

CARACTERISTIQUES PHYSICO-CIMIQUES,  
MICROBIOLOGIQUES ET TOXICOLOGIQUES  
DES EFFLUENTS HOSPITALIERS

*HOSPITAL WASTEWATERS : PHYSICO-CHEMICAL,  
MICROBIOLOGICAL AND TOXICOLOGICAL  
CHARACTERISTICS*

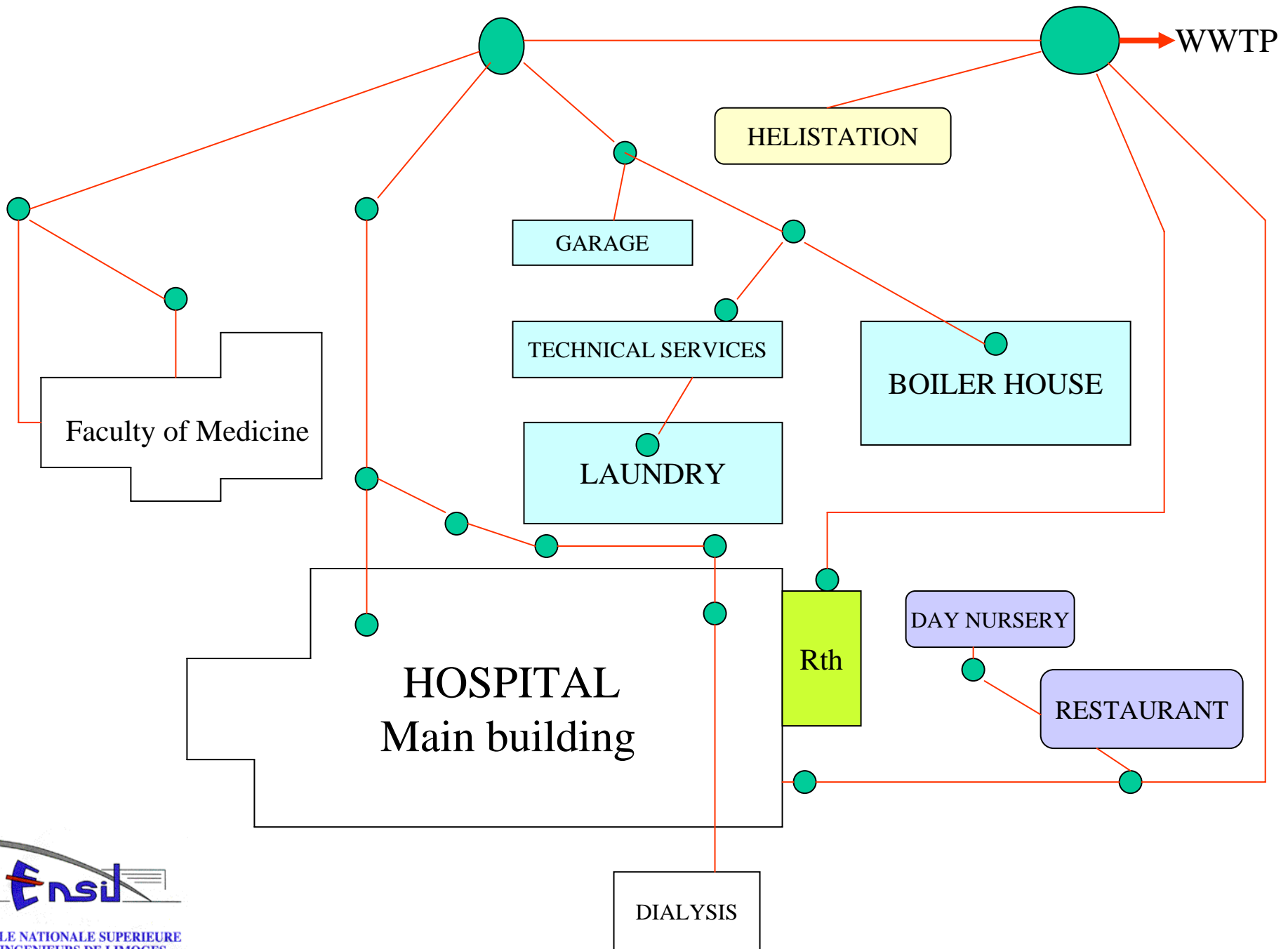
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# WATER CONSUMPTION

	<b>VOLUME (m<sup>3</sup>)</b>	<b>%</b>
Main building	286100	69,87
Boiler house	31000	7,09
Laundry	63100	14,43
Hemodialysis	8300	1,90
Restaurant	12800	2,92
Day nursery	1000	0,22
Technical services	780	0,18
Garage	300	0,07
Faculty of medicine*	13900	3,20
Watering (public park)	100	0,02
<b>TOTAL</b>	<b>437480</b>	<b>100</b>

1200 m<sup>3</sup> per day (\* excepted) - 1400 patients  
850 L per day per patient

# ANALYTICAL SAMPLES

\* **WEEK** (for 7 consecutive days)

⇒ 9 weeks over a period of 3 years

\* **WASTE WATER SAMPLE :**

→ prelevé from the main sewer of each building

→ function of flow and time

# EXPERIMENTAL



## WASTE WATER FROM 4 HOSPITALS (300 to 1400 hospital beds)

- **Physical-chemical characteristics**
- **Microbiological characteristics**
- **Toxicological characteristics**
- **Genotoxic characteristics**

# PHYSICAL-CHEMICAL CHARACTERISTICS

<b>Parameter</b>	<b>Limoges Hospital (mg / L)</b>	<b>Limoges WWTP (mg / L)</b>	<b>WWTP General Values (mg / L)</b>
COD	630 (370 – 1100)	510	300 - 1000
BOD <sub>5</sub>	243 (100 – 400)	240	100 – 400
Total Suspended Solids	125 (35 – 170)	285	150 – 500
N (organic nitrogen)	35 (25 – 55)	43	30 – 100
TP (total phosphorus)	10 (7 – 30)	10	10 – 25
DETERGENTS	27 (12 – 64)	8	6 - 13

# PHYSICAL-CHEMICAL CHARACTERISTICS

## POLLUTANT AMOUNT / DAY / PERSON IN DOMESTIC WASTEWATER

<b>COD</b>	85 g
<b>BOD</b>	43 g
<b>OM</b> (oxidizable matters)	57 g
<b>TSS</b>	90 g
<b>N</b>	15 g
<b>P</b>	4 g

$$MO = (COD + 2BOD) / 3$$

# PHYSICAL-CHEMICAL CHARACTERISTICS

1200 m<sup>3</sup> / day - 1400 hospitals beds

850 L / day / patient

<b>PARAMETERS</b>	<b>AMOUNT (Kg / day)</b>	<b>CORRESPONDANCE WITH DOMESTIC WASTEWATER (EQ / person)</b>
<b>COD</b>	708	8329
<b>BOD</b>	315	7325
<b>OM</b>	436	7650
<b>TSS</b>	150	1666
<b>N</b>	42	2800
<b>P</b>	12	3000



# HEAVY METALS

## METHOD : ATOMIC ABSORPTION SPECTROMETRY

- lower than the detection threshold for:

Zu - Cd - Ni - Pb - Cr

- occasionally presence for :

Ag : 0 to 13  $\mu\text{g.L}^{-1}$  (2002)  
3 to 80  $\mu\text{g.L}^{-1}$  (1997)

Hg : 0 to 20  $\mu\text{g.L}^{-1}$  (2002)  
0 to 80  $\mu\text{g.L}^{-1}$  (1997)

- permanent presence for :

Cu : 3 to 28  $\mu\text{g.L}^{-1}$  (2002)  
3 to 30  $\mu\text{g.L}^{-1}$  (1997)

# MICROBIOLOGICAL CHARACTERISTICS

PARAMETER	UFC / ml
Total aerobic microorganisms	200000
Coliforms	15000
thermotolerant coliforms	15000
<i>E. Coli</i>	5000
Faecal Streptococcus	11000
Enterococcus	2000
<i>Pseudomonas aeruginosa</i>	1300
Clostridium	450
Staphylococcus	< 10
Salmonella spp.	100
Salmonella (pathogenic)	0

# MICROBIOLOGICAL CHARACTERISTICS

## Microorganisms and resistance to antibiotics

*E. Coli*

*Enterococcus faecium*

*Enterococcus faecalis*

*Pseudomonas aeruginosa*

*Staphylococcus xylosum*

*Staphylococcus sciuri*

*Staphylococcus caprae*

*Proteus mirabilis*

*Proteus vulgaris*

*Enterobacter sakazakii*

*Acinetobacter spp.*

*Citrobacter freundii*

# TOXICOLOGICAL CHARACTERISTICS

## MICROTOX TEST

- *Photobacterium phosphoreum*
- luminescent bacteria

EC 50 % :        wastewater concentration (%)  
                         inhibiting 50 % of luminescence

Equitox / m<sup>3</sup> = 1 / EC 50 %

# TOXICOLOGICAL CHARACTERISTICS

## RESULTS

equitox / m <sup>3</sup>	equitox / day *	equitox / person **
8 (3,5 - 22)	9600	48000

\* 1400 m<sup>3</sup> / day

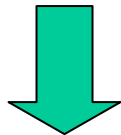
\*\* 0,2 equitox / person / day

# **Influence of hospital wastewater on WWTP efficiency**

## **•METHODS :**

**Comparison between the respirometric activity of an activated sludge (pilot scale) with and without adding hospital effluent (Limoges hospital wastewater (2 % V/V))**

- Measurement of the dissolved oxygen with an accurate oxygen probe (ppm)**
- Calculation of the oxygen uptake rate**



**10 % of inhibition in term of the OUR**