Water Treatments Overview

Drinking Water Treatment
Municipal & Industrial Wastewater Treatment
Boiler Water Treatment
Desalination (RO Water Treatment)
Industrial Process water

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Water Treatments Overview

Drinking Water Treatment

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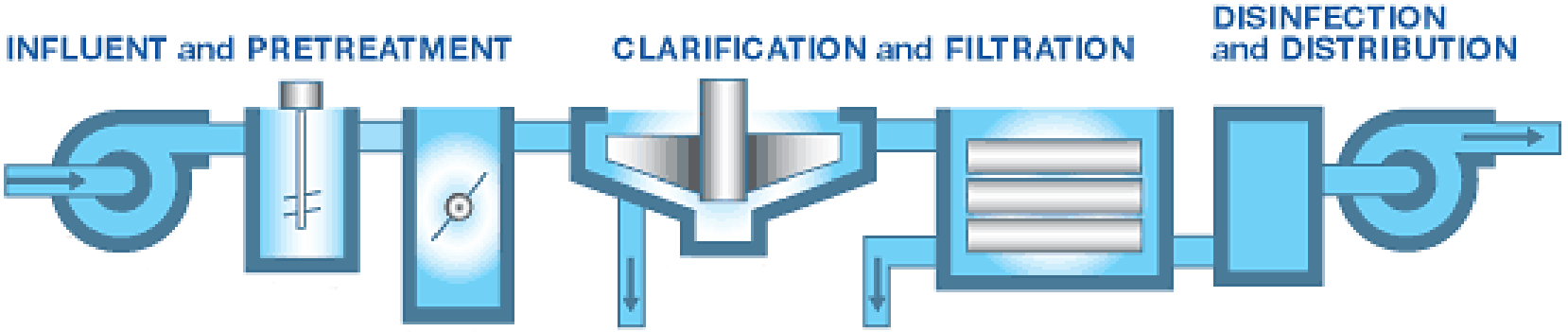
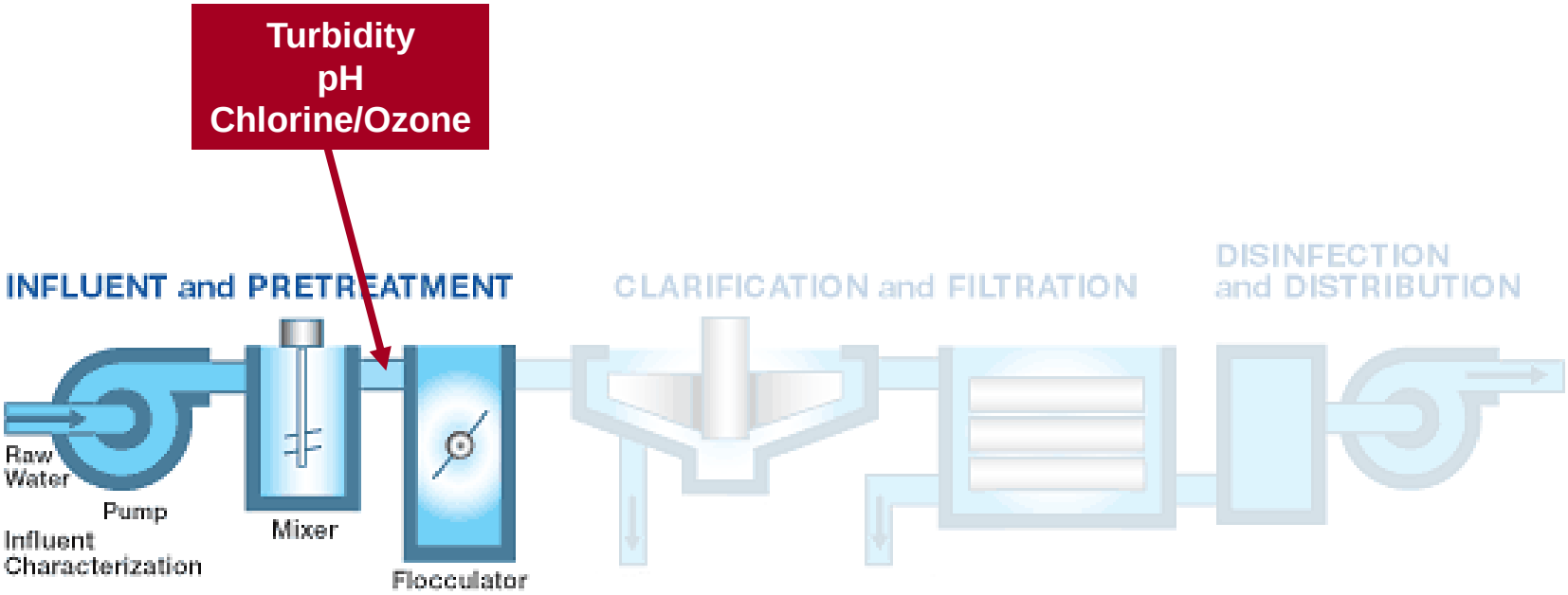
Drinking Water Treatment Flow Diagram



Drinking Water Treatment Flow Diagram



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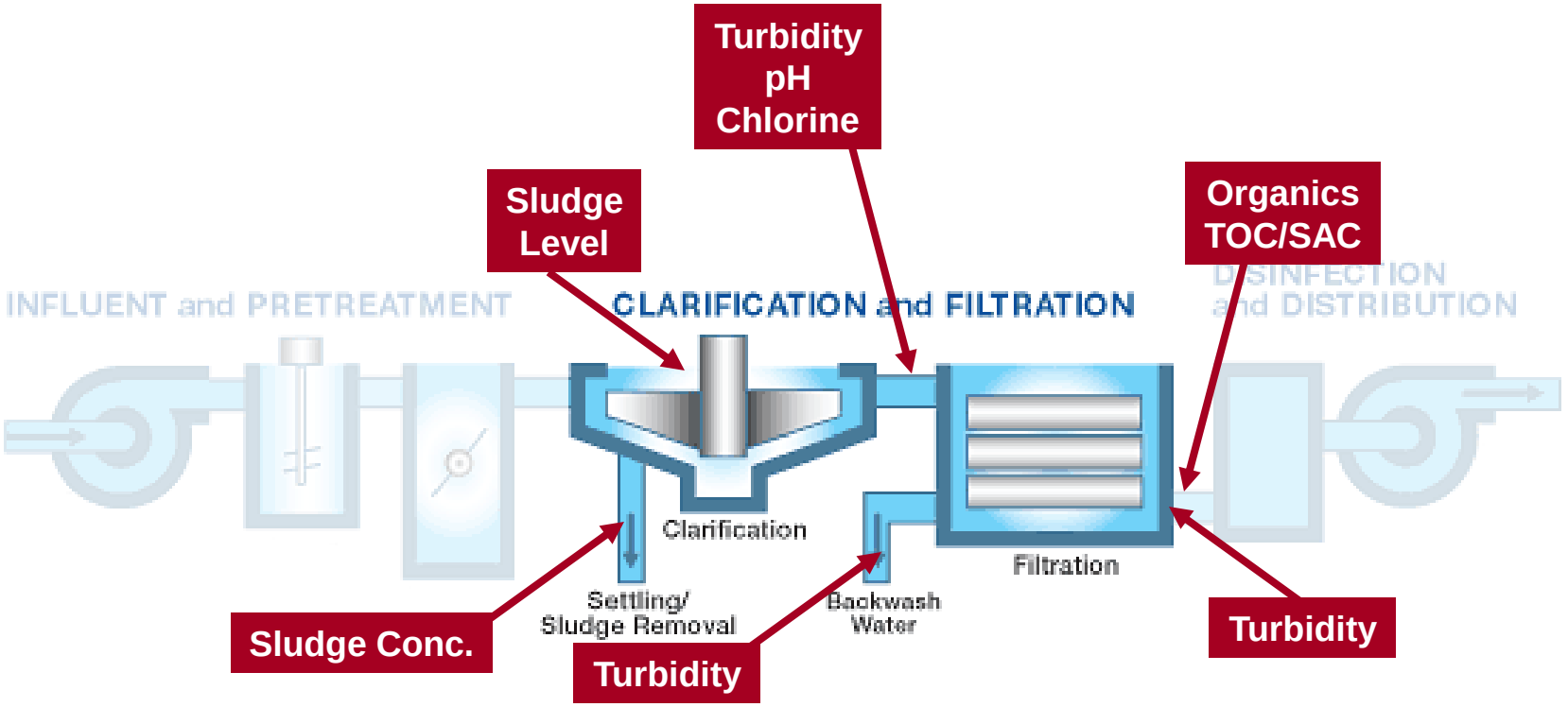
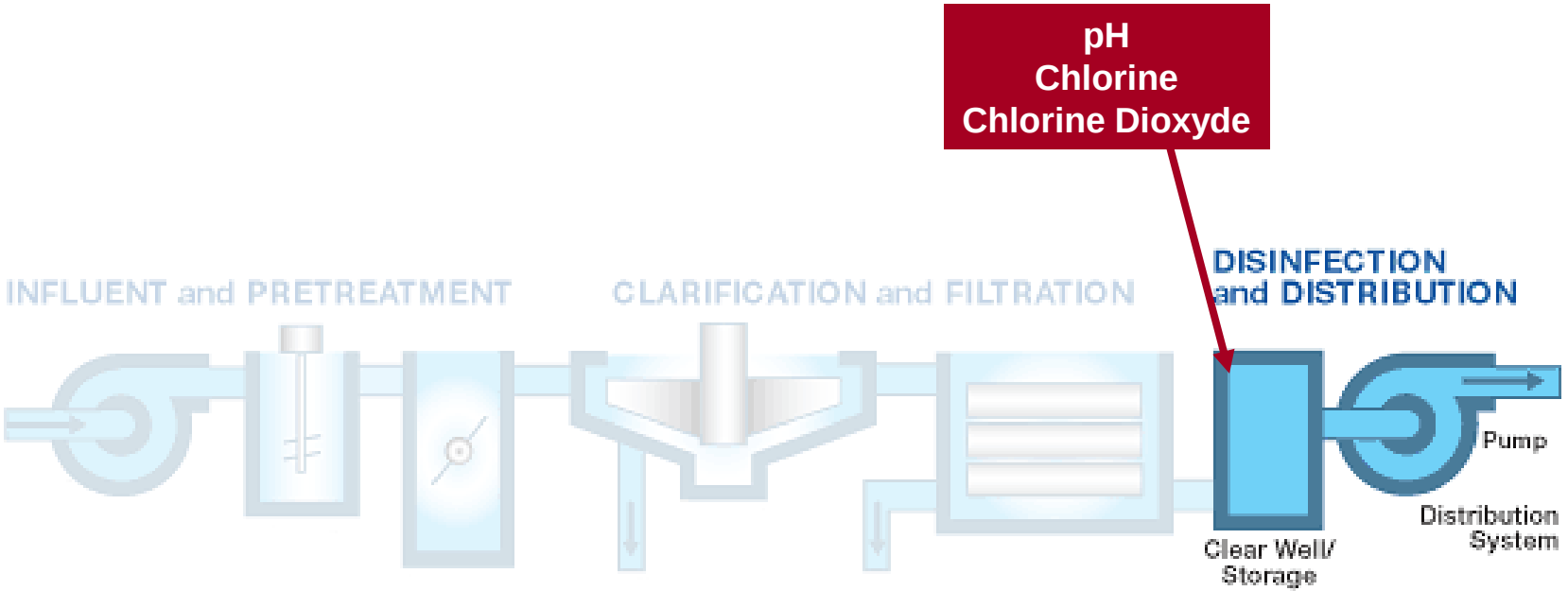


Drinking Water Treatment Flow Diagram



Water Treatments Overview

Municipal & Industrial Wastewater Treatment

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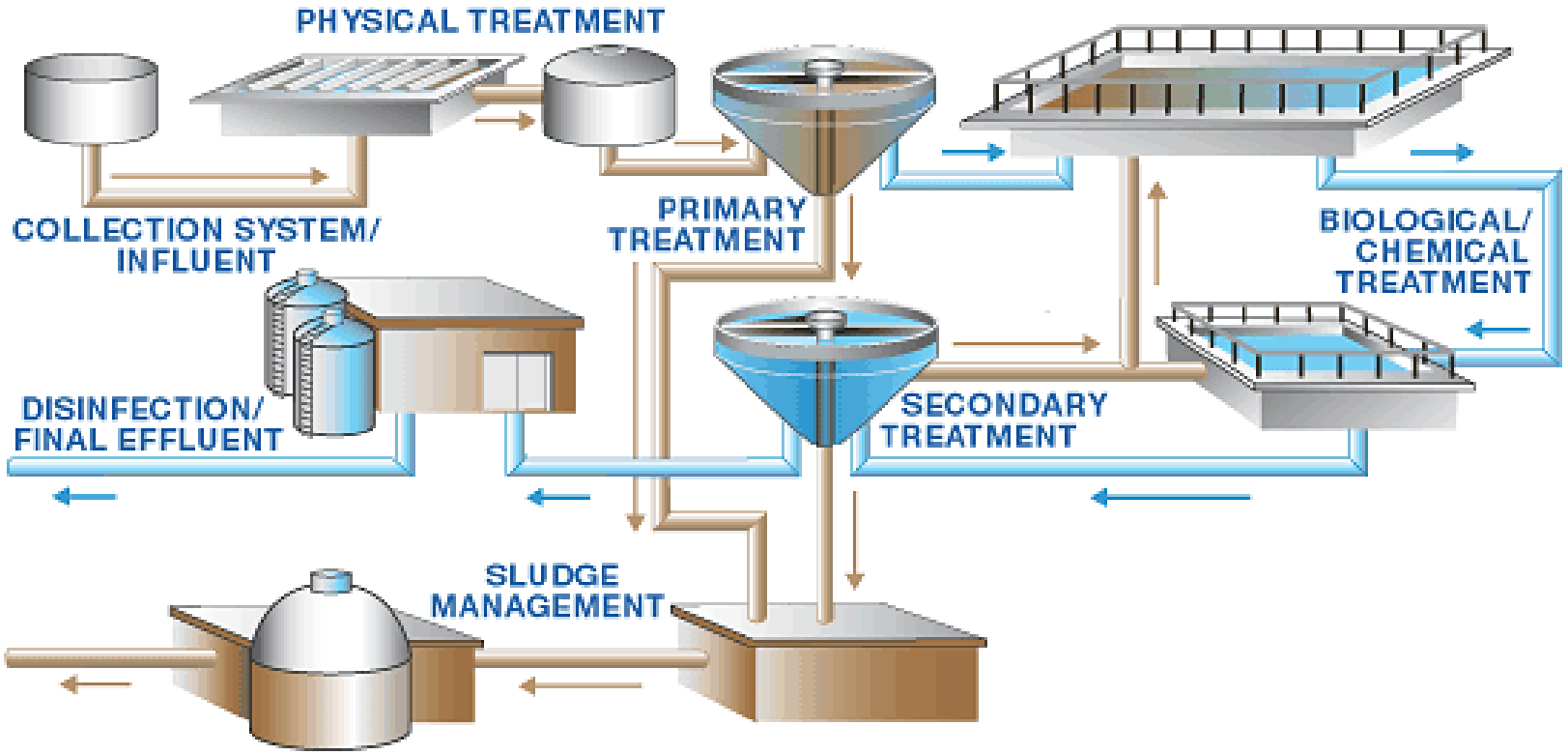
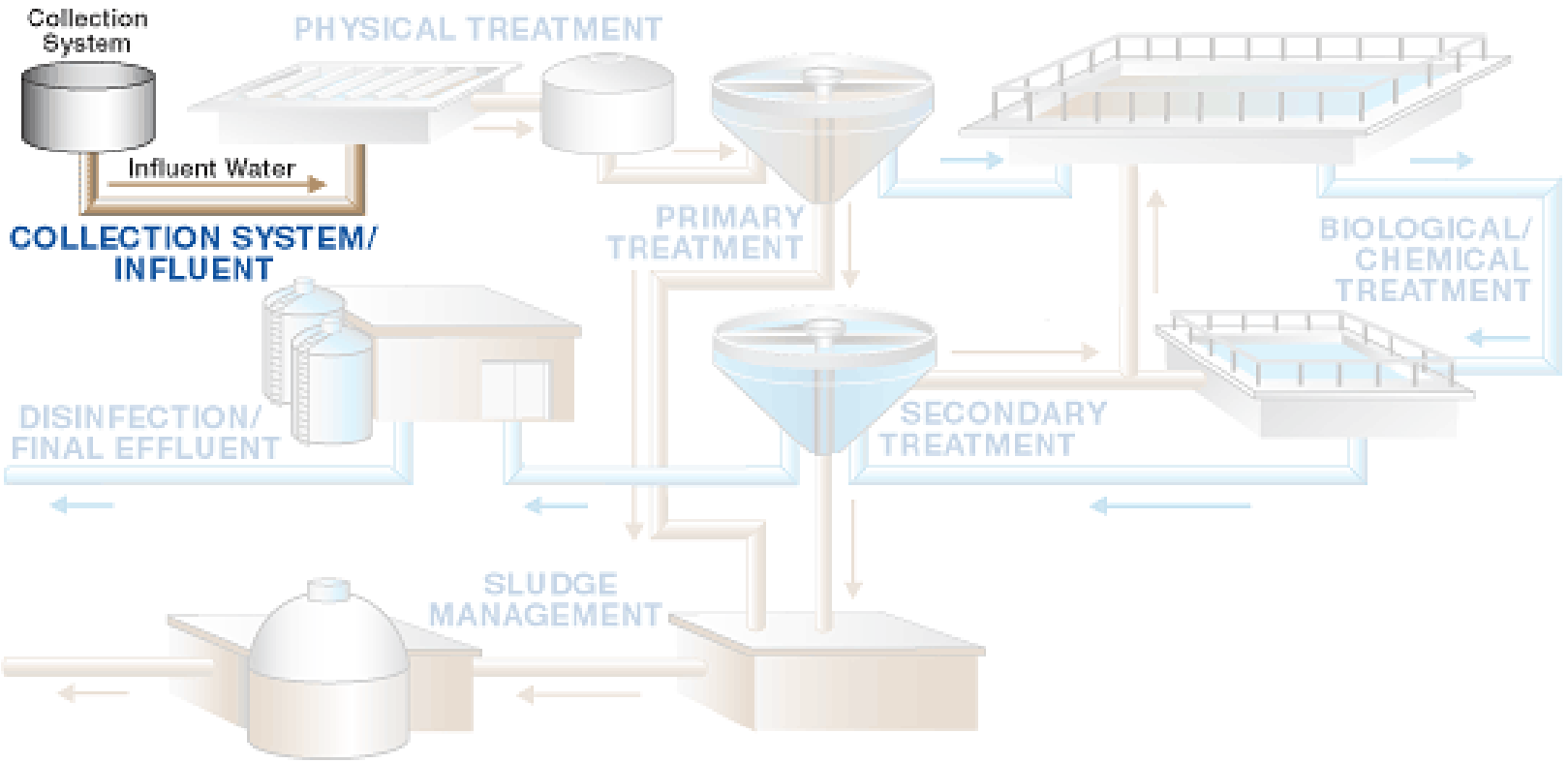
Municipal & Industrial Water Treatment Flow Diagram

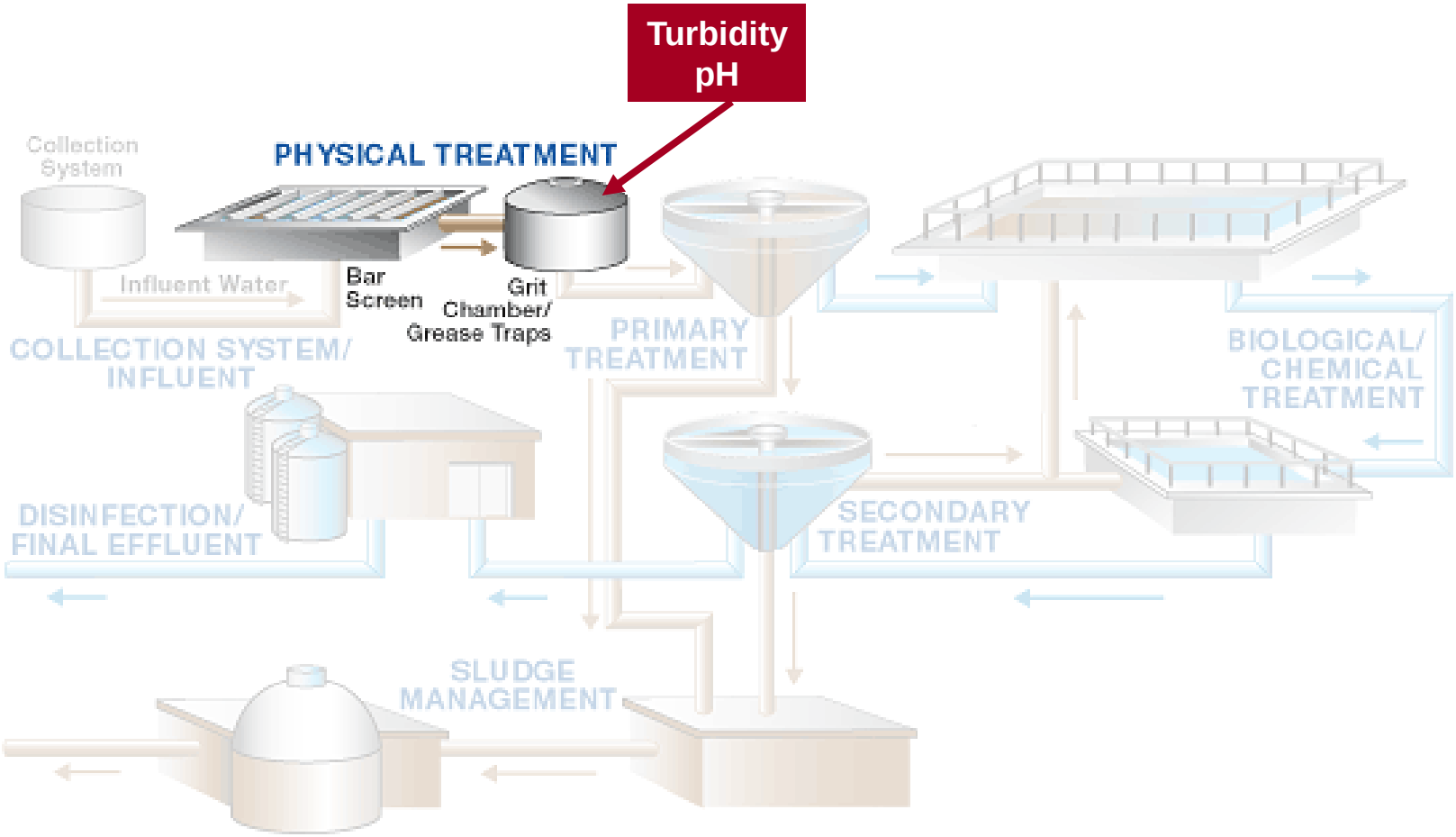


Municipal & Industrial Water Treatment Flow Diagram



Municipal & Industrial Wastewater Treatment

Municipal & Industrial Water Treatment Flow Diagram



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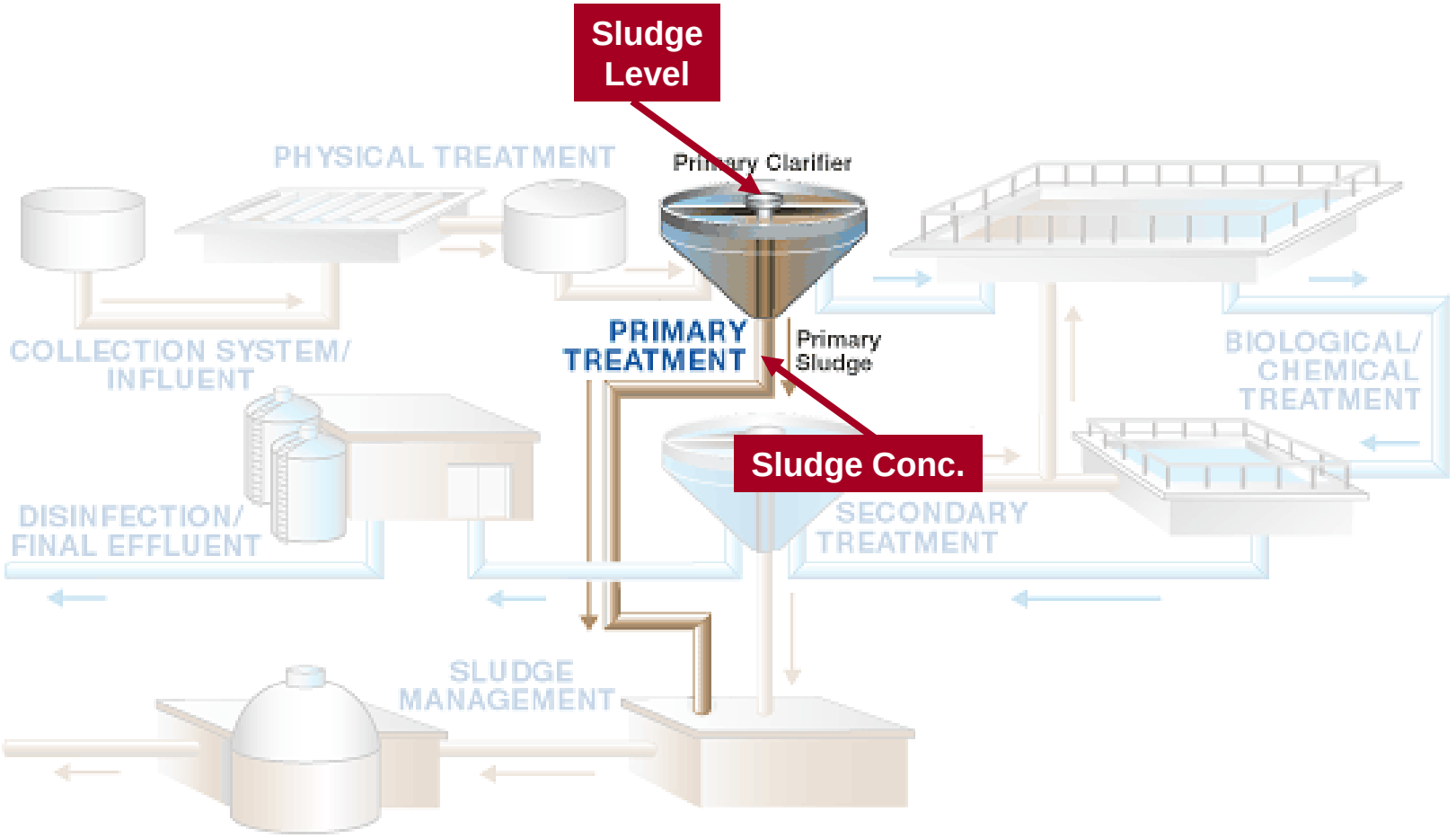
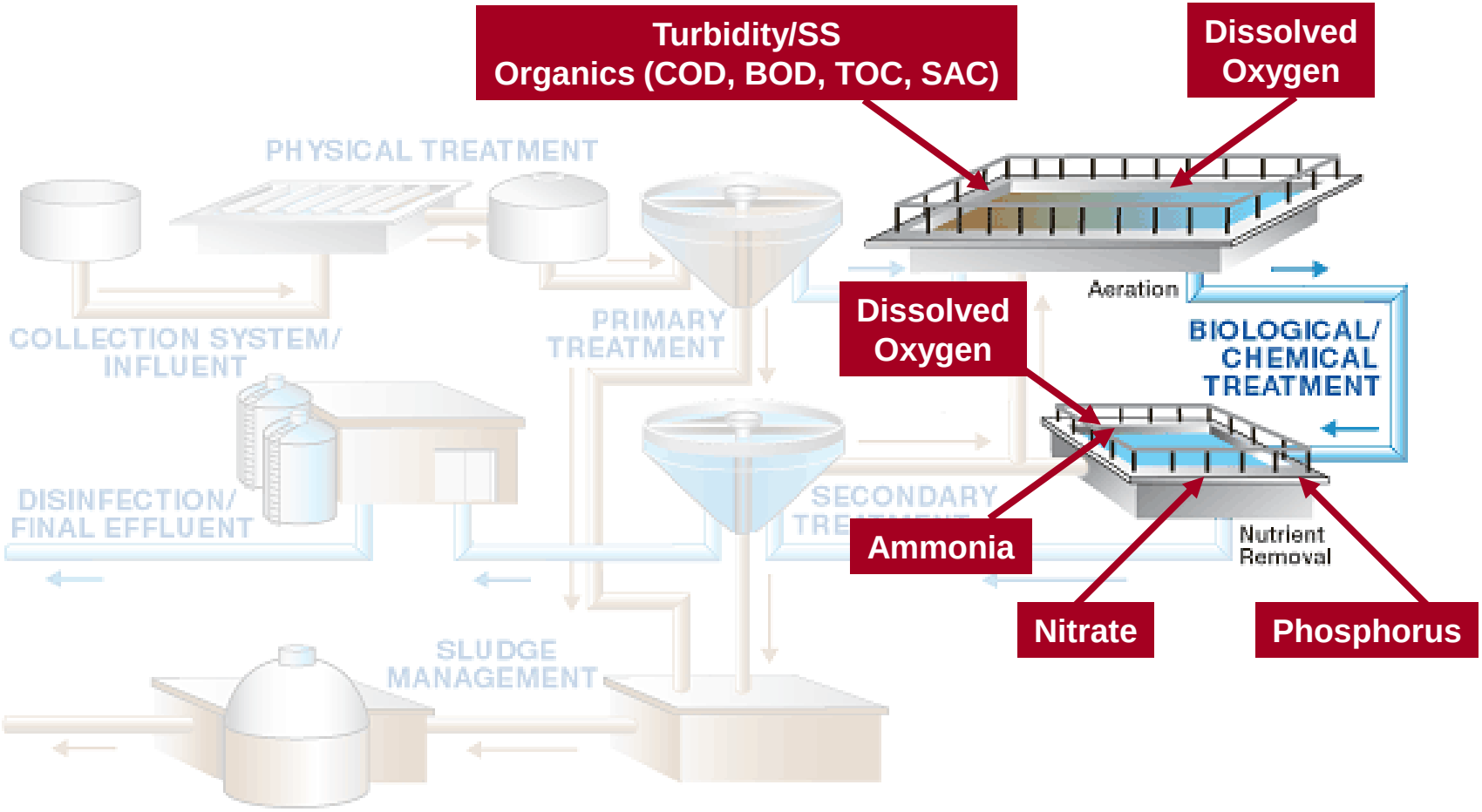


Municipal & Industrial Water Treatment Flow Diagram



C -elimination

Dissimilation (approx. 30 %) principle : $C + O_2 \rightarrow CO_2$

Assimilation (approx. 70 %) principle : $C + O_2 \rightarrow$ organic growth

• So the main part of C-elimination is done via incorporating the carbon into undissolved bacteria mass and afterwards taking that bio-mass out of the water.

• Only a minor part of the influents carbon is stripped as carbon-dioxid into the air.

• Both is done by C -heterotroph bacteria under certain conditions like :

➲temperature between 5 - 33 °C

➲ pH-value between 6 - 8

➲ supply with degradable nutriments (C : N : P)

➲ sufficient supply with dissolved oxygen (above 2,0 mg/l O_2)

N –elimination (Nitrification)

• WWTP´s influent contains nitrogen mainly as NH_4 and organic N (like Urea, Proteins).

• Due to the fact that NH_4 at pH-levels above 8 is toxic to fish, Nitrification for N - elimination had been done since approx. 40 years :

Nitrification step I principle : $NH_4 + O_2 \rightarrow NO_2$

What is simplified mentioned under „principle“ is done by a very specific C -autotroph bacteria called ***nitrosomonas***.

Unfortunately the product of that micro-organismen work (NO_2) is highly toxic to fish, so it is essential to operate a:

Nitrification step II principle : $NO_2 + O_2 \rightarrow NO_3$

that accrued NO_3 is formed by another C -autotroph bacteria called ***nitrobacter***.

Unfortunately those don´t like the presence of NH_4.

So ***only*** if both bacterias are acting synchroniously they can perform the complete 2-stage process of Nitrification in a sufficiant way.

N –elimination (Denitrification)

• The real decrease of total nitrogen in water is done by several specia of C -heterotroph micro-organismen.

• They are called denitrificants and reducing the dissolved NO_3 into molecular nitrogen (N_2-gas), which can be stripped out of the water :

Denitrification principle : NO_3 → N_2

therefor the mentioned below conditions should be given :

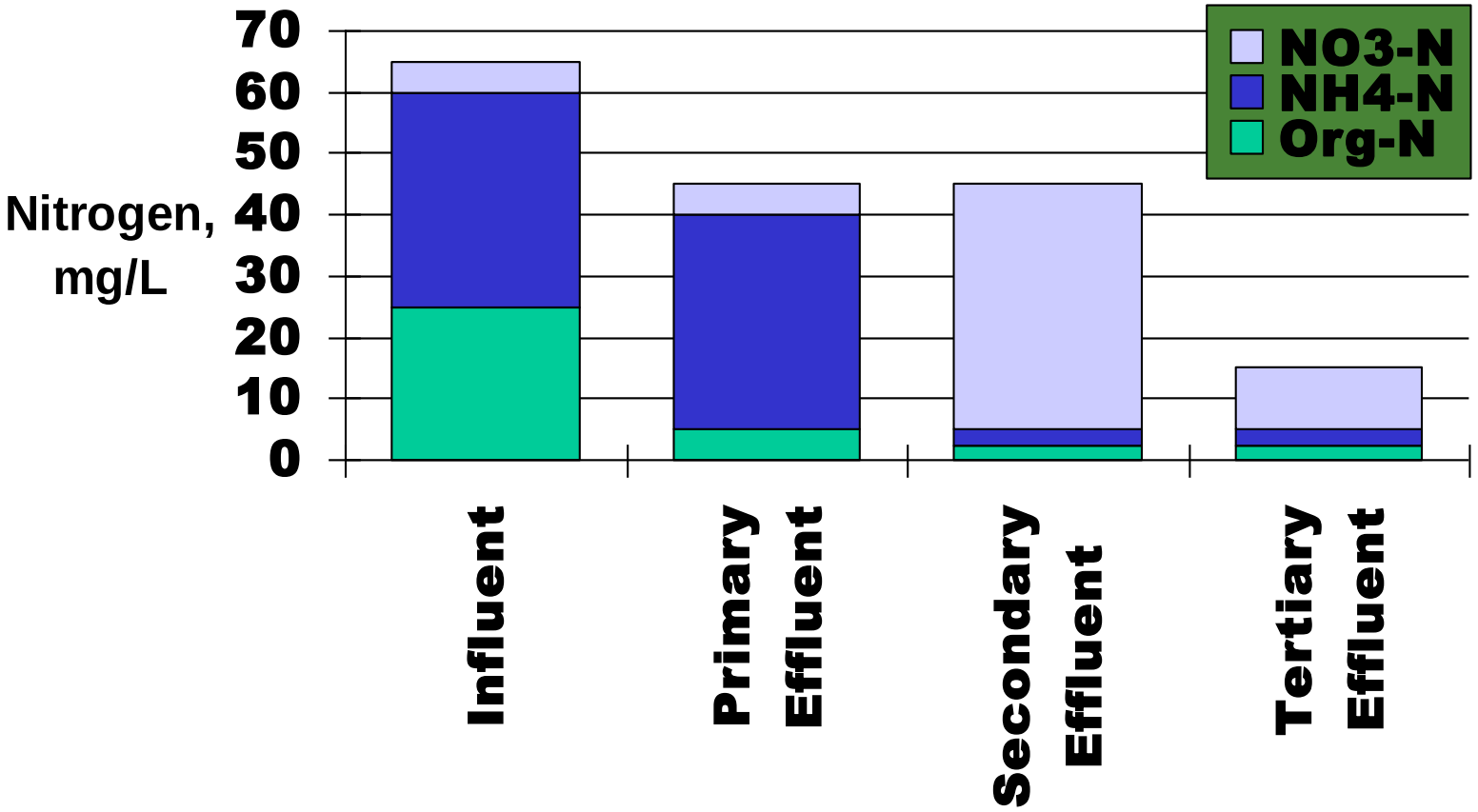
➲ supply with degradable C-source (because bacteria is C -heterotroph)

➲ pH-value between 6,0 - 8,0

➲ absence of *dissolved* oxygen (**anoxic** conditions)

Denitrification as an advanced N -elimination is done in Germany since approx. 30 years.

Nitrogen Forms, Concentration vs. Wastewater Treatments



P -elimination

This elimination can be done

- by precipitants (chemical removal)
- by bacteria (biological removal).

Chemical removal principle : $PO_4^{3-} + Me^{3+} \rightarrow MePO_4 \downarrow$

By adding dissolved salts of aluminia or iron (Me3+) you can transfer the also dissolved ortho-phosphates into poorly soluable aluminia- or iron-phosphates, which can be taken out at the settling tank.

necessary conditions:

➲ pH-value of 5,5 ($FePO_4$) or 6,0 to 7,0 ($AlPO_4$), which normally can´t be achieved on a WWTP

➲ an excess of aluminia- or iron-ions in ratio to the phosphates that have to be precipitated (so called „beta-value“)

P -elimination

Biological removal principle:

incorporation of dissolved phosphates based on a bacterias luxury-uptake-effect

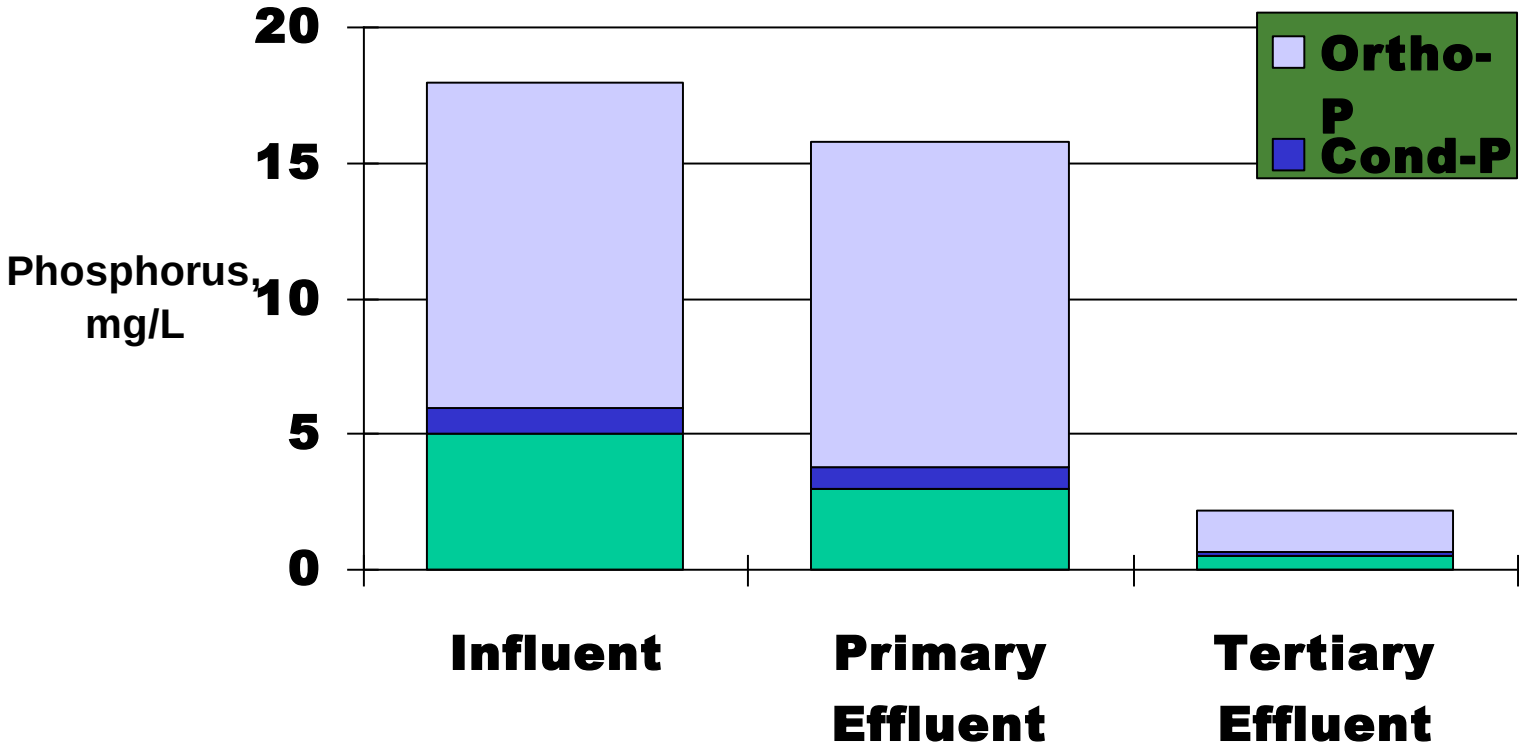
(to TAKE up more phosphates, than bacteria formerly had GIVEN up)

necessary conditions are :

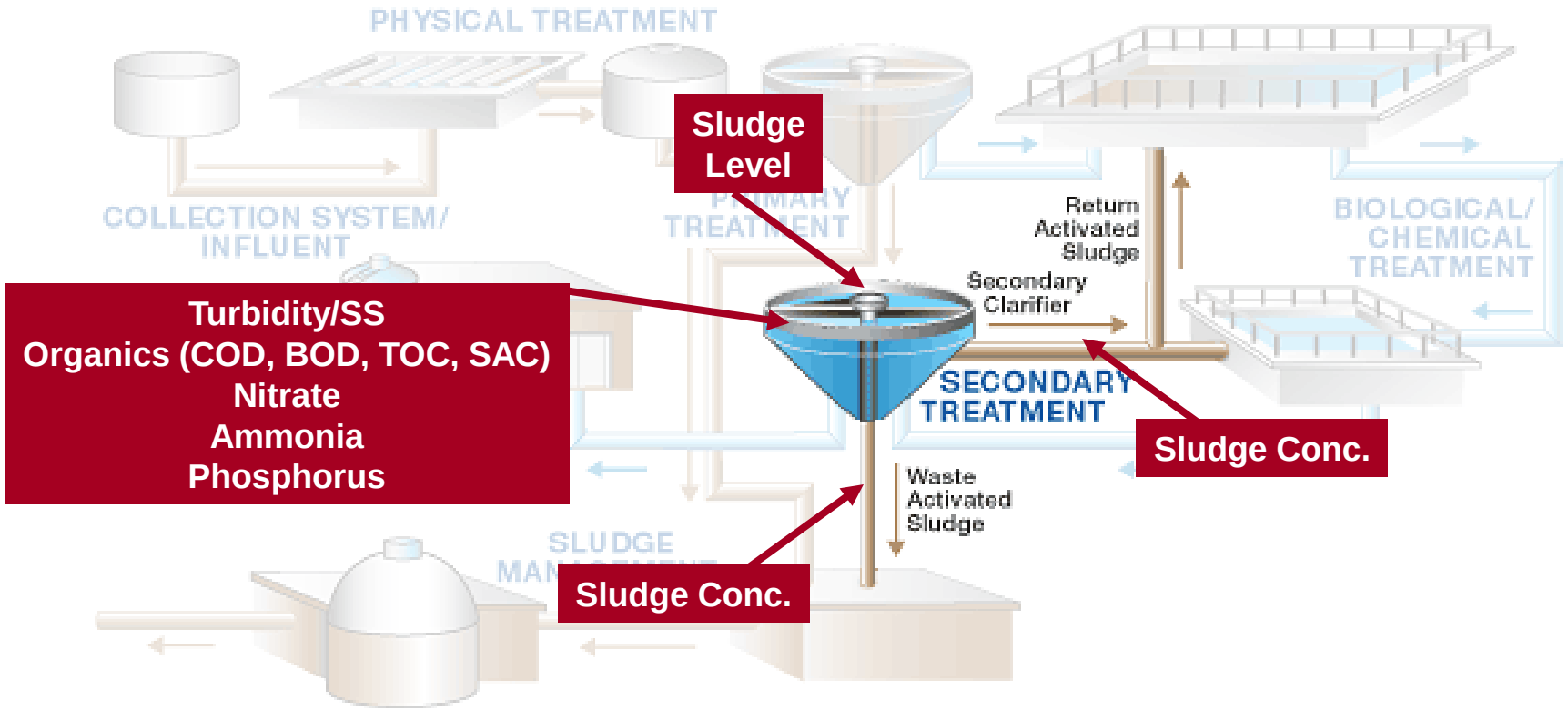
➲ systematic change between **anaerob** (NO solved or bounded oxygen) conditions (PO_4^{3-} is given up) and **aerob** conditions (PO_4^{3-} is taken up)

➲ supply with degradable C-source during the anaerob stage

Phosphorus Forms, Concentration vs. Wastewater Treatments



Municipal & Industrial Water Treatment Flow Diagram



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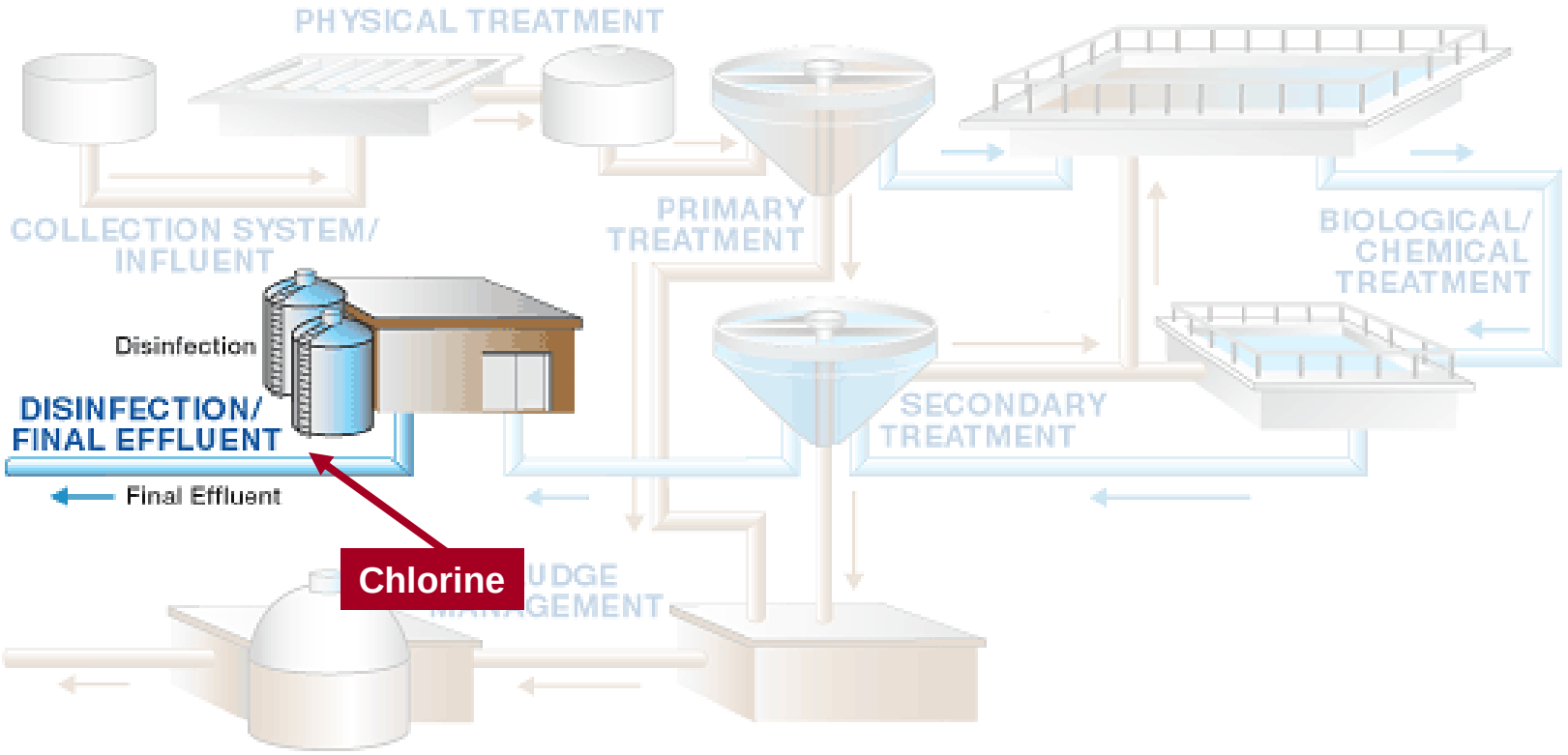

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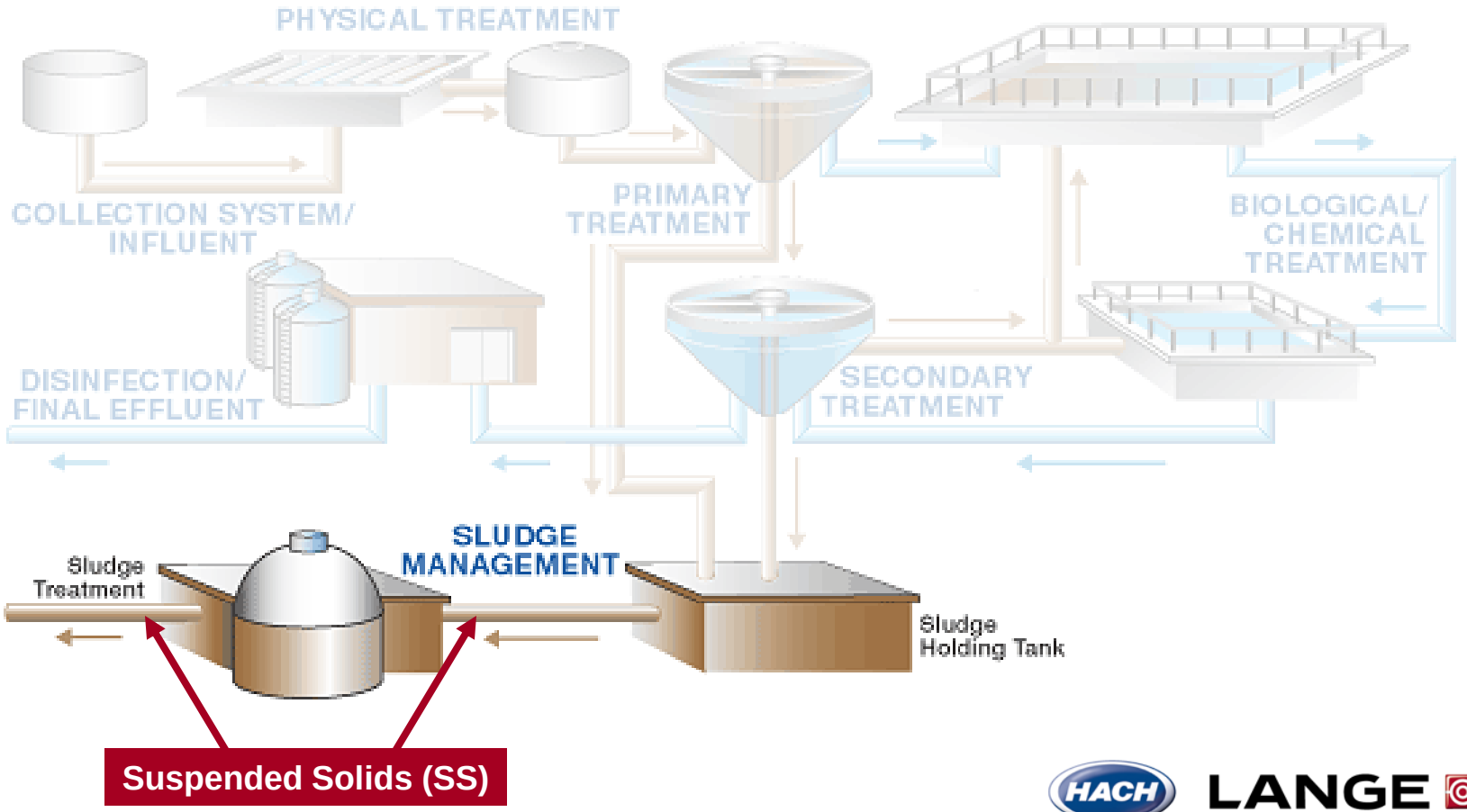

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Boiler Water Treatment

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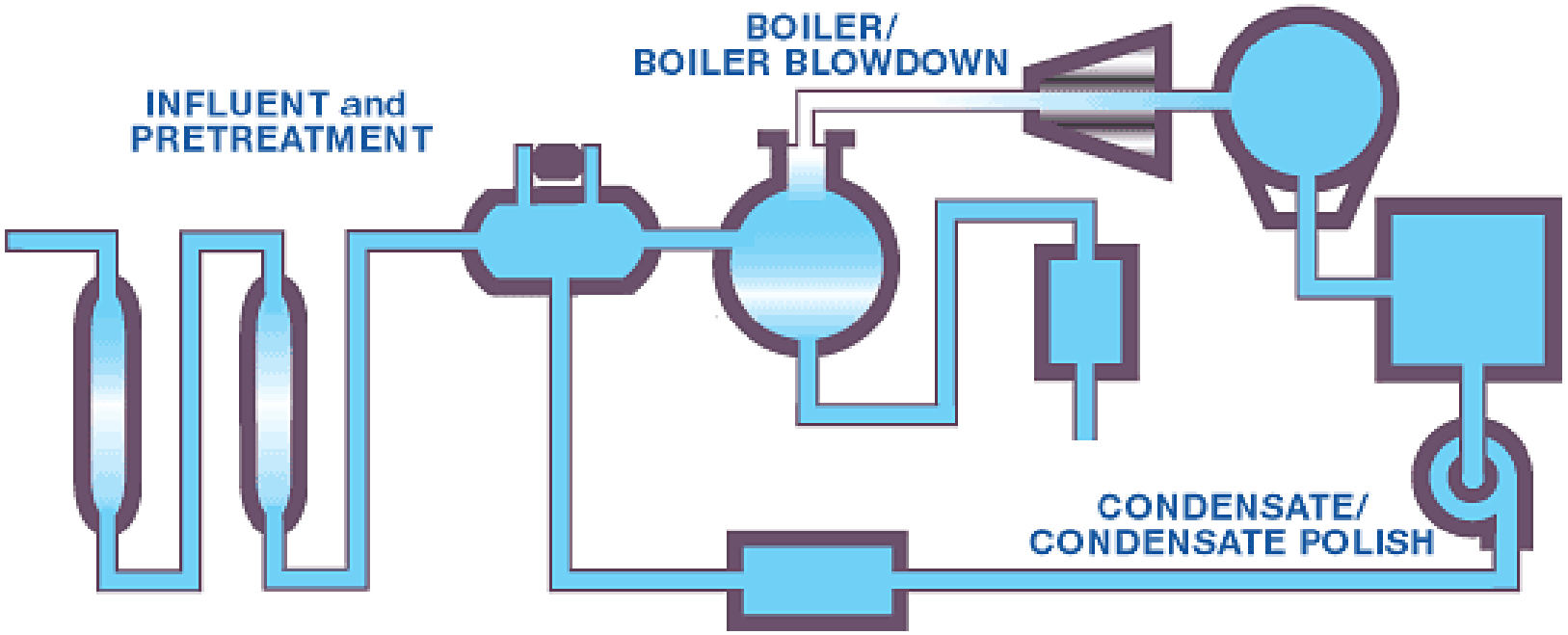
Boiler Water Treatment Flow Diagram



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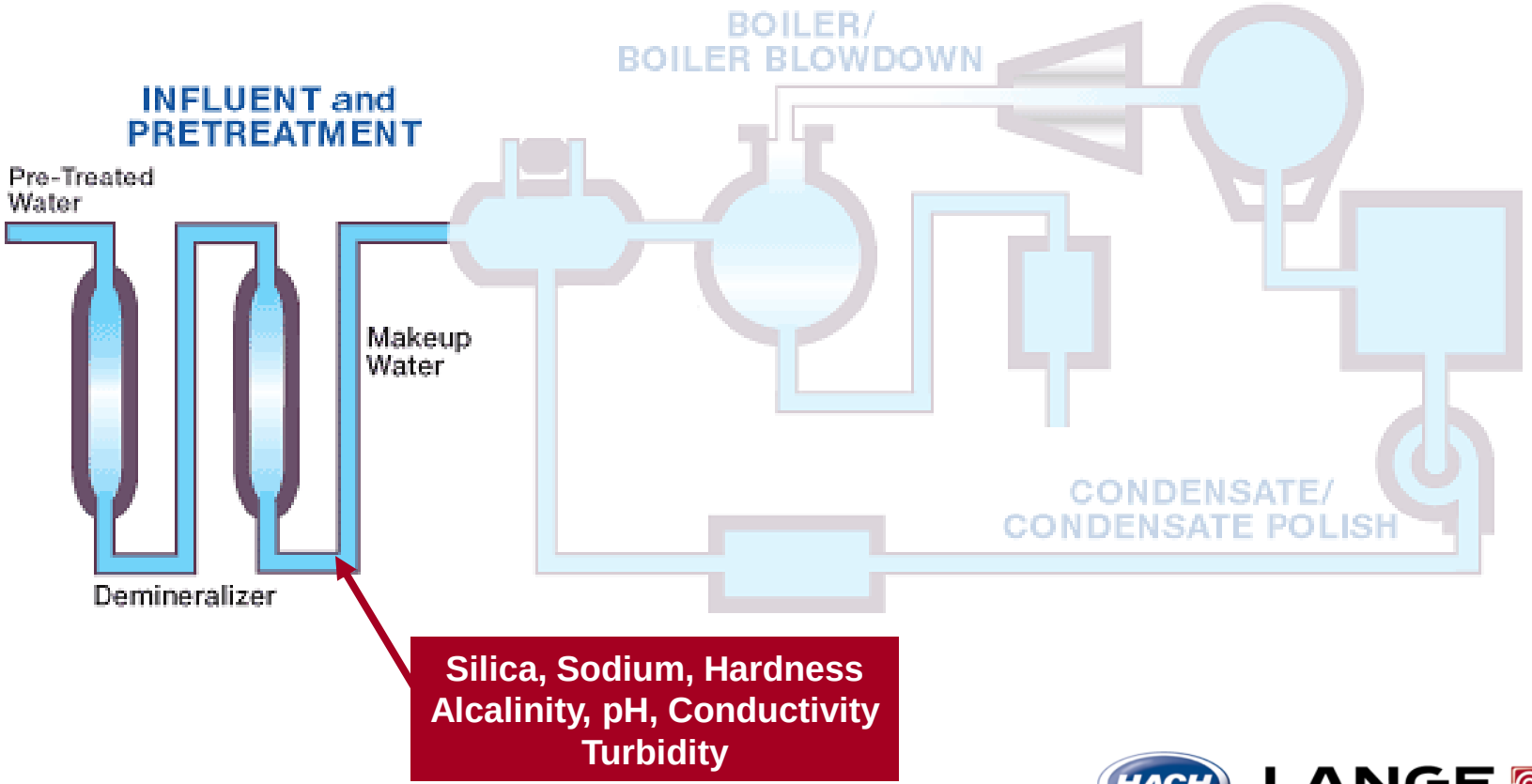

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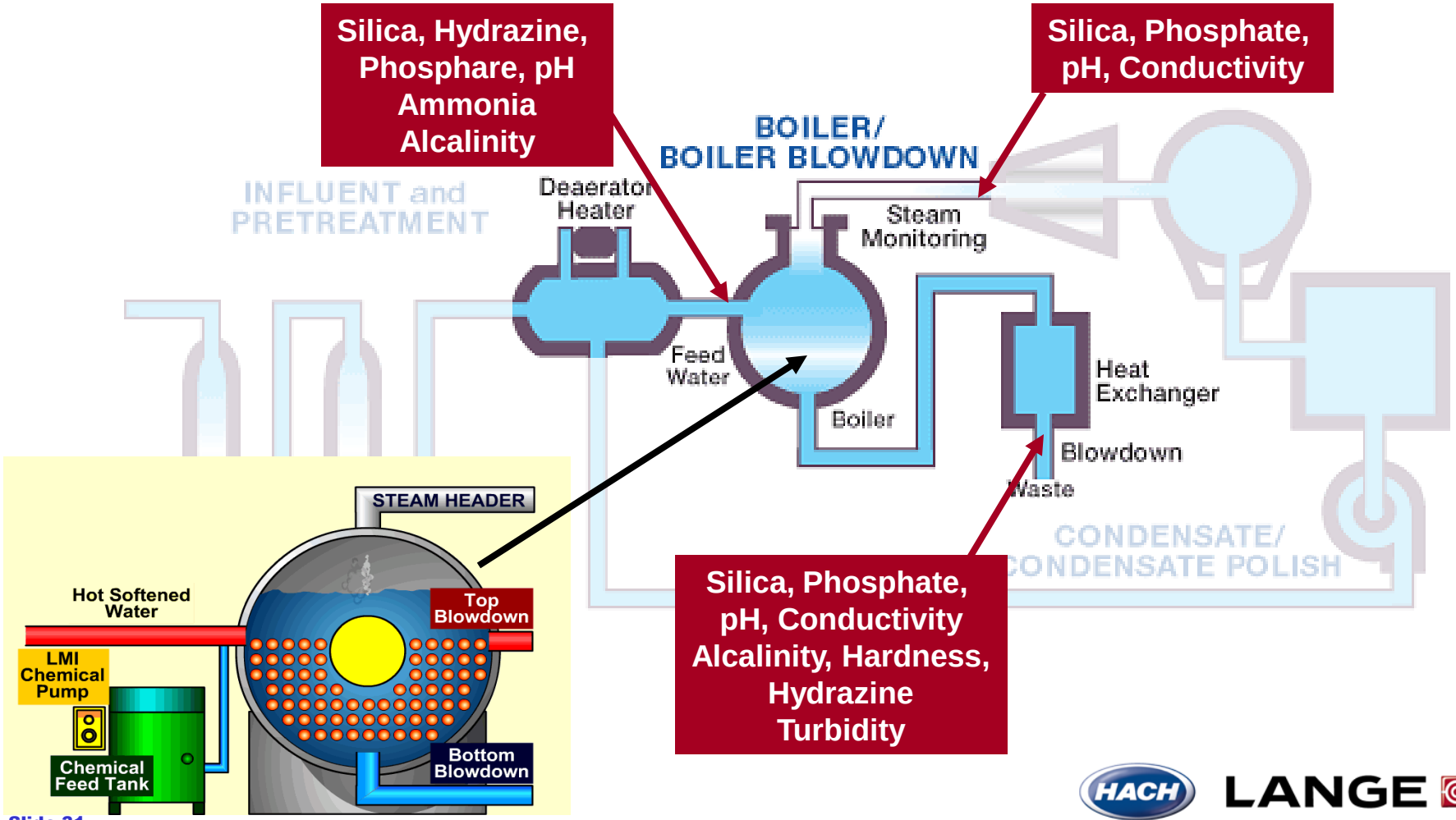

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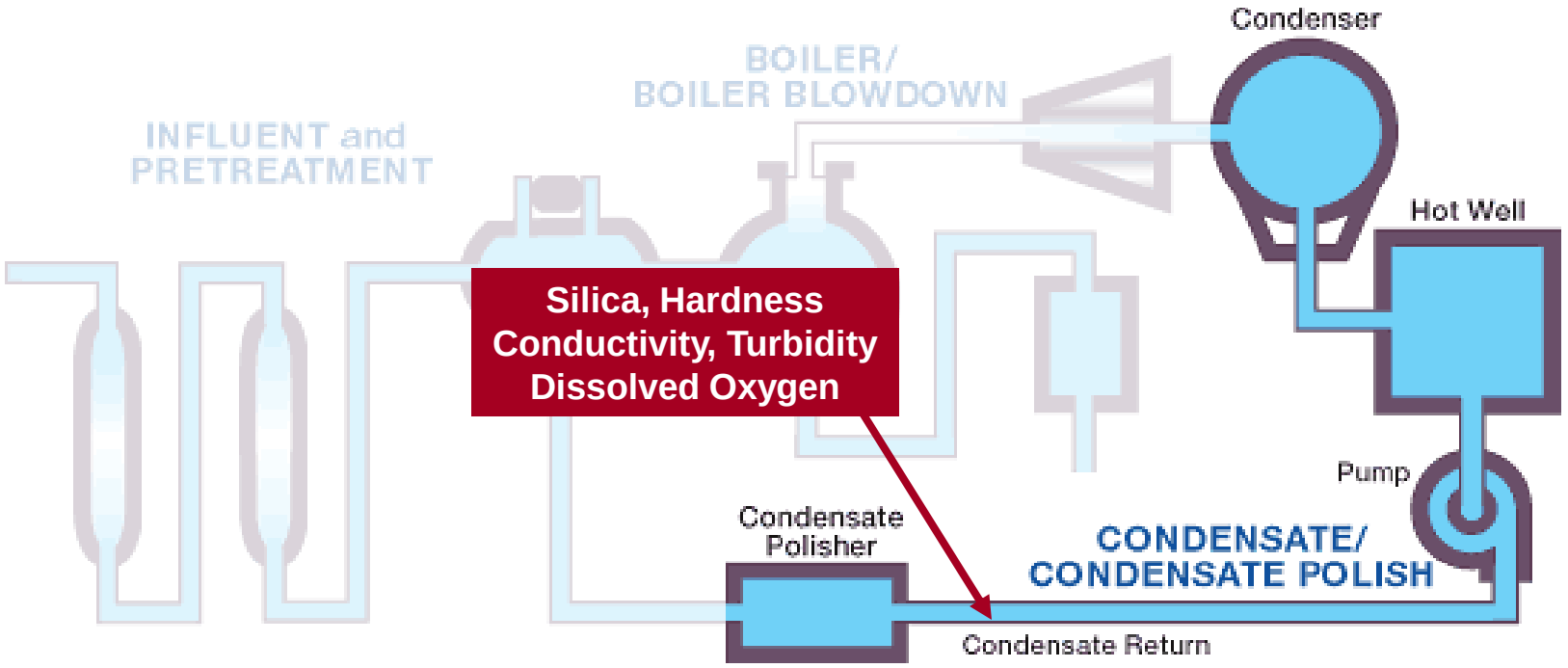

Water Treatments Overview

Desalination
(RO Water Treatment)

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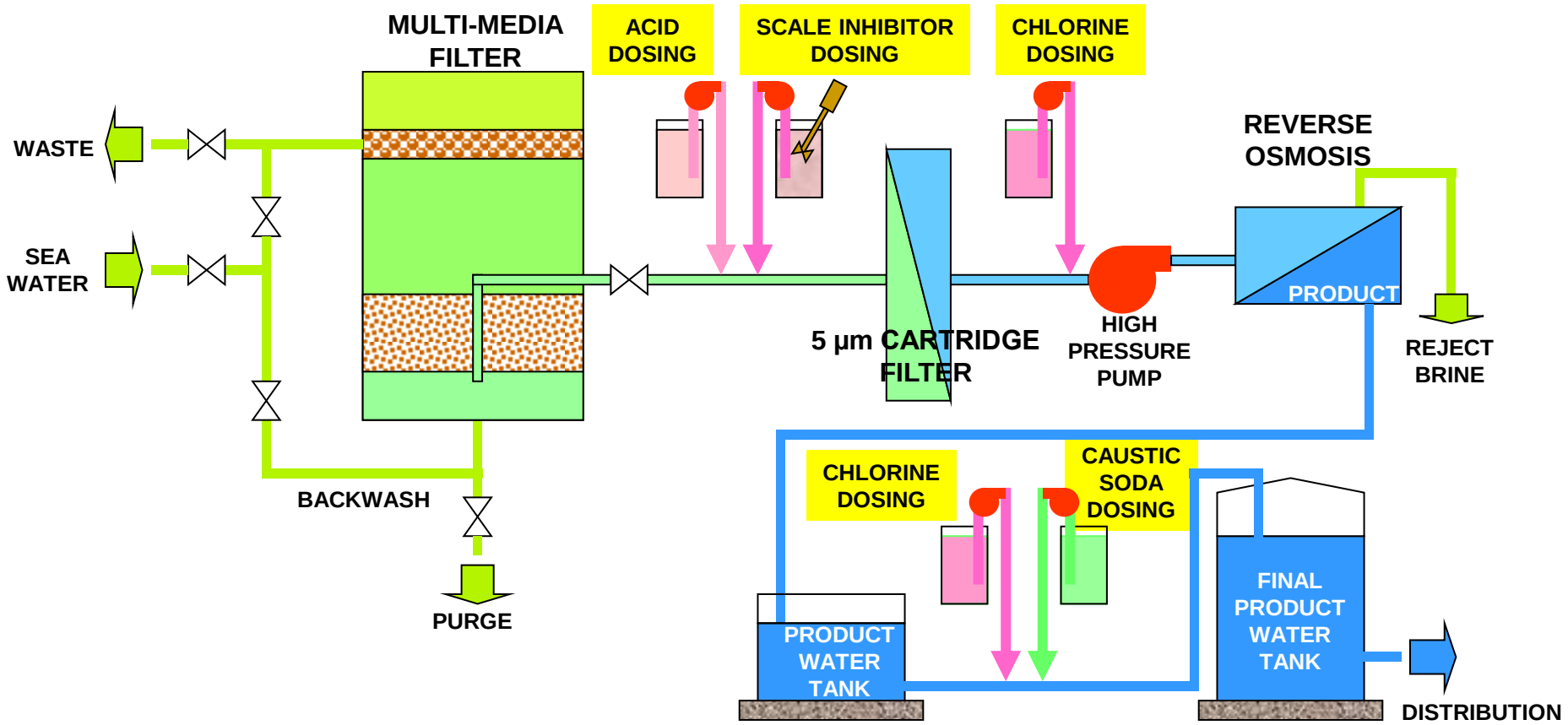
WATER DESALINATION BY REVERSE OSMOSIS FLOW DIAGRAM



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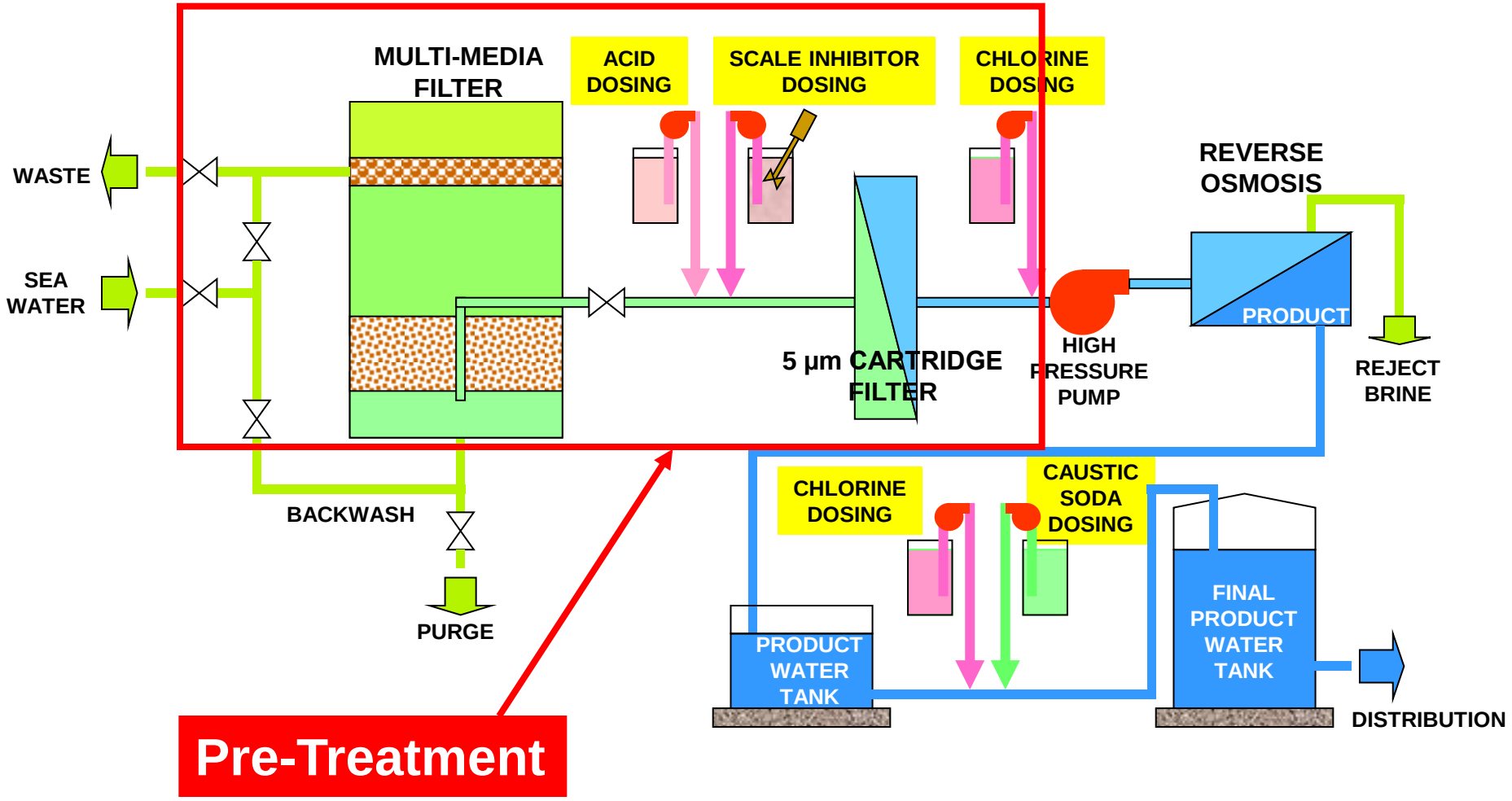

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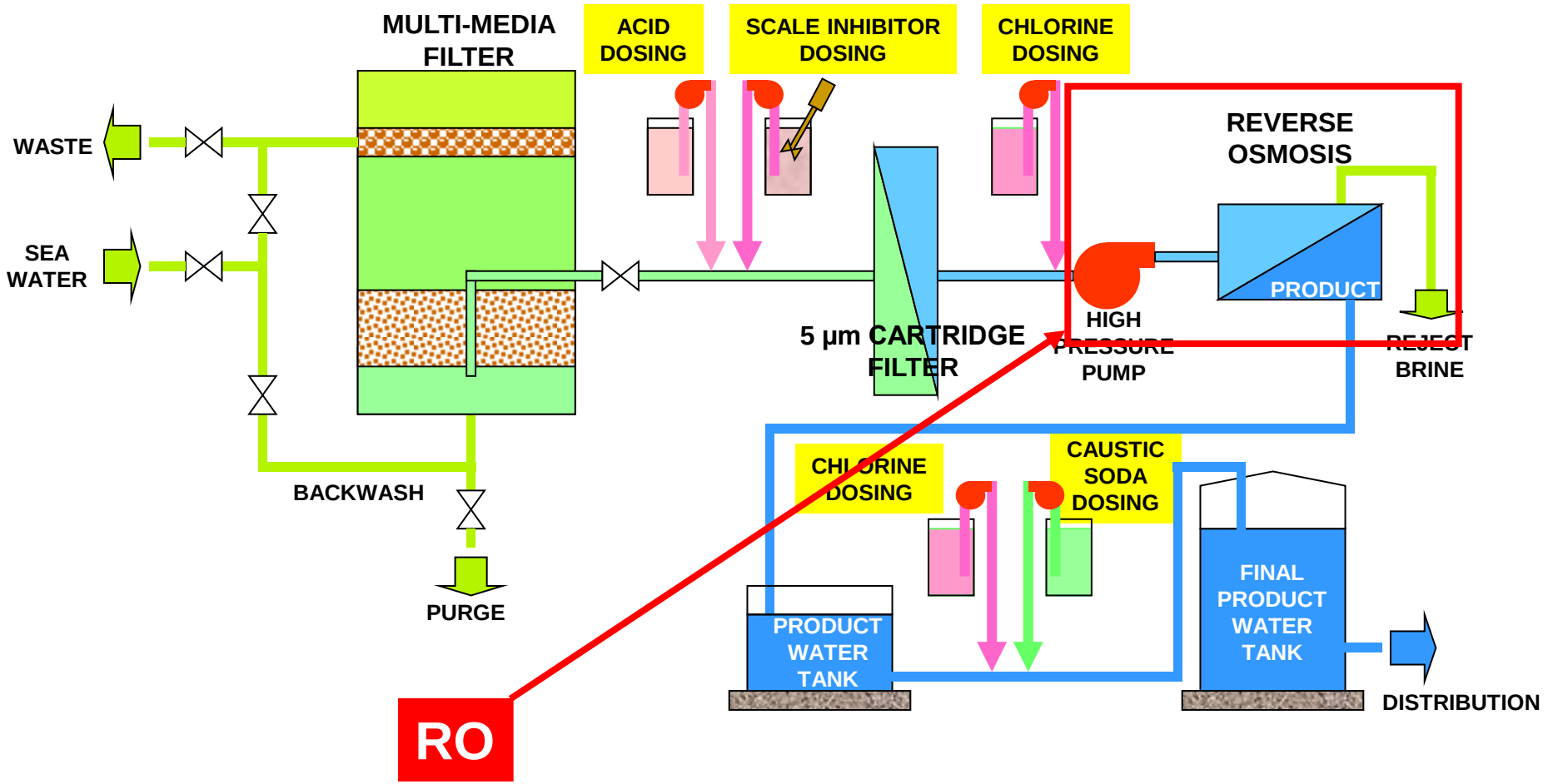

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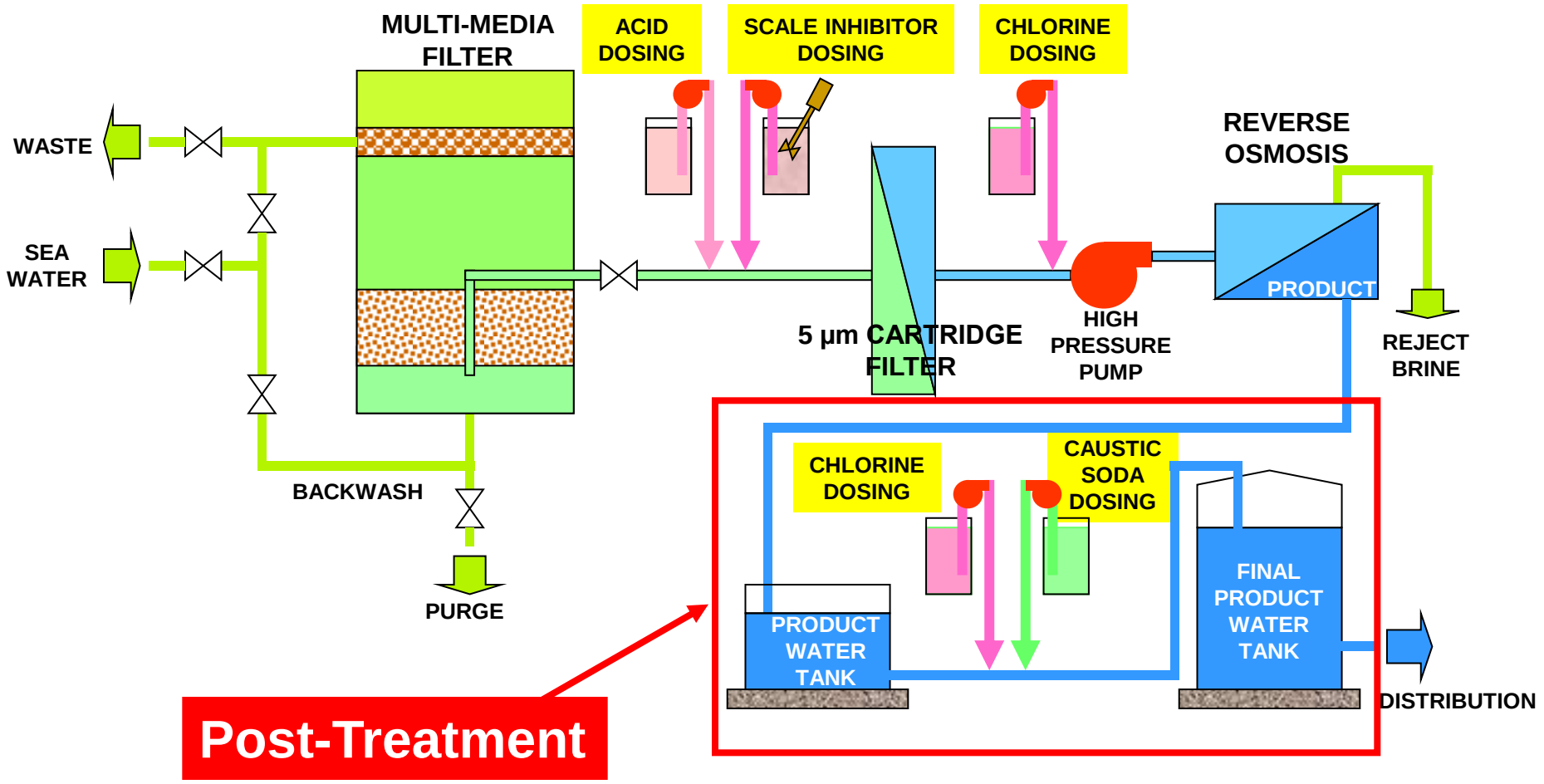
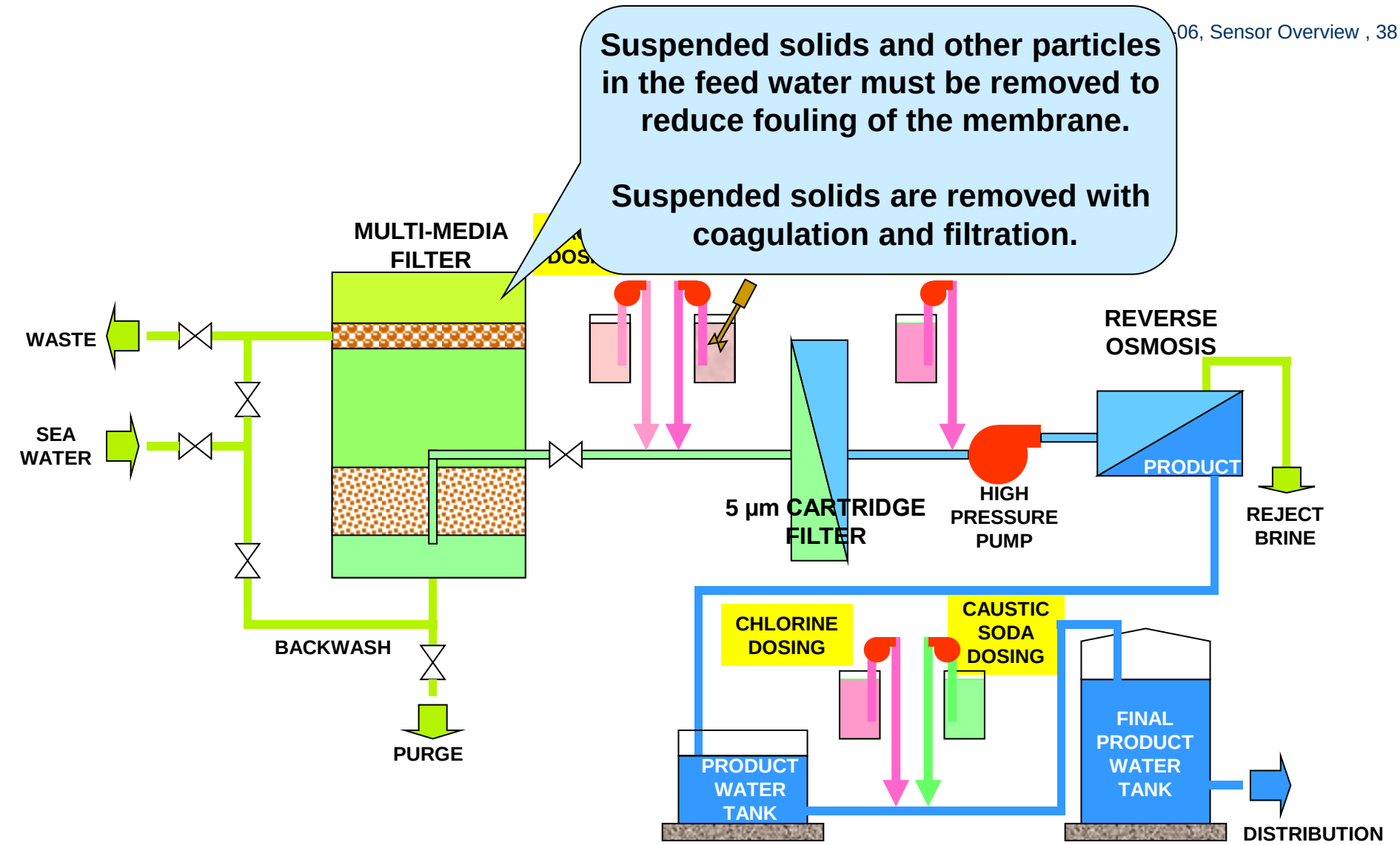
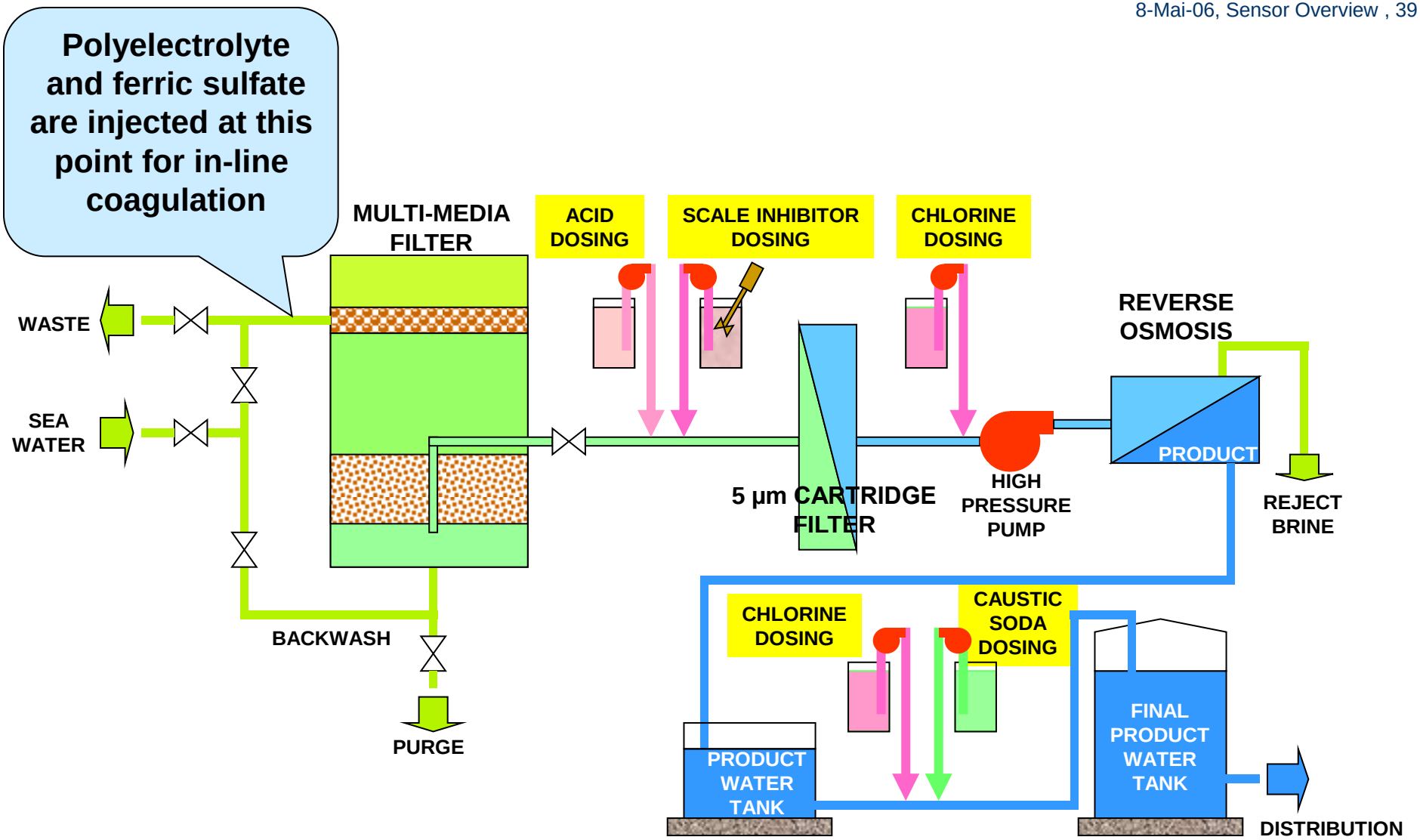
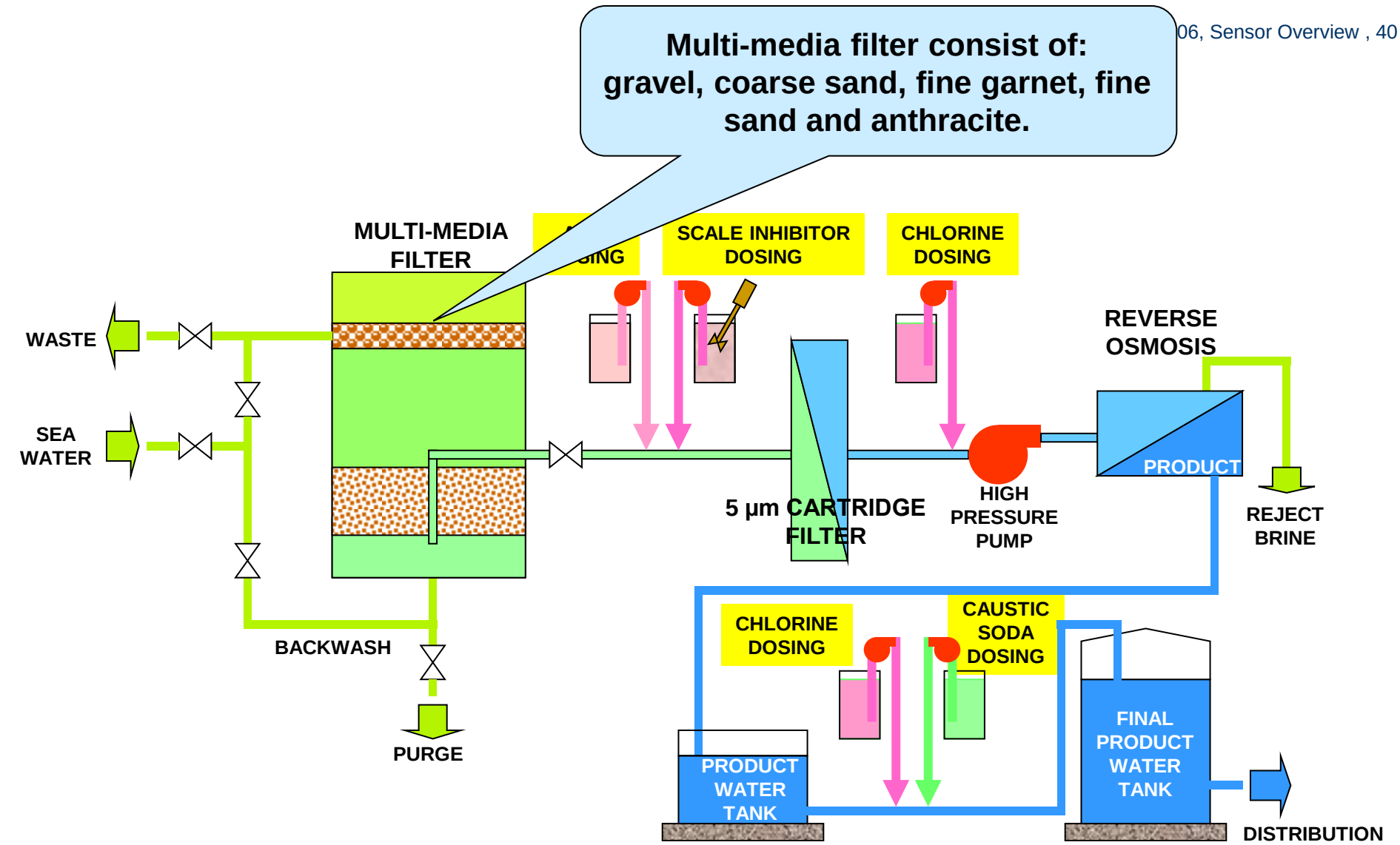
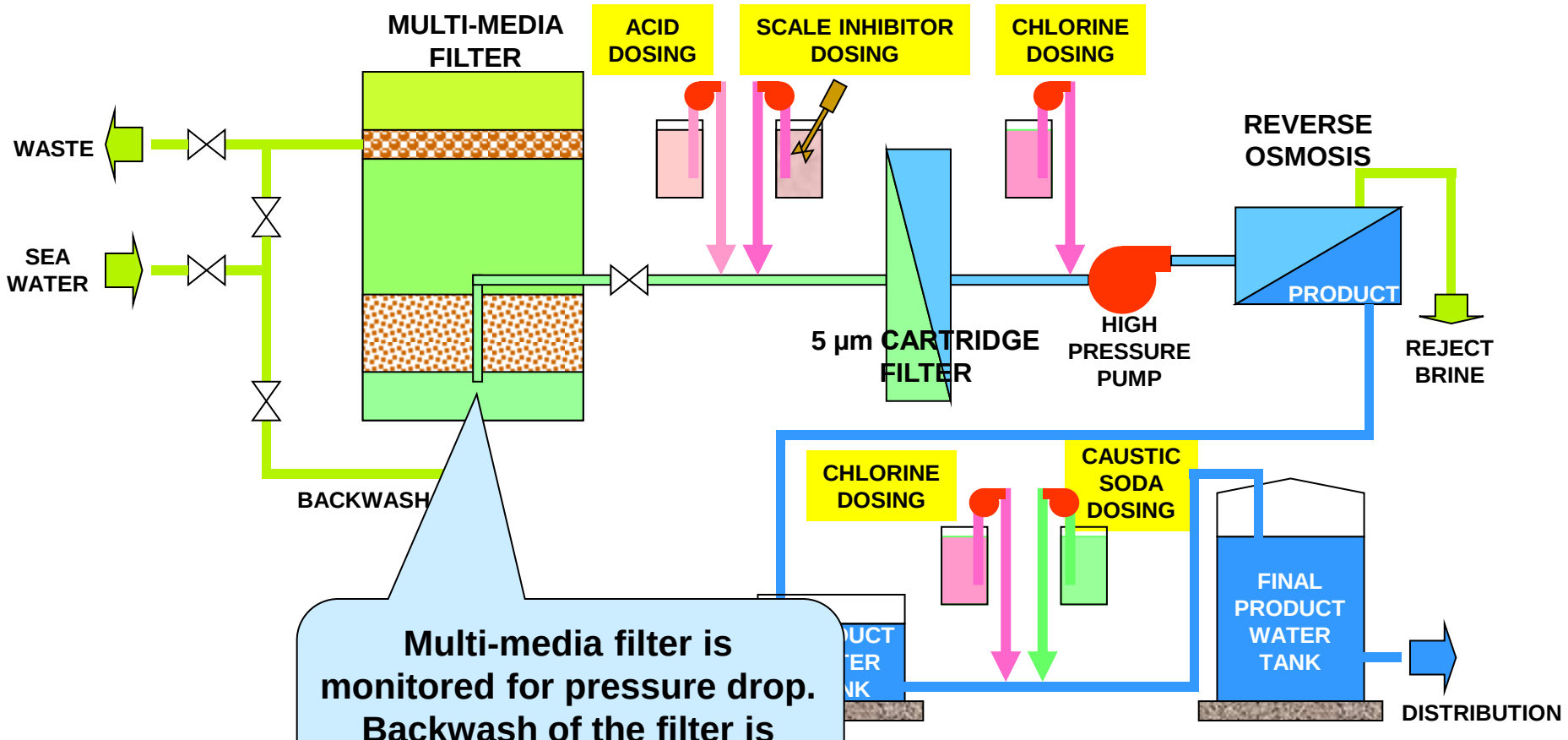
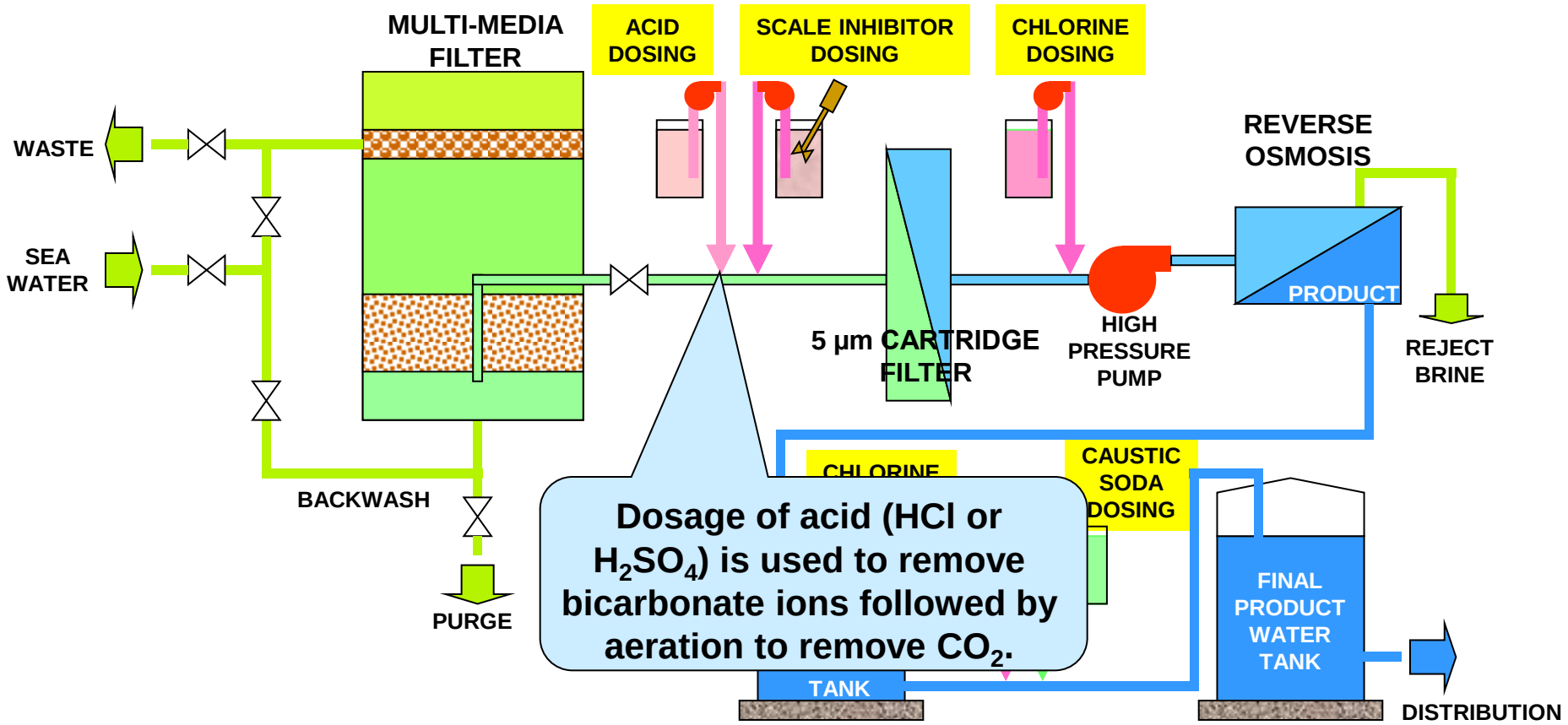


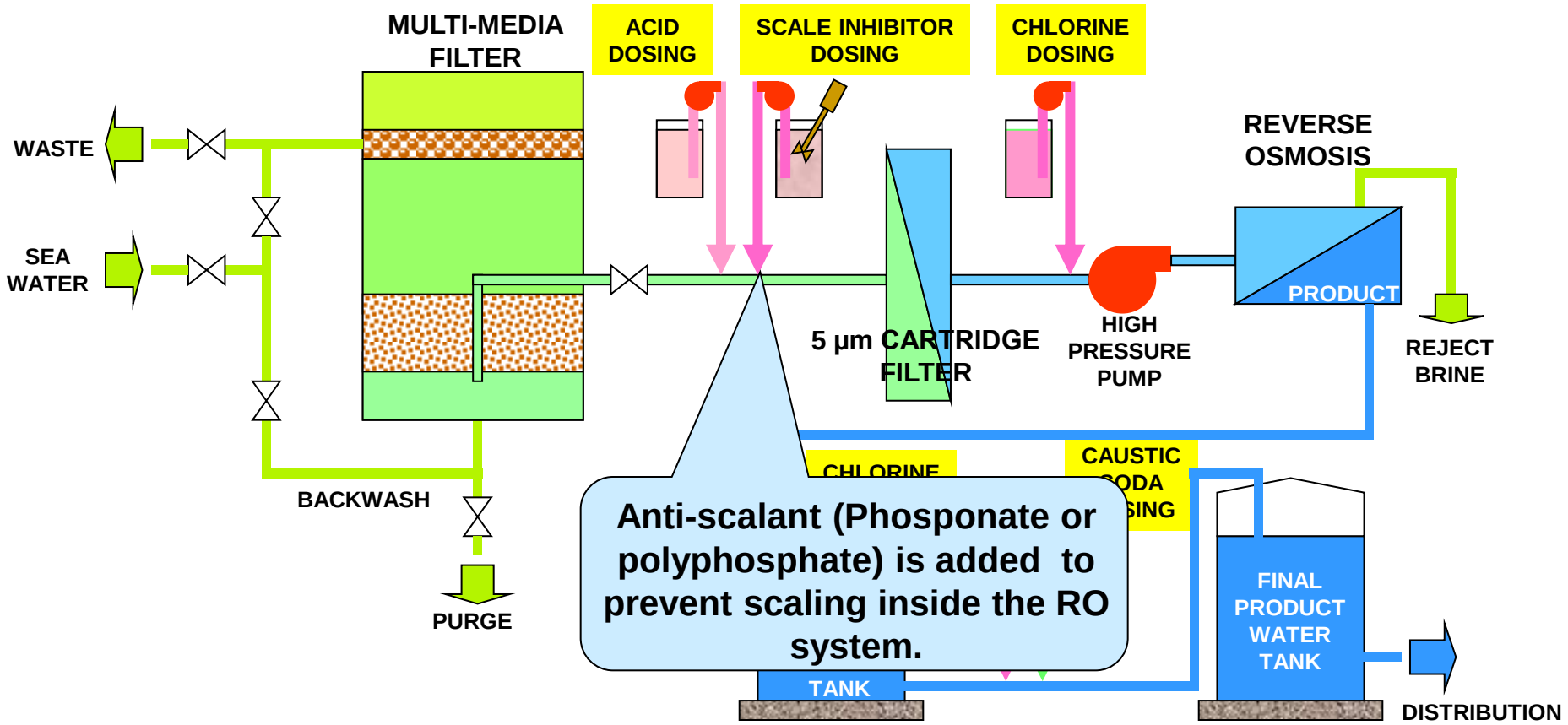


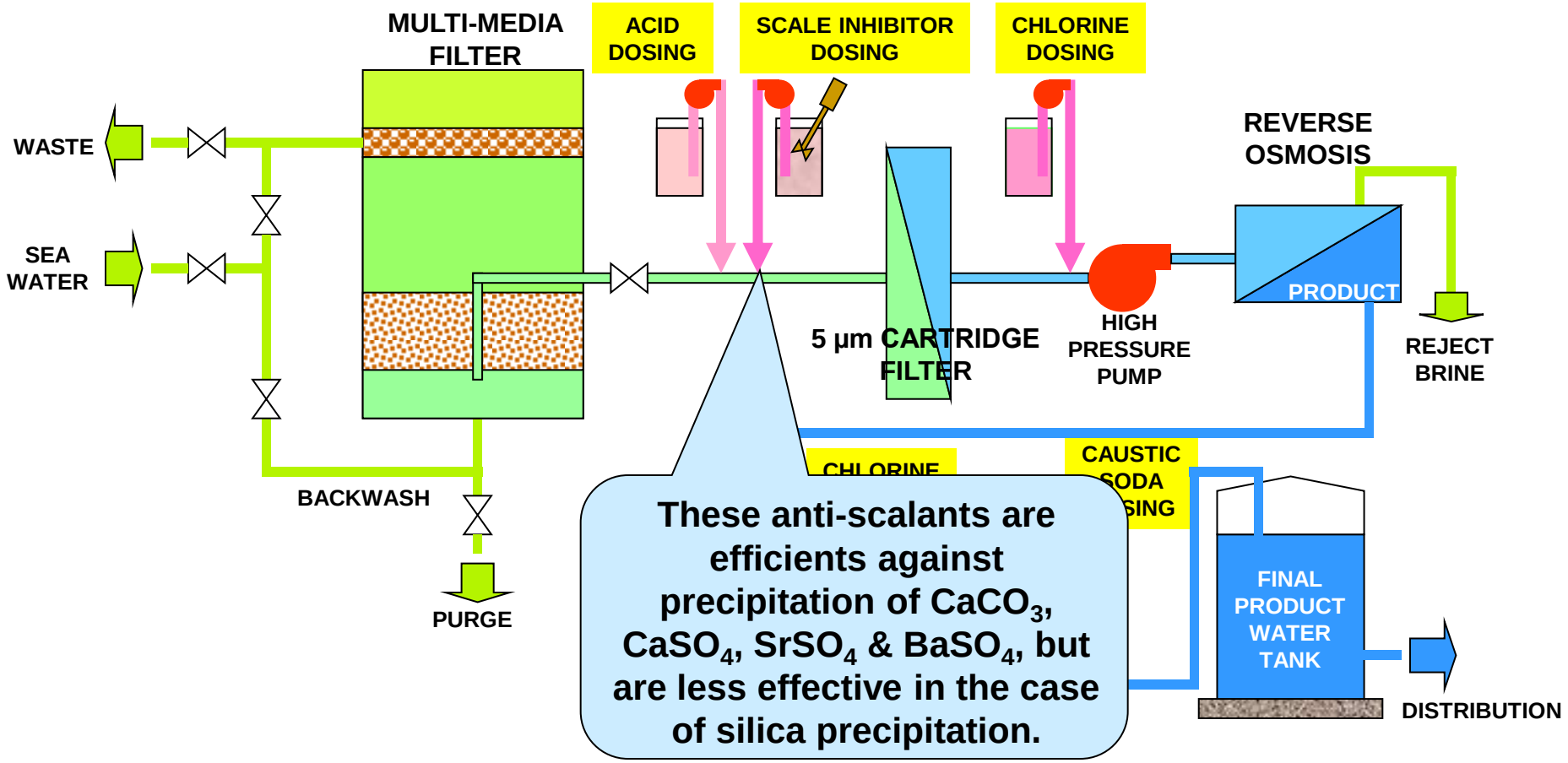


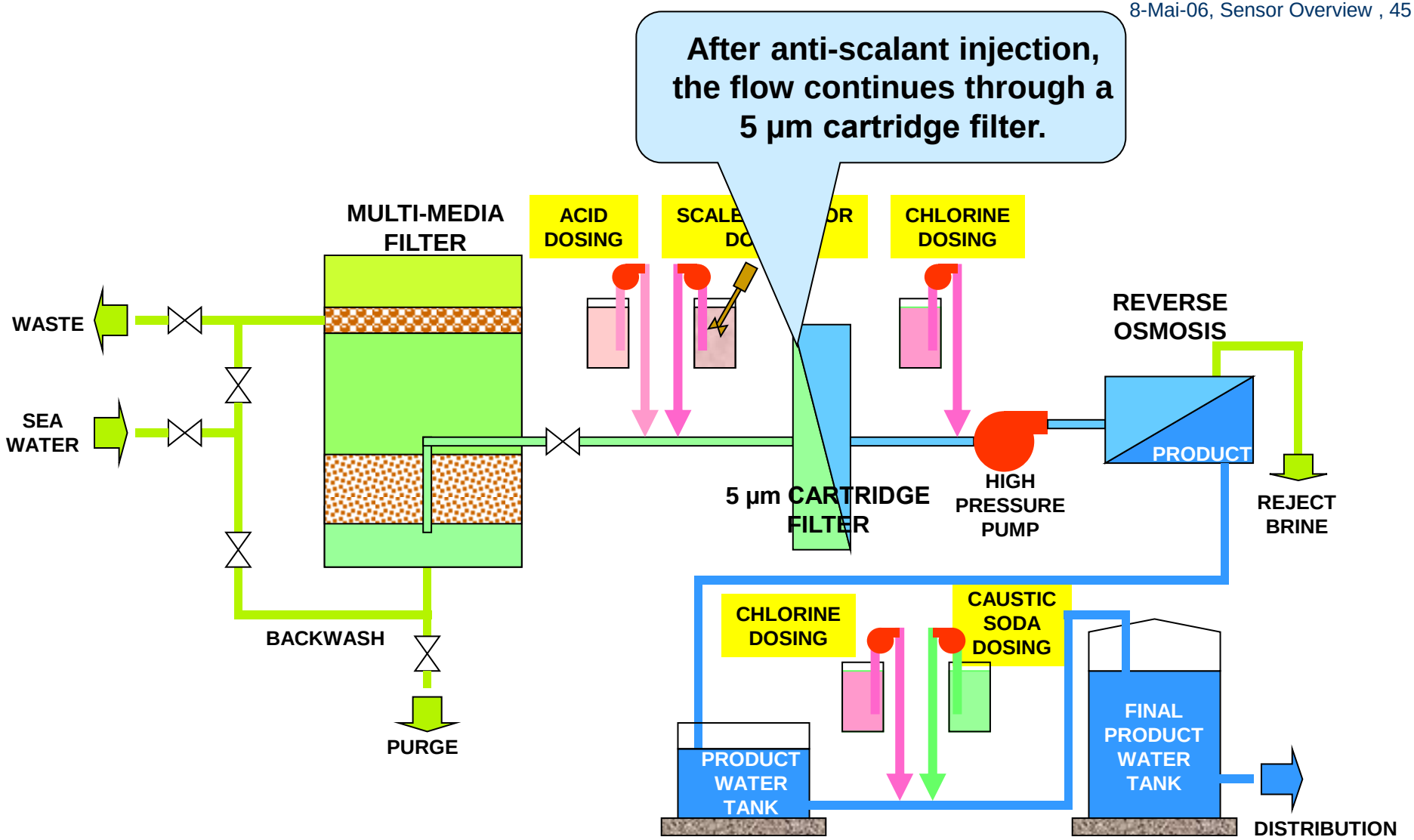


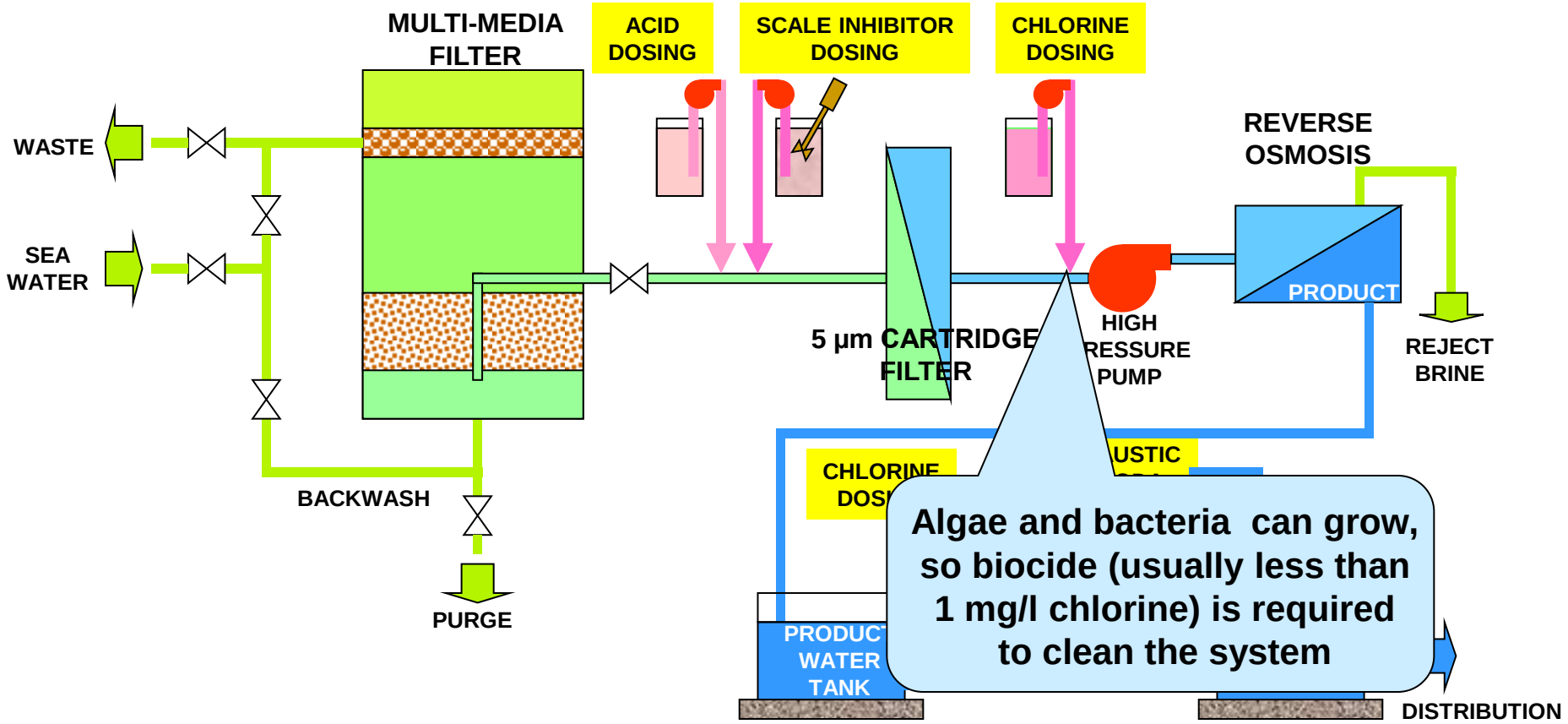


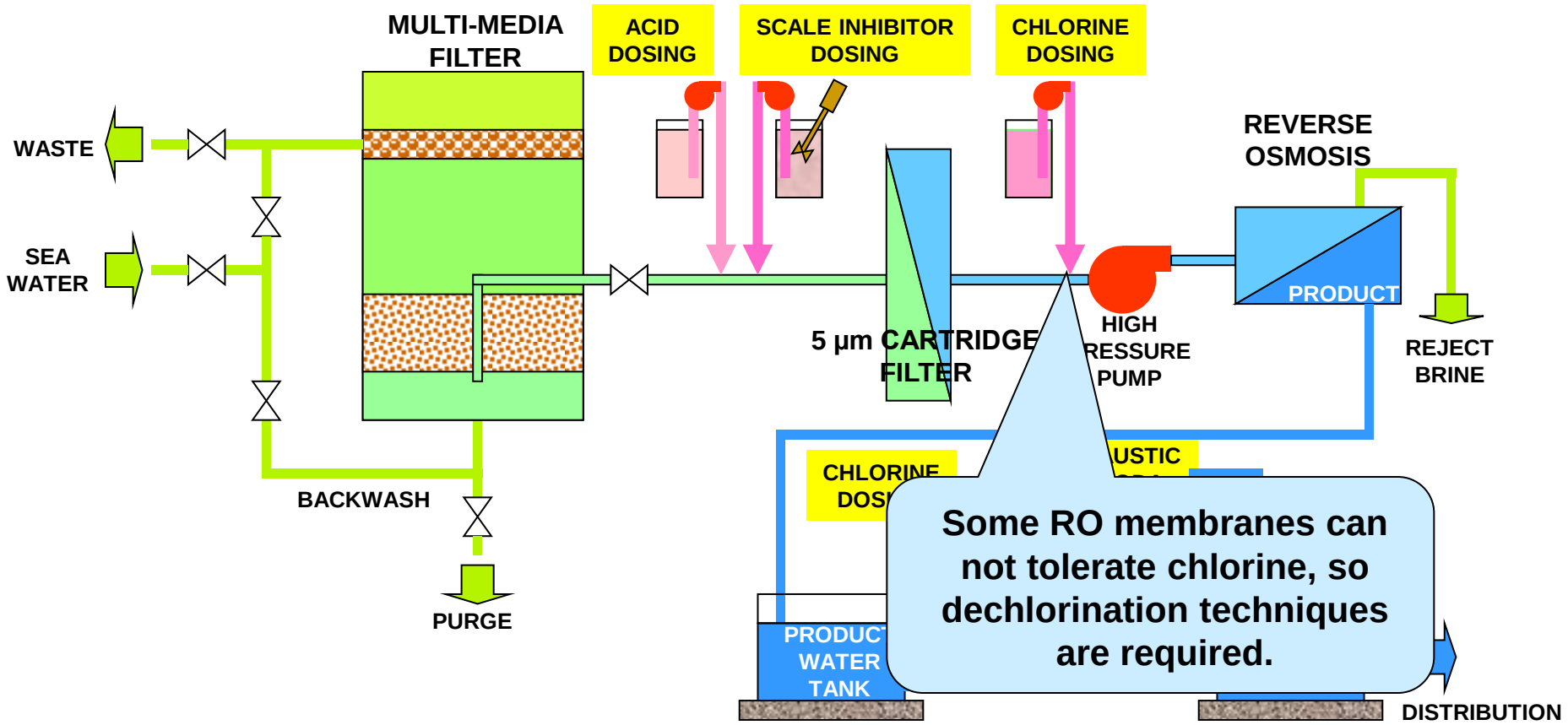


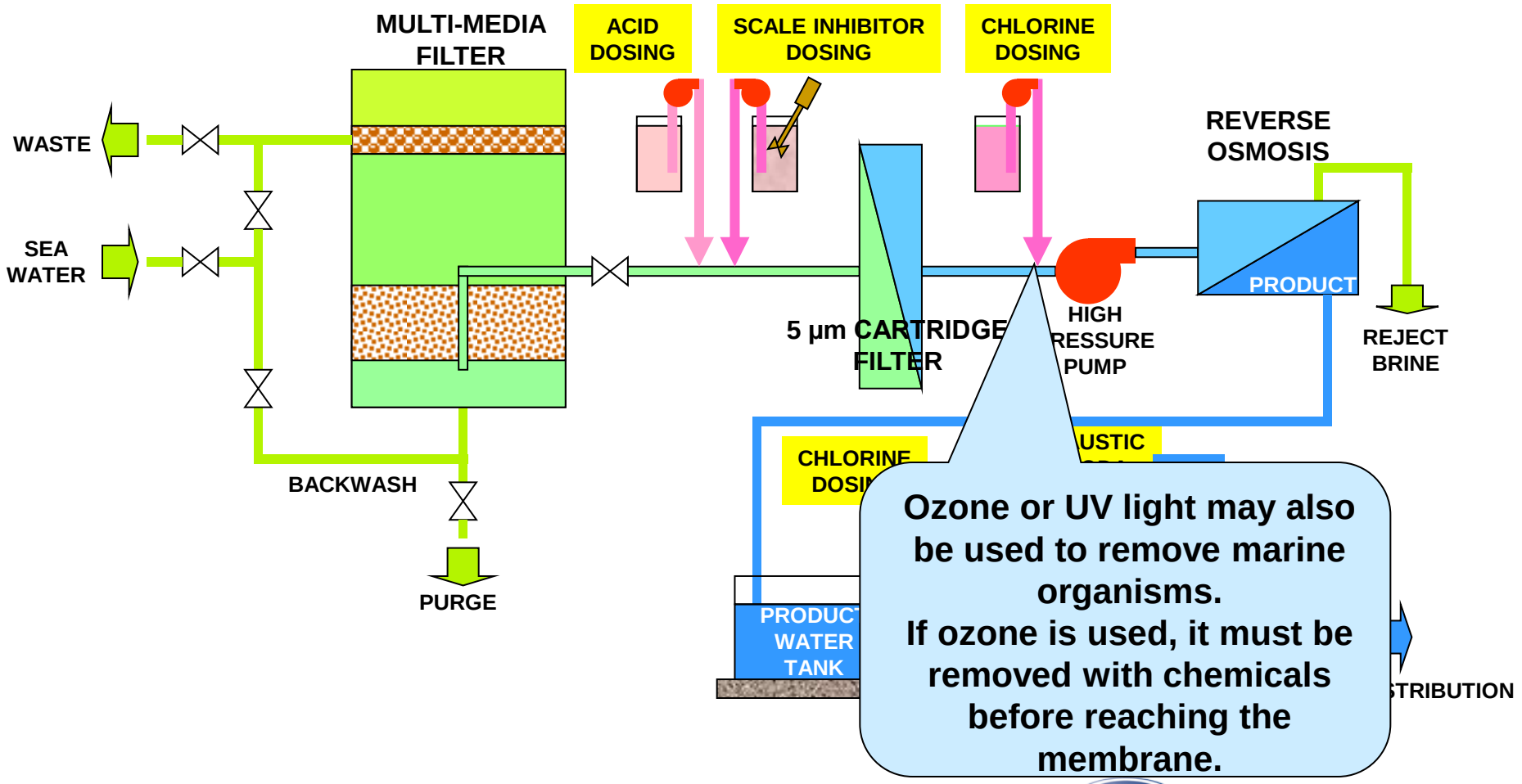


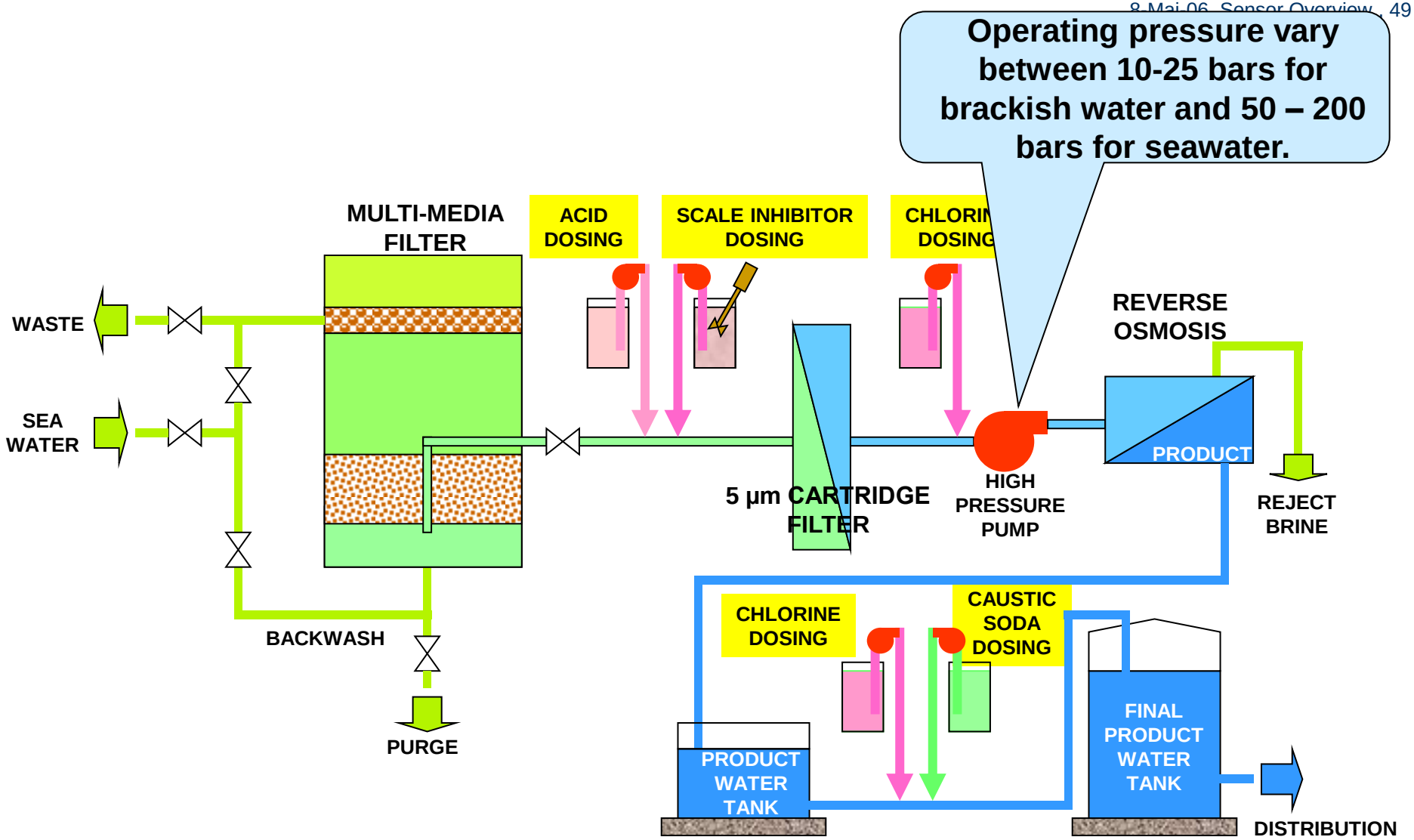


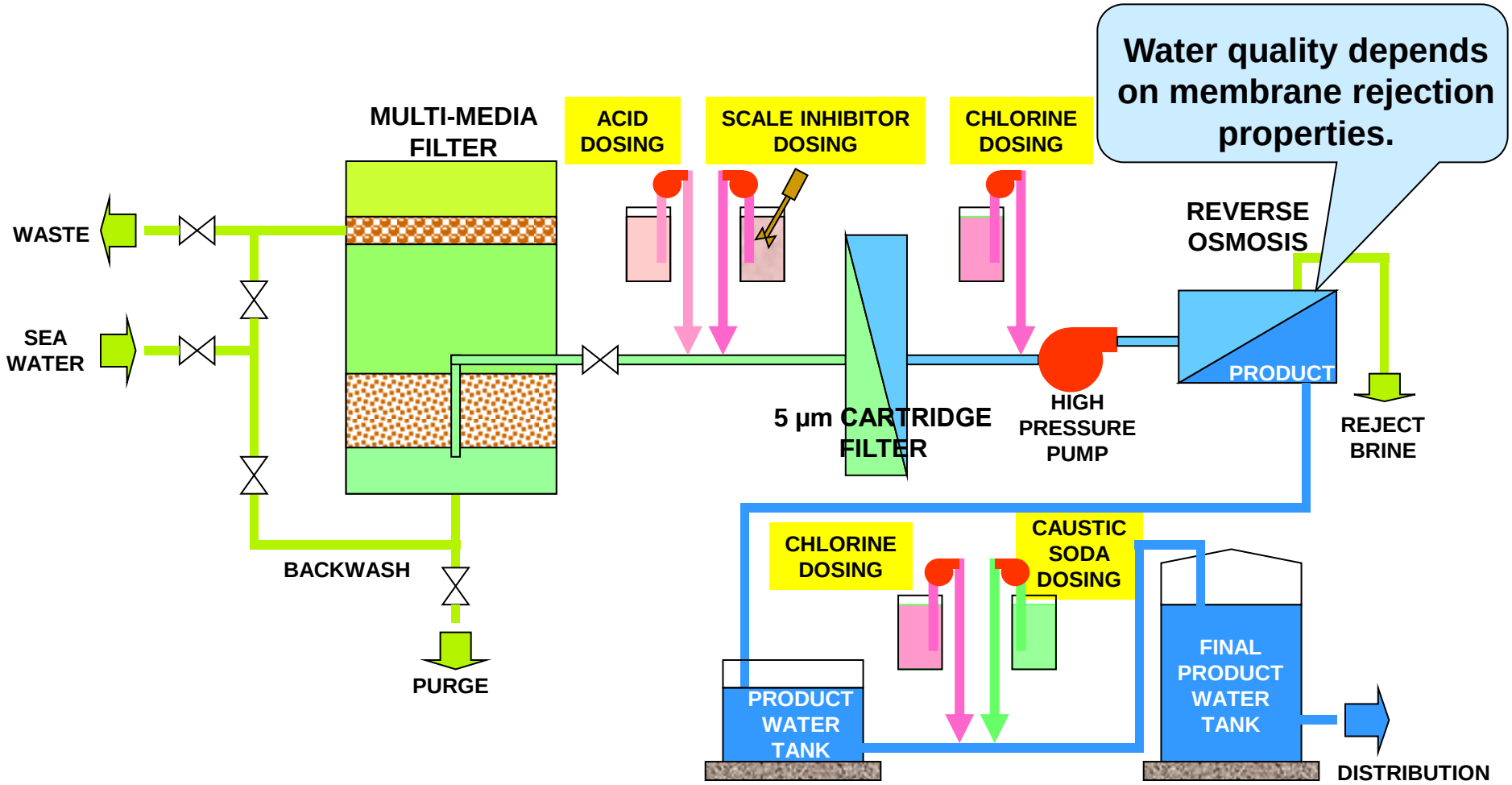


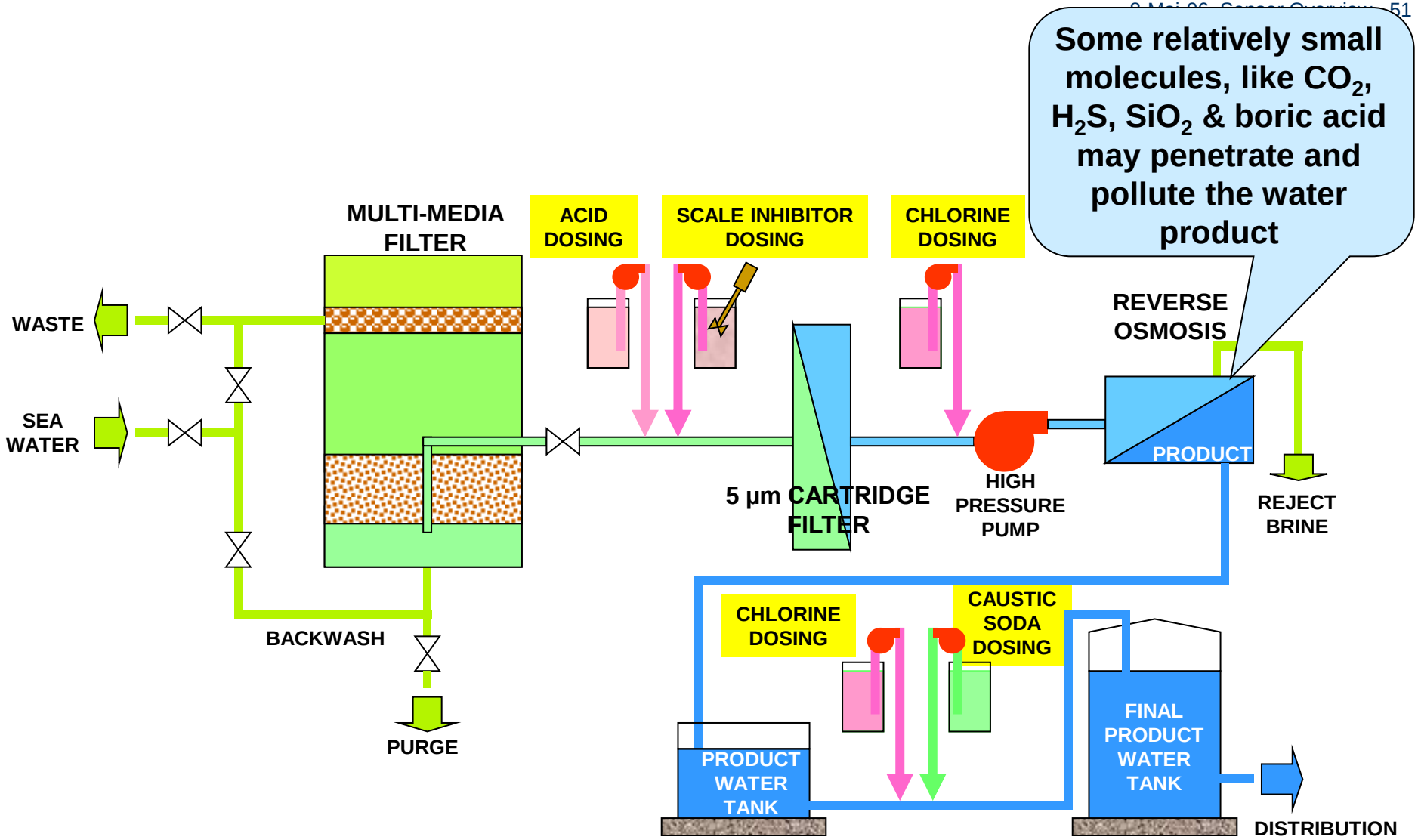


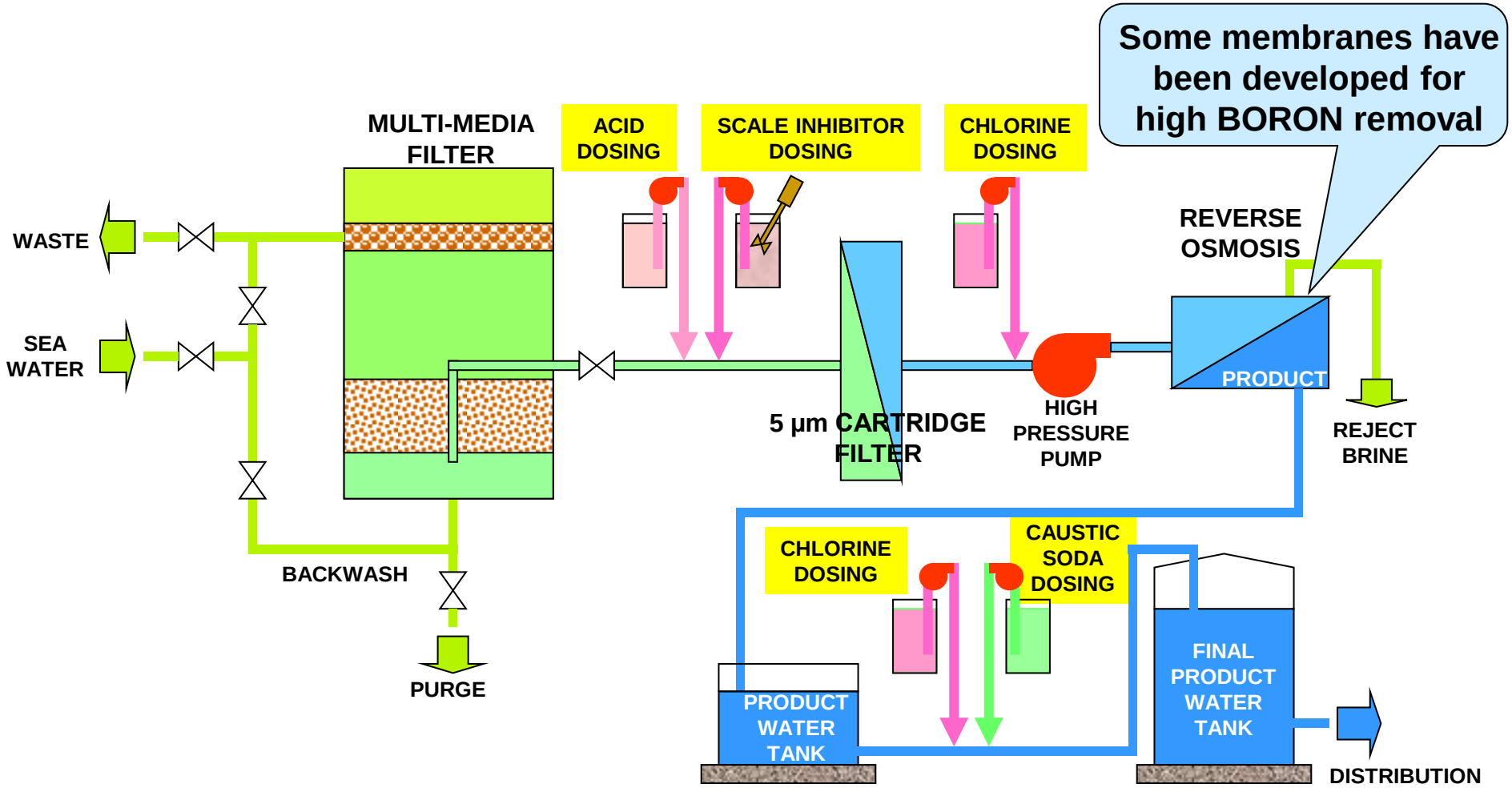


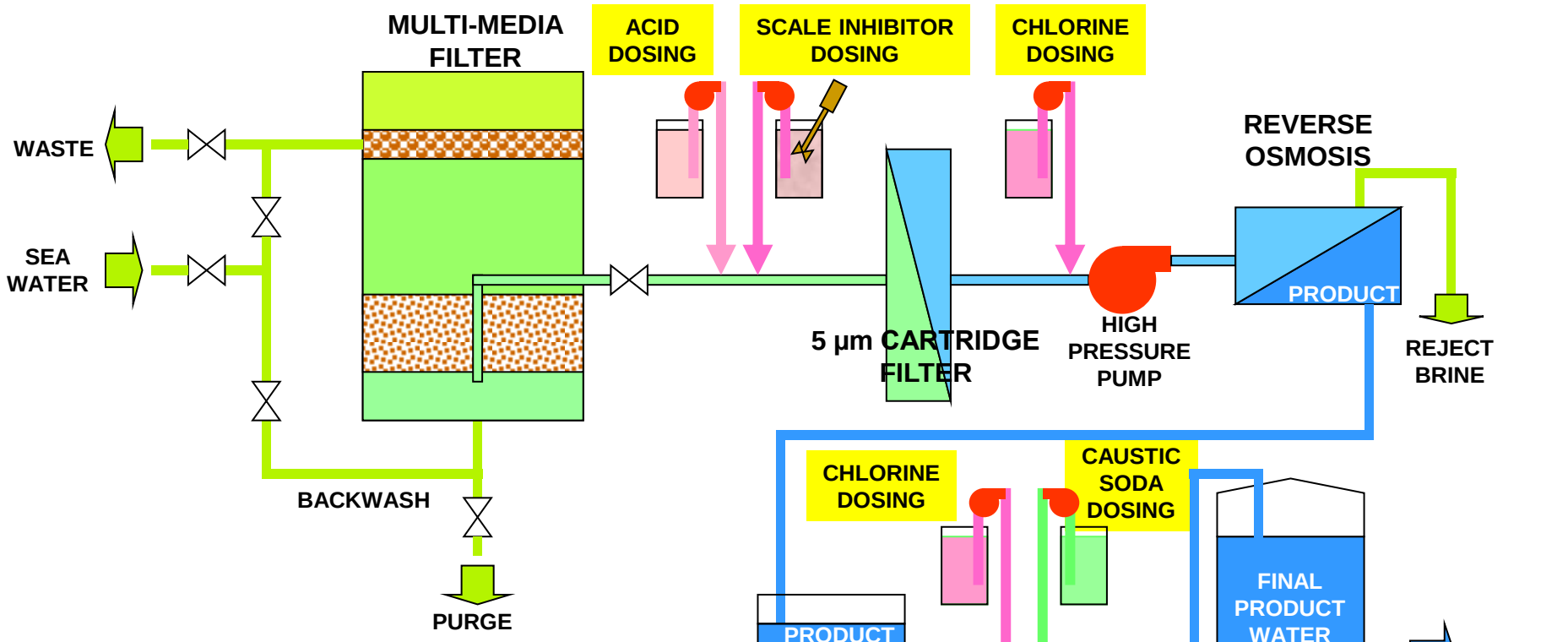




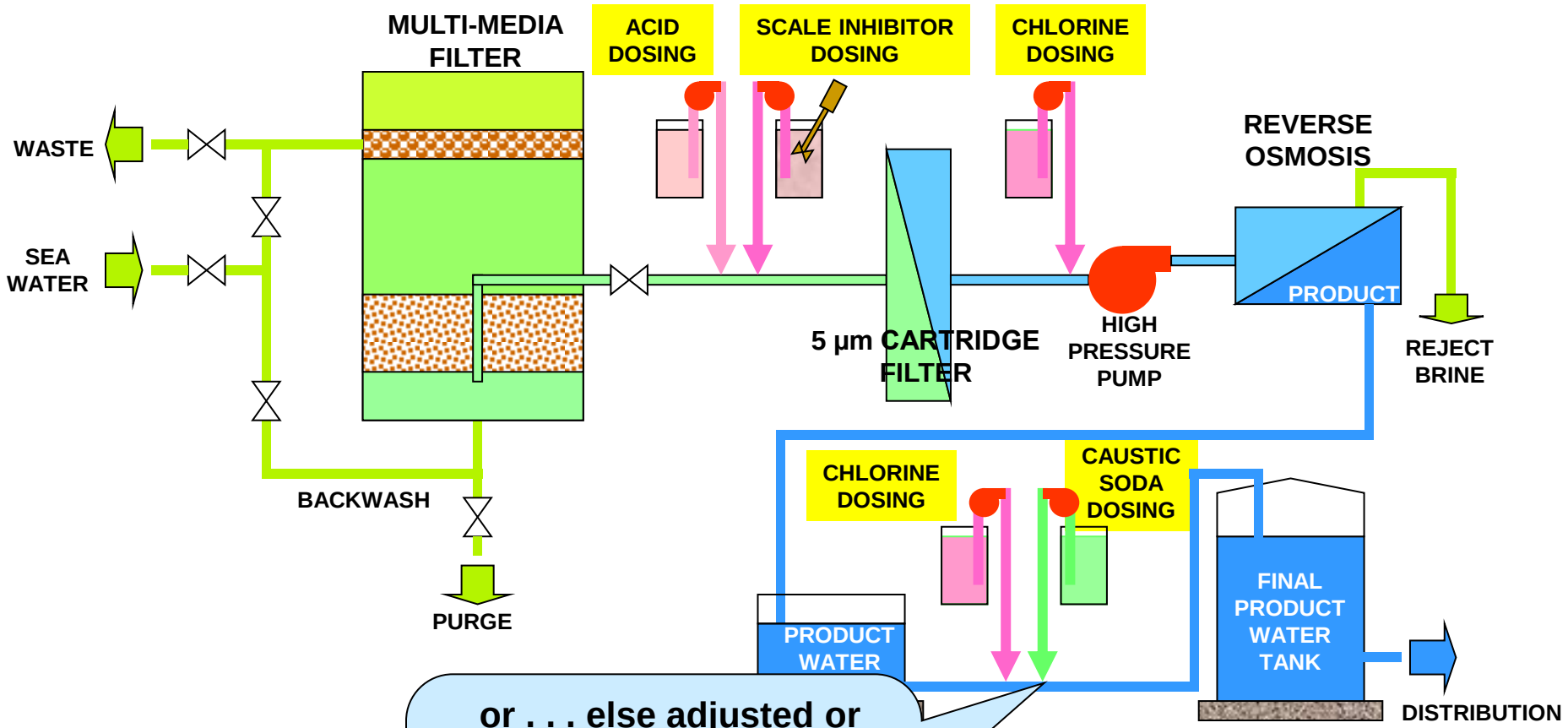




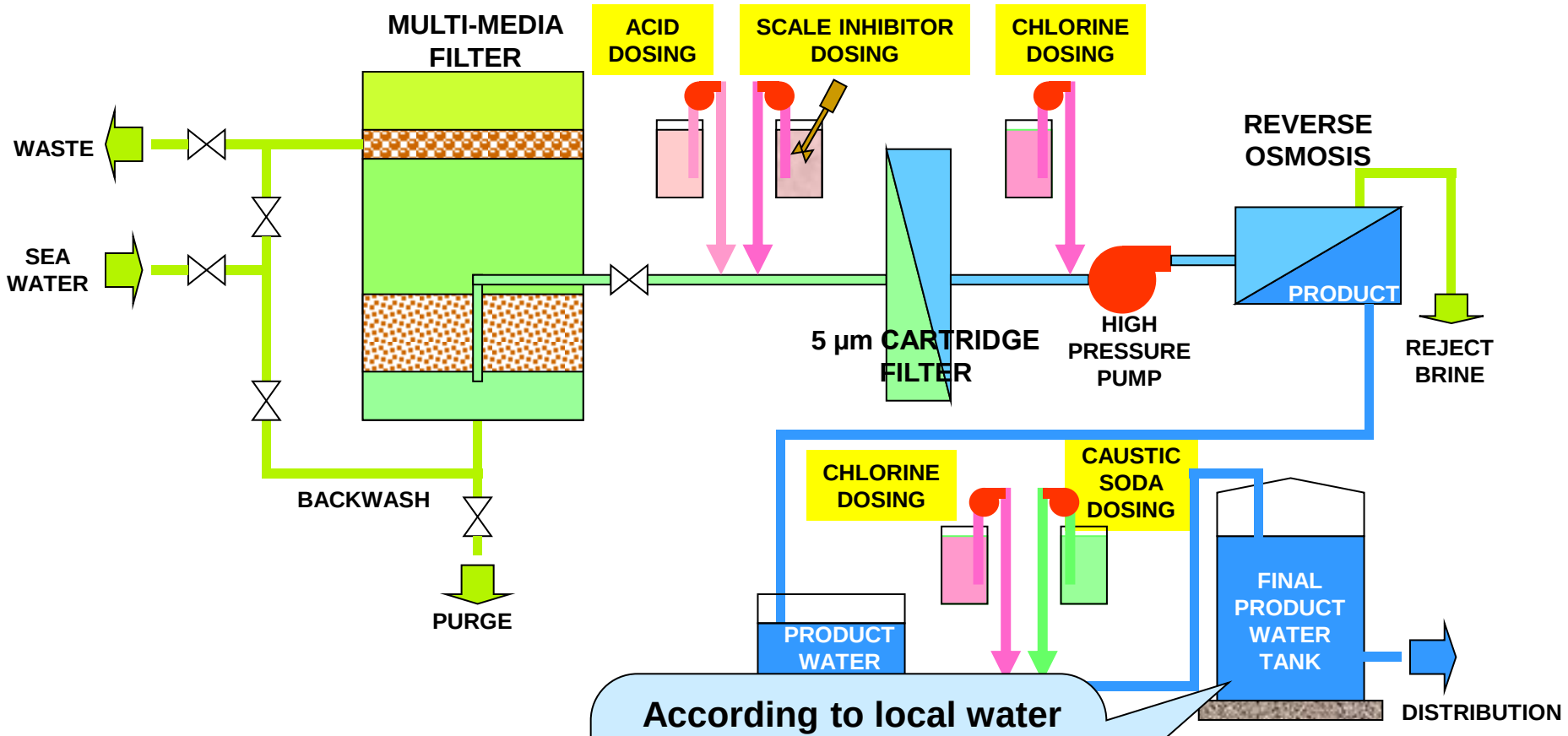




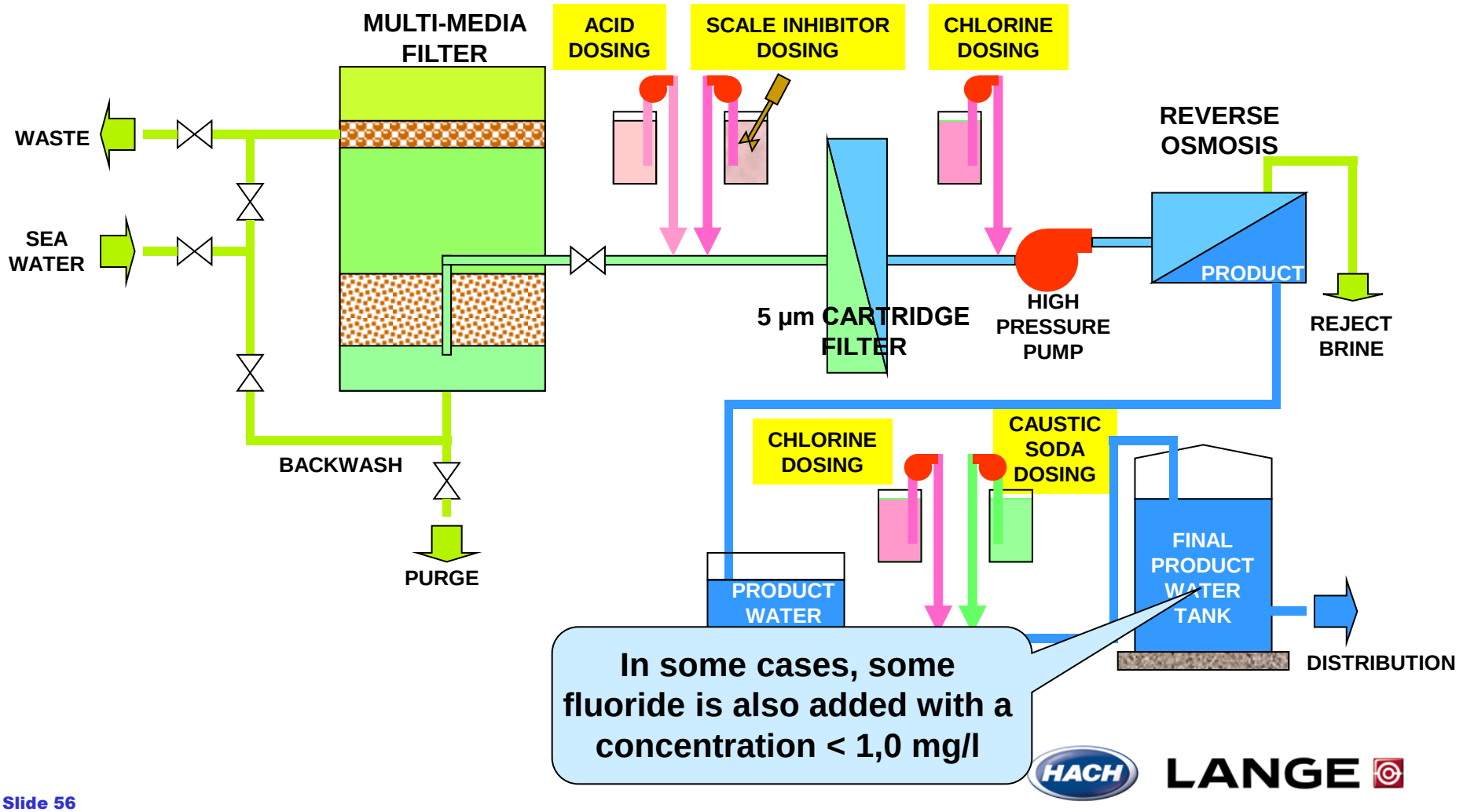
Pure desalination water is highly acidic and is thus corrosive to pipe, so it has to be mixed with other source of water that are piped outside or . . .



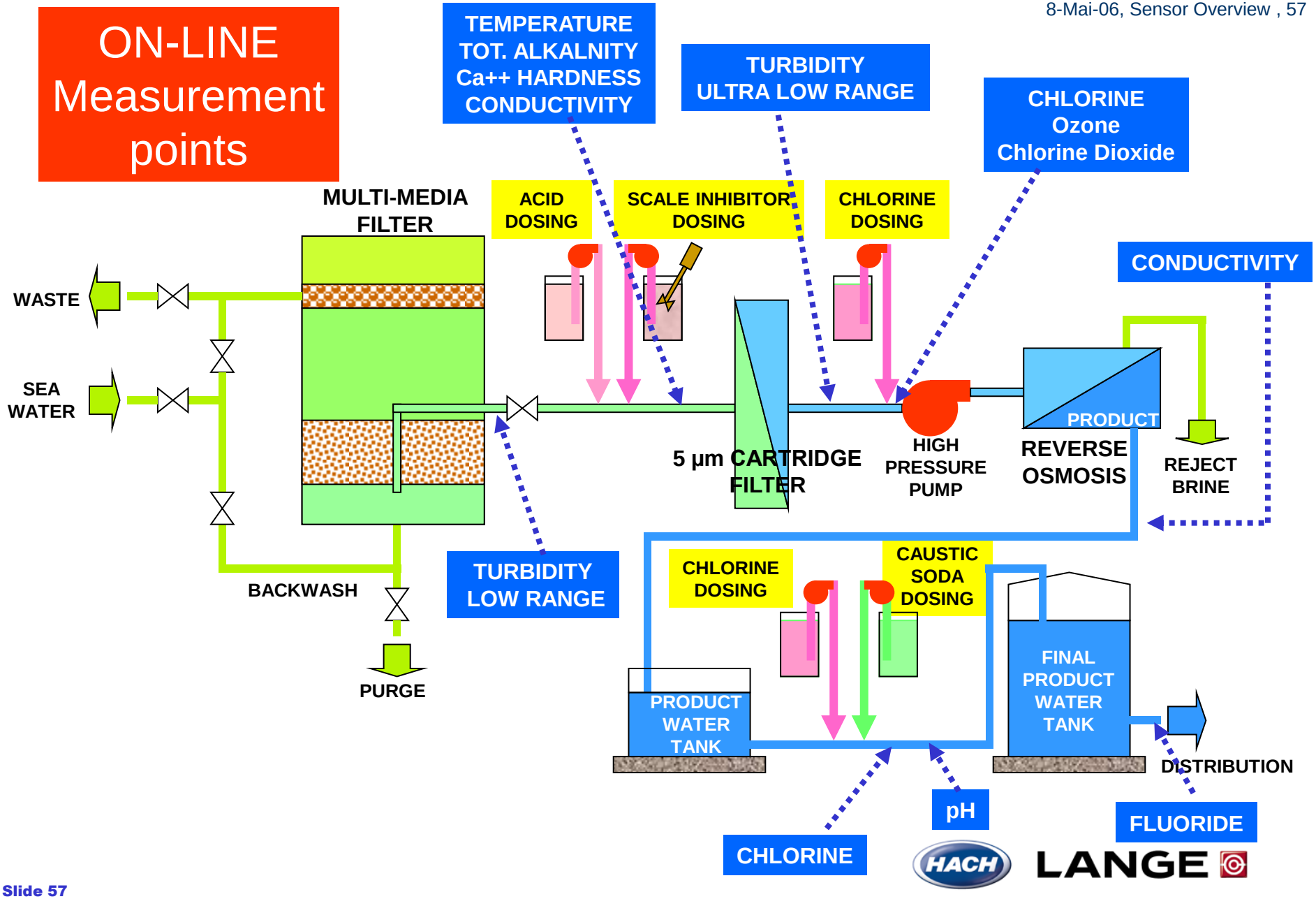
or . . . else adjusted or
pH
hardness
alkalinity
before being piped outsite



According to local water regulations, pH level 7,2 – 7.6, Ca hardness +/- 100 mg/l, HCO3- +/- 100 mg/l and 0,5 mg/l for Boron



ON-LINE Measurement points



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Industrial Water Process

So various market, we will not have the possibility to make a deep examination of them:

- Petrochemistry
- Beverage products
    - Water botteling
    - brauweries
    - Softdrinks (Cola)
    - Vine
- Vegetable oils
- Chemical Industry
- Paper Mills Industry
- Pharmacopeia Industry
- Cosmetic Industry
- Metal Industry
- . . . Everywhere aqueous samples are used