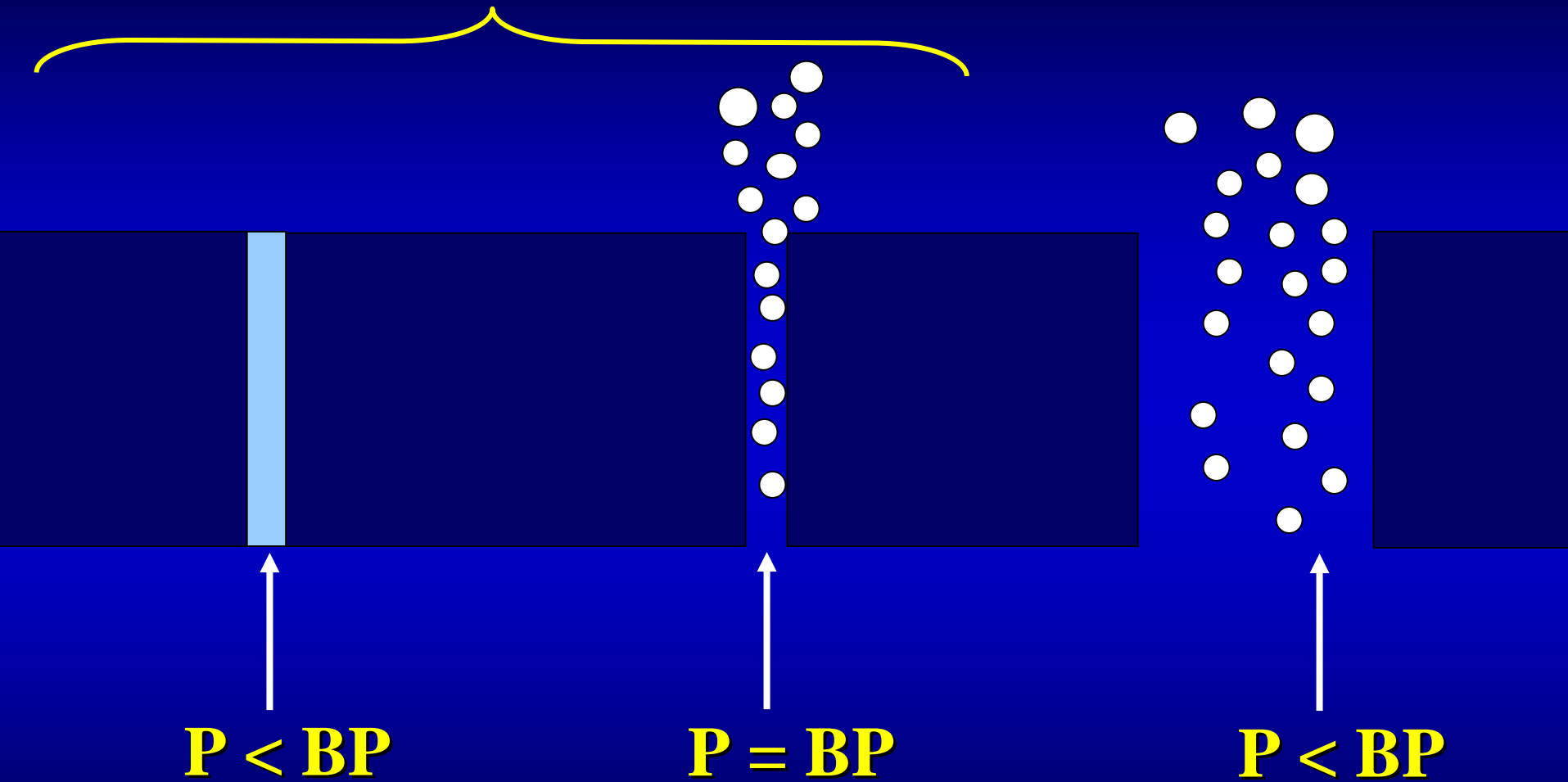


## Interests

- control of integrity
- 0,2  $\mu\text{m}$  membrane
- rapid test
- no destruction
- no contamination
- no research of bacteria

$\varnothing < 0,2 \mu\text{m}$

$\varnothing > 0,2 \mu\text{m}$



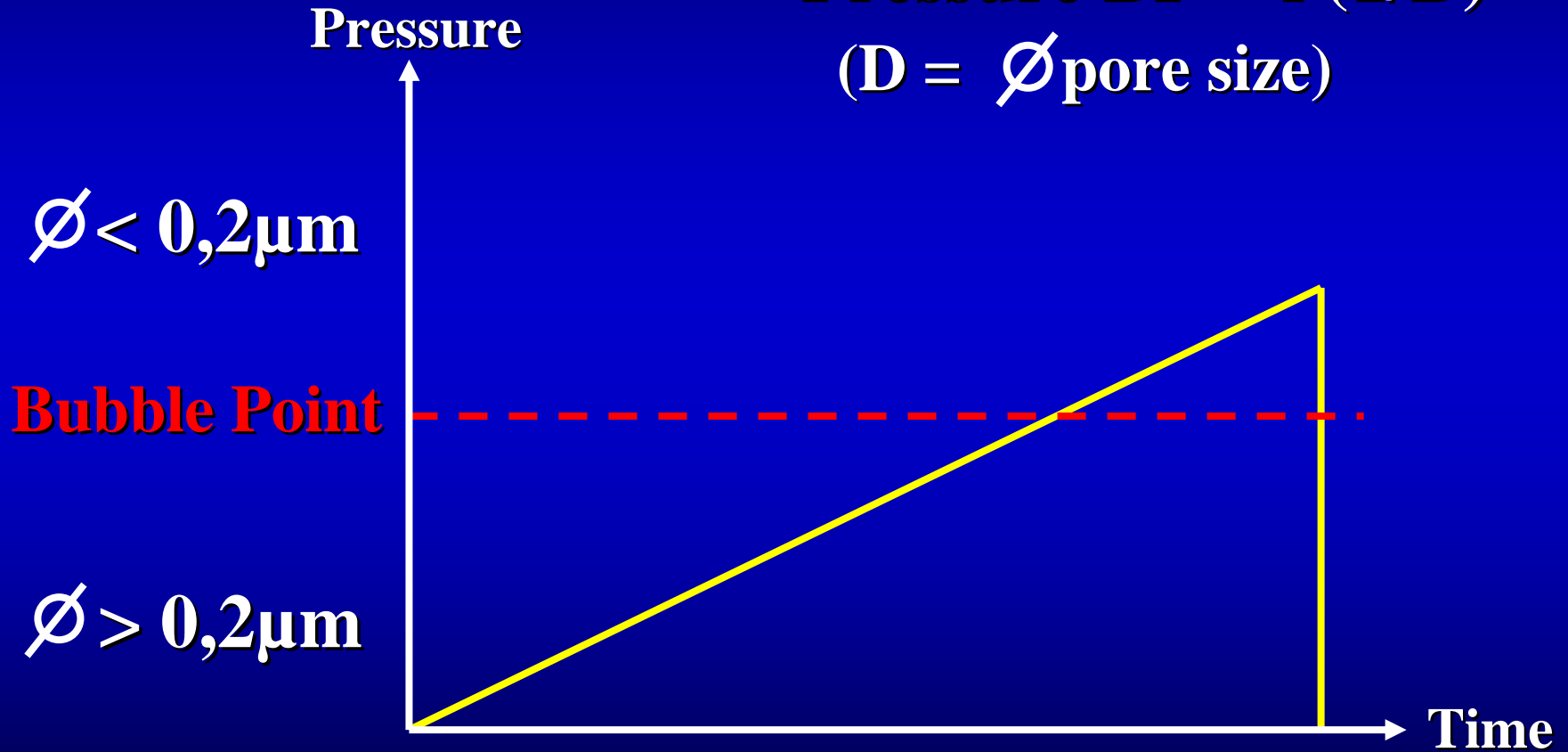
**P: Air Pressure**

**BP : Bubble Point**

# Relation Pressure and pore size

$$\text{Pressure BP} = f(1/D)$$

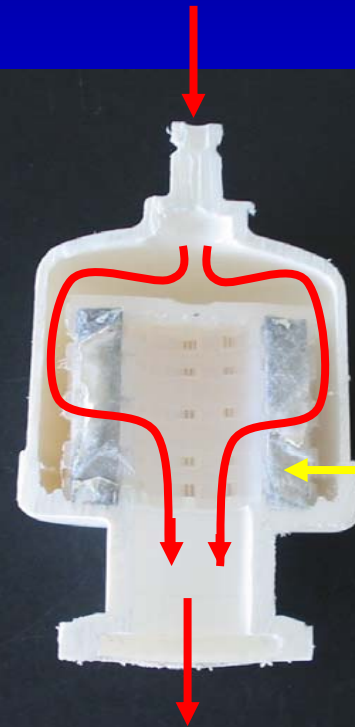
$$(D = \varnothing \text{ pore size})$$



# FILTRANIOS PV 1000

0,2  $\mu\text{m}$  microfilter

Up to 90 resterilisations at 125 °C – 20 min



Prefiltration  
+ 2  
0,2  $\mu\text{m}$   
membranes

0,2  $\mu\text{m}$  microfiltered water

**0,2 µm microfilter  
24h utilisation**

**Resterilisation every 24h  
125°C – 20 min  
Up to 90 resterilisations**

**45 uses**

**90 uses  
or fouling**

**YES**

**Physical tests  
Up to standard  
Bubble point + Diffusion test  
> 6000 tests**

**YES**

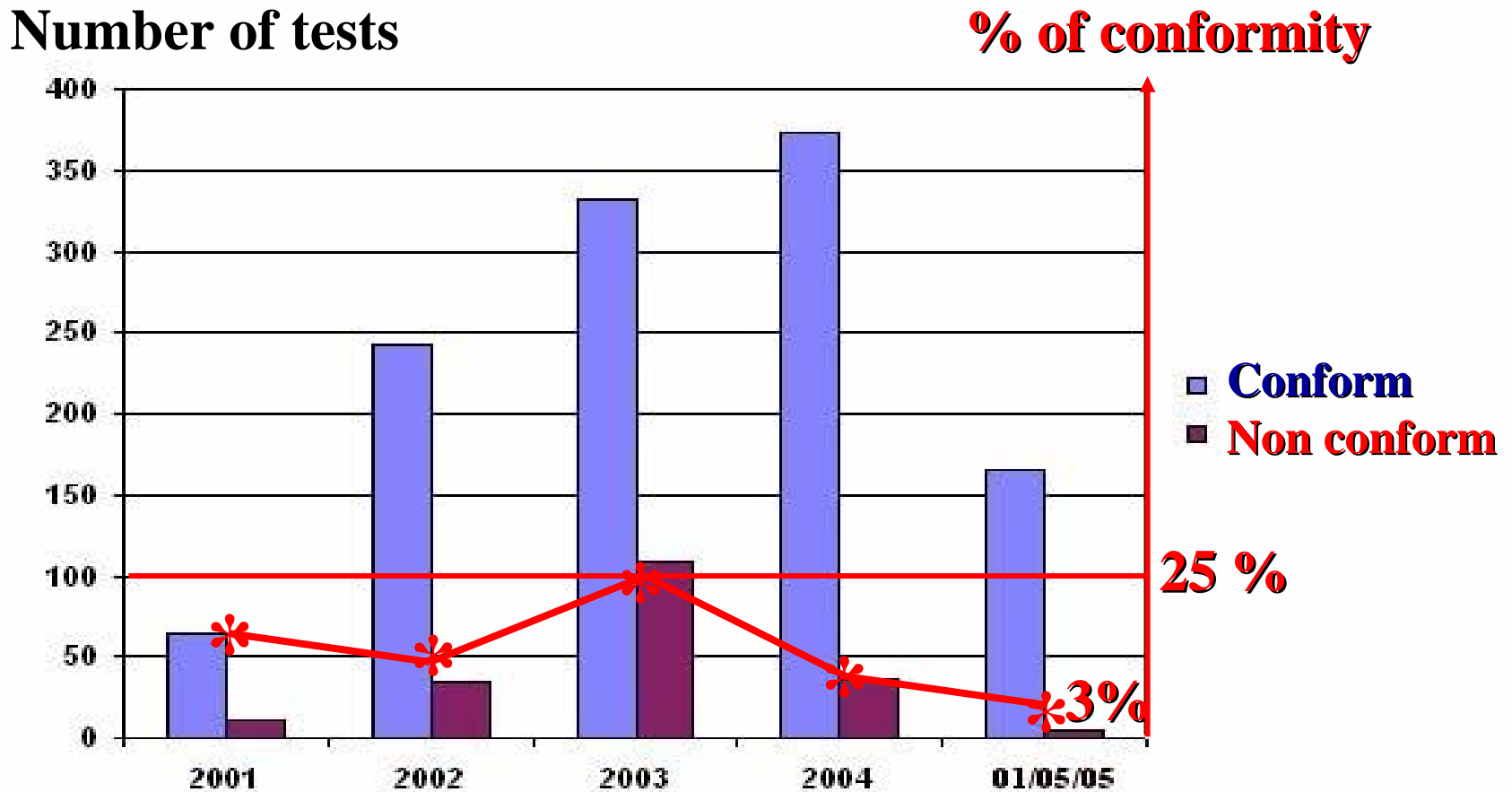
**Conformity  
certificate**

**NO**

**Non conformity  
certificate**

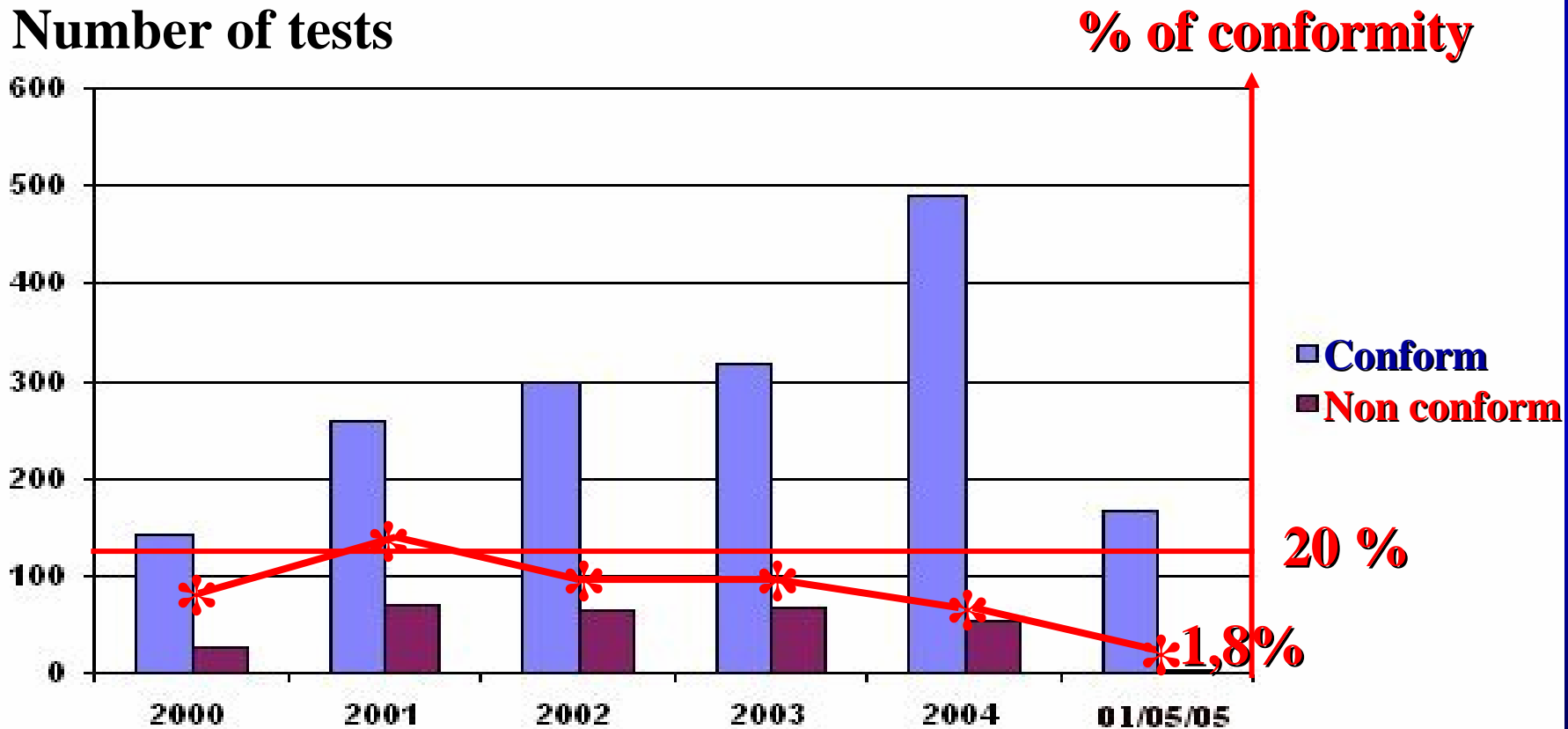
# Physical integrity tests after 45 sterilisations

## Bubble test and Diffusion test



# Physical integrity tests after 90 sterilisations

## Bubble test and Diffusion test



# Conclusion 1

## Resterilisable microfilters for showers

### Bubble point and Diffusion test :

Good tools to guarantee the integrity  
of the 0,2  $\mu$ m membrane

### Assurance quality system :

It improves the bacteriological security  
of microfiltered water for showers

# Origins of the deterioration of re-sterilisable 0,2 $\mu$ membrane ?

- Handling
- Drying
- Sterilisation



Single use microfilter : is it the solution ?

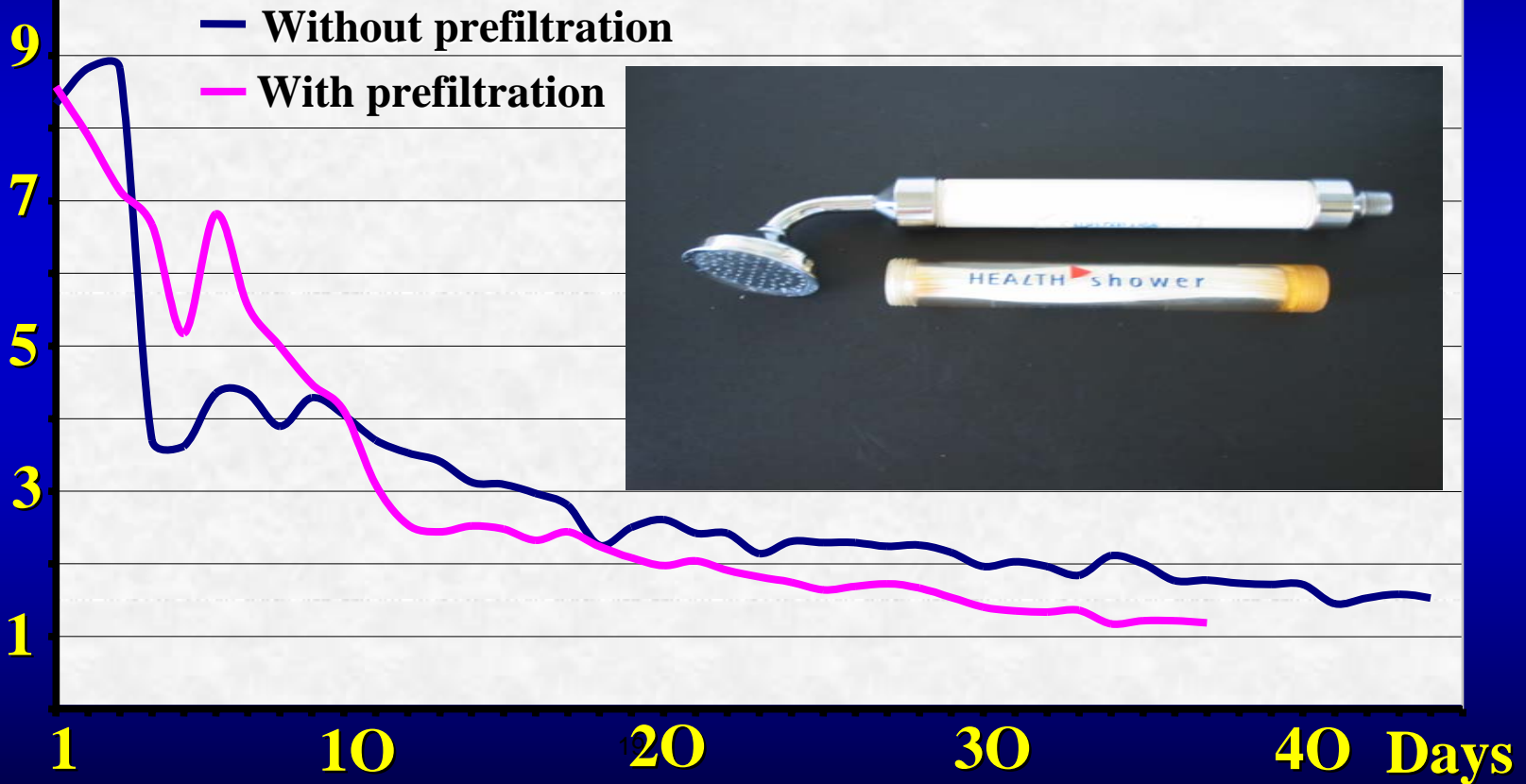
## Single use microfilters for showers

- **What is a real single use microfilter ?**
- **Is a single use microfilter safer / resterilisable microfilter to prevent legionella ?**

# Single use « Water line » 0,1 $\mu\text{m}$ hollow fibers microfilter

Flow rate

L/min





## Single use PALL Aquasafe L 14 days

10 microfilters tested

**Legionella Pneumophilia : 0 CFU/ L**

**Bubble tests : 2/10 no conformity**

**Diffusion tests : 10/10 conformity**



**PALL AQL3**  
**0,2 µm Microfilter**  
**Légionella pneumophila**  
**Single use 30 days**

# Validation of Microfilter PALL AQL3

**30 microfilters : 10 showers during 3 months**

**Prefiltrated showers -Fouling index : 1 to 4**

## Legionella Pneumophila

Before microfiltration :  $10^3 - 10^5$  CFU/ L

After microfiltration : 0 CFU/L (80 research)

(every week on every shower)

# Flow rate

L/min

## 1 month single use - PALL - AQL3

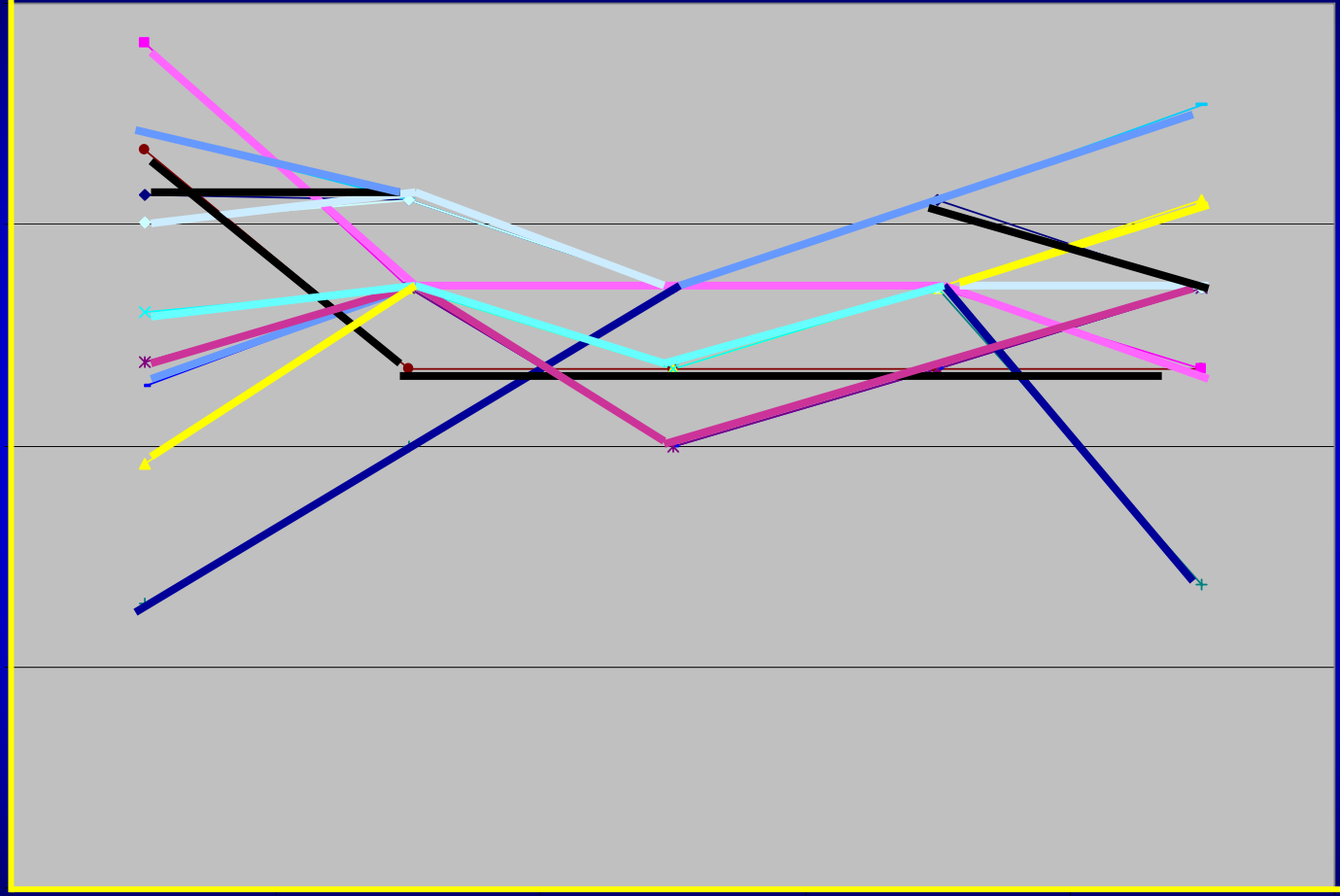
FLOW RATE AQL3 18/02/04 - 18/03/04 LA TIMONE SERVICE PR FAVRE

12 L/min

10 L/min

8 L/min

Débit (L/min)



- 211
- 212
- 213
- 214
- 215
- 201/202
- 203/204
- 205/206
- 207/208
- 209/210

Flow 0 AQL3  
18/02/2004

Flow 1 AQL3  
26/02/2004

Flow 2 AQL3  
04/03/2004

Flow 3 AQL3  
11/03/2004

Flow 4 AQL3  
18/03/2004

Weeks

# Flow rate L/min

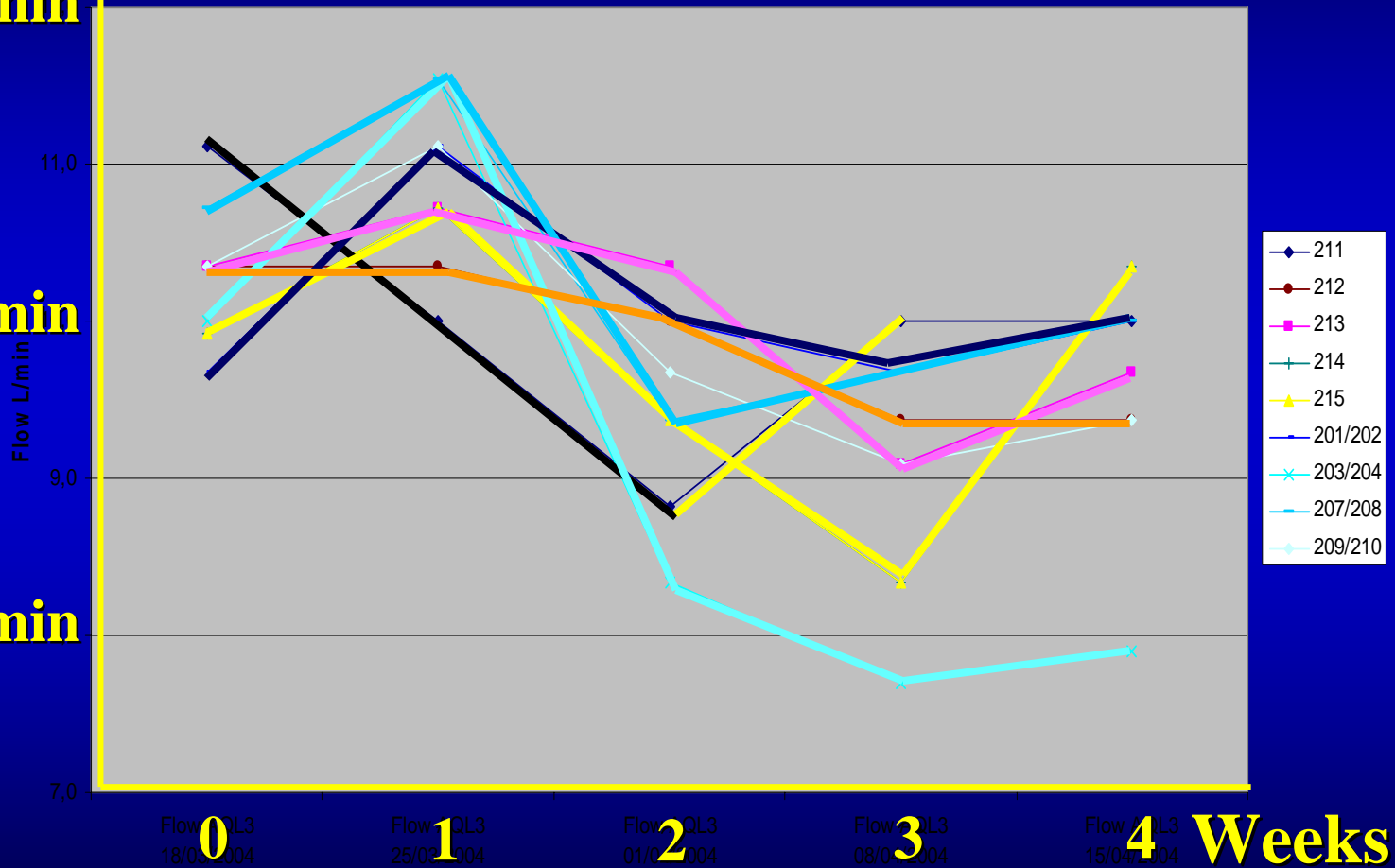
## 1 month single use - PALL AQL3

FLOW RATE AQL3 18/03/04 - 15/04/04 LA TIMONE SERVICE PR FAVRE

12 L/min

10 L/min

8 L/min



# Cost study resterilisable/single use microfilter

	<b>Resterilisable filter ANIOS PV 1000</b>	<b>Single use filter PALL AQL3</b>
<b>Useful lifetime</b>	<b>69 days</b>	<b>30 days</b>
<b>Number/shower/year</b>	<b>5,3/year</b>	<b>12/year</b>
<b>Cost /microfilter</b>	<b>106,4 €</b>	<b>82,5 €</b>
<b>Cost: filter/shower/year</b>	<b>564 €</b>	<b>990 €</b>
<b>Cost: resterilisation/day</b>	<b>1,56 €</b>	<b>0 €</b>
<b>Cost: resterilisation/an</b>	<b>570 €</b>	<b>0 €</b>
<b>Legionella Pneumophila</b>	<b>95 €</b>	<b>0 €</b>
<b><u>Total cost/shower/year</u></b>	<b><u>1229 €</u></b>	<b><u>990 €</u></b>

## Conclusion 2

**Single use microfilters for showers seems to be:**

- **safer to prevent Legionella Pneumophila infections**
- **cheaper / resterilisable microfilter**
- **more convenient to use**