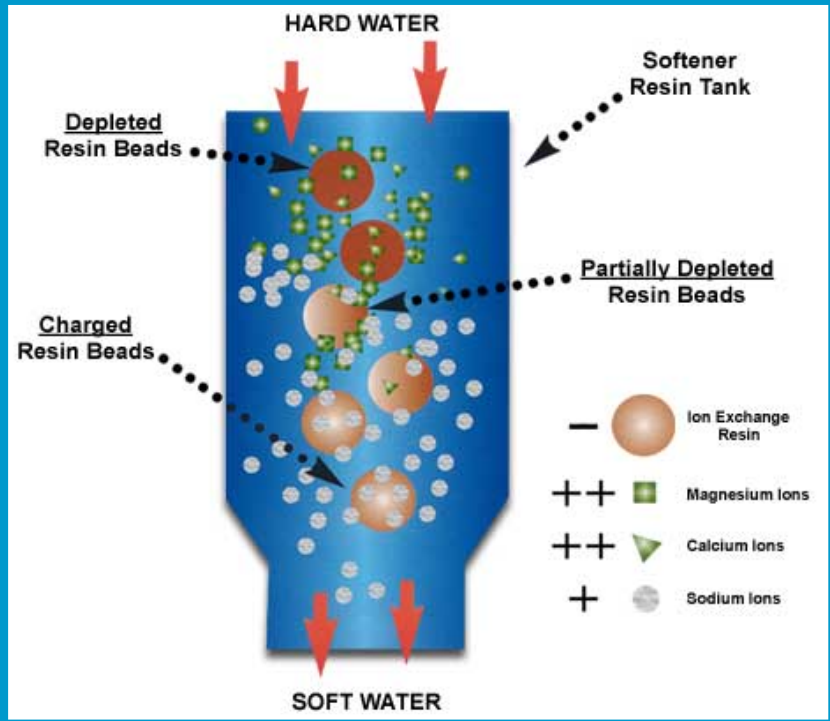
Softening Ion-exchange



Marianne van der Griendt
Heleen van der Vliet

Design of 4th Mega location Oasen

CT 5520, Drinkwater Treatment 2

11 May 2007

oaseo

TU Delft
Delft University of Technology

Ion exchange

Used technique for:

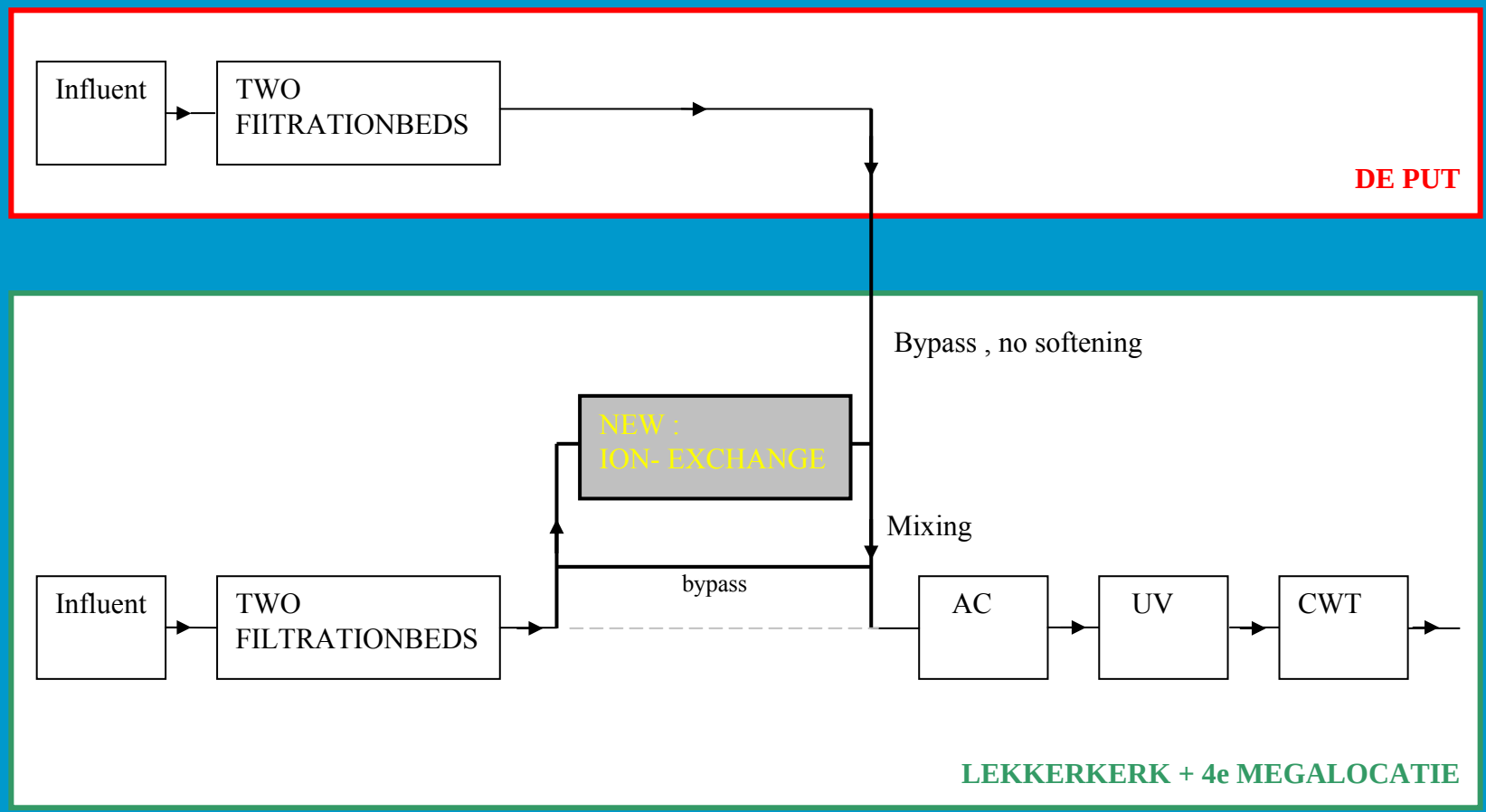
- **Softening !** (often used industrial applications)

- Heavy Metals
- Nitrate Removal
- DeColourising
- NOM removal

oaseo

TU Delft

Option 4: Ion-exchange



Ion exchange

- 2 possible applications:

Kationen (positive)	and	Anions (negative)
Removal Ca^{2+}, Mg^{2+}		SO_4^{2-} ,Cl^- ,OH^-

Correct hardness

2 Types : strong and weak

1. Strongly acidic (or basic) cation exchange

   $2\ (Resin)\text{-}Na^{+} + Ca^{2+} \rightarrow (Resin)\text{-}Ca + 2Na^{+}$

   $2\ (Resin)\text{-}Na^{+} + Mg^{2+} \rightarrow (Resin)\text{-}Mg + 2Na^{+}$

2. Weakly acidic (or basic) cation exchange

   $2(Resin)\text{-}H^{+} + Mg^{2+} \rightarrow (Resin)\text{-}Mg + 2\ H^{+}$

   $H^{+} + HCO_3^{-} \rightarrow CO_2 + H_2O$

   $CO_2 \rightarrow CO_2\ (gas)$

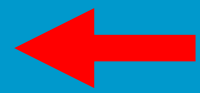
oaseo

TU Delft

2 Types : strong and weak

Strongly acidic (or basic) cation exchange

- Possible reduction hardness to 0,0



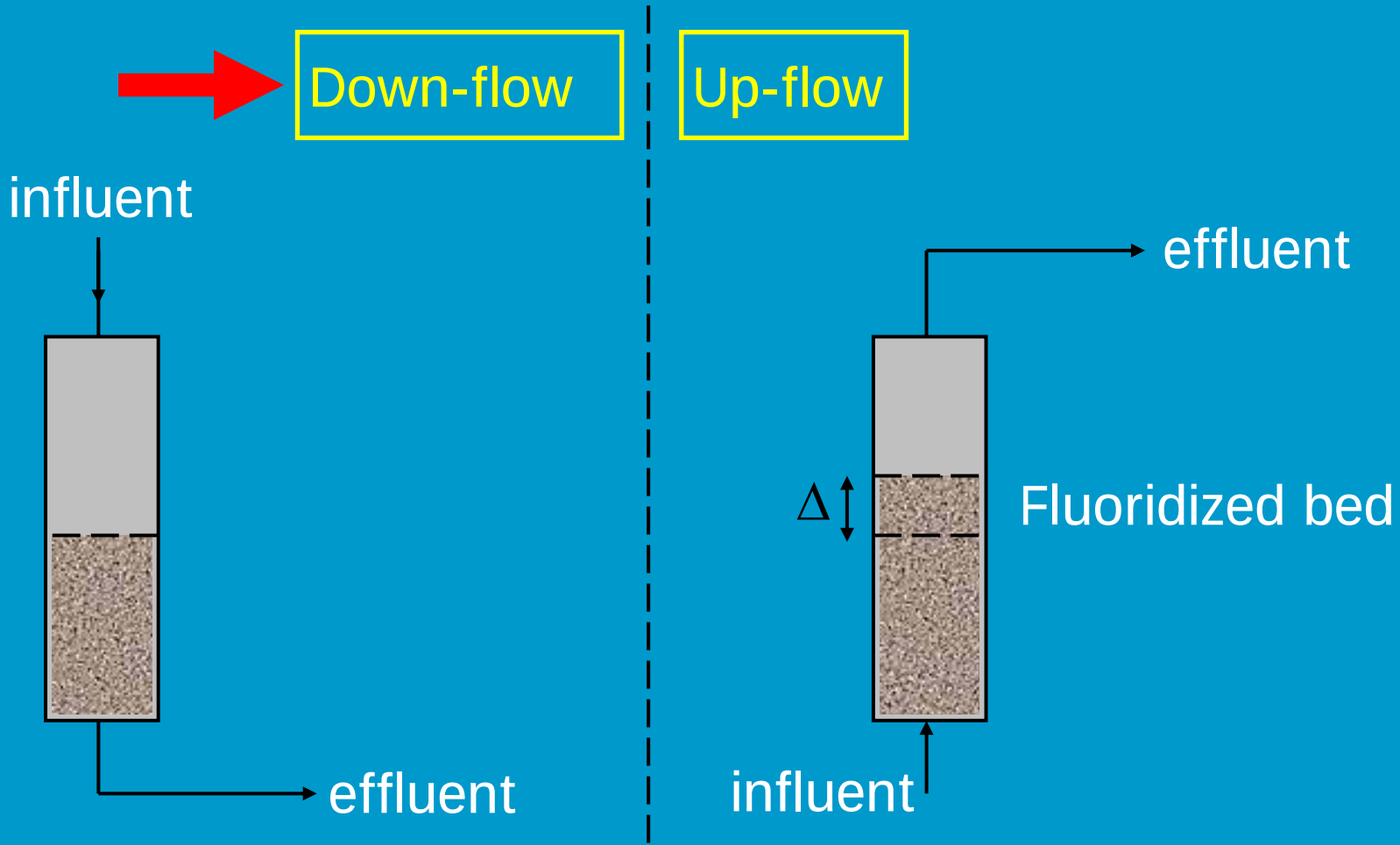
Weakly acidic (or basic) cation exchange

- reducing hardness to 2,0

oaseo

TU Delft

Process 2 options:



Regeneration

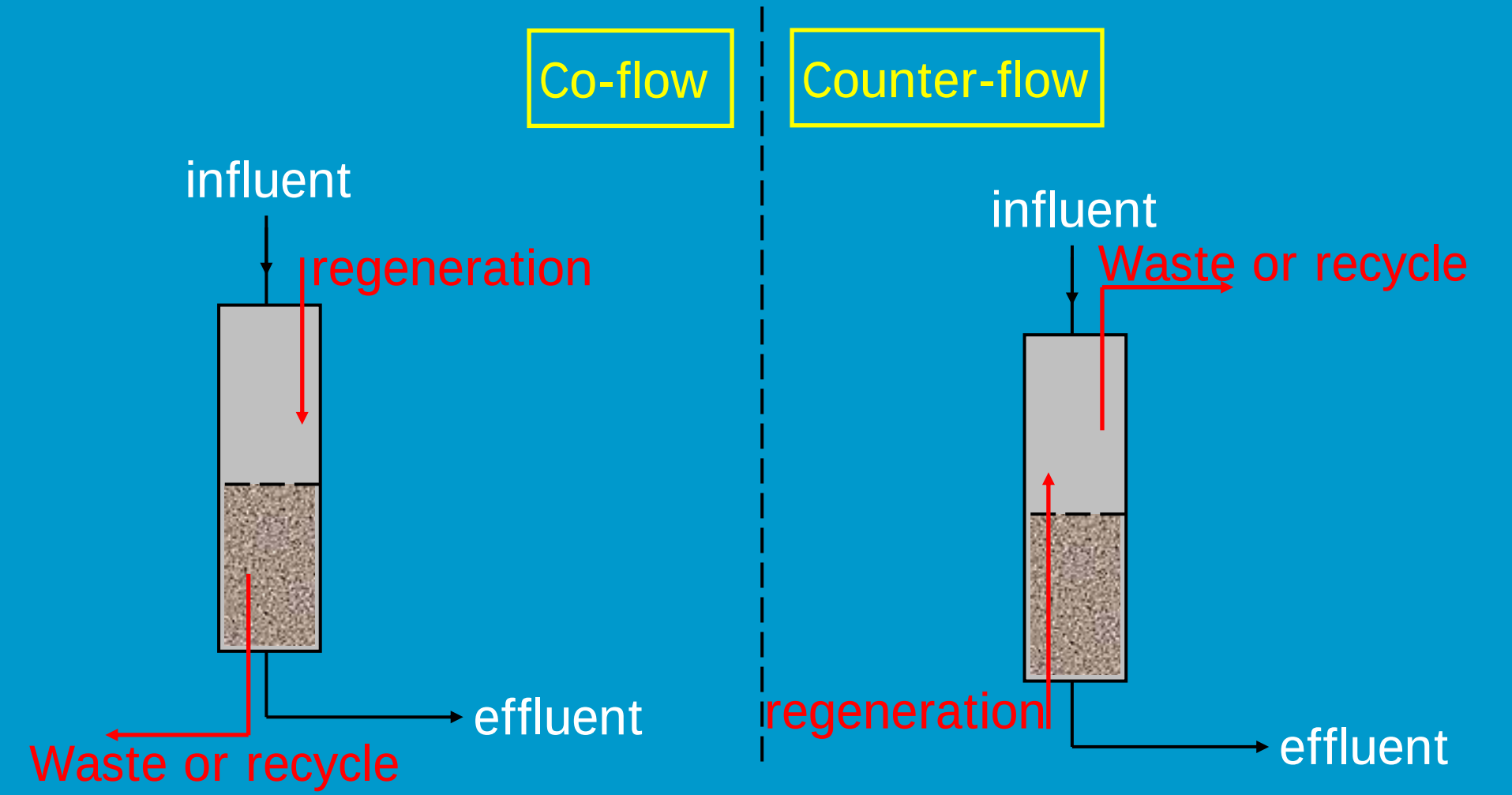
Regeneration necessary after 1-2 weeks

- Backwash resin
- Adding chemicals
- Remove chemicals
- washing the bed of resins clean

oaseo

TU Delft

Regeneration process : 2 directions



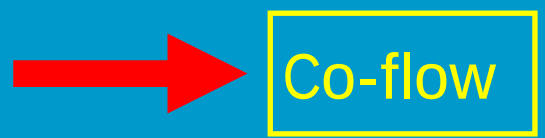
Co-flow / counter-flow

Advantage regeneration co-flow :

- Easy to build
- Longer contact time, because low flows are possible

Disadvantage regeneration co-flow:

- Risk of canal flow
- Shorter contact time, because of expended bed
- Higher construction



oaseo

TU Delft

Co-flow / counter-flow

Waste or recycle regeneration process water:

- Contains chemicals

Investigate Nanofiltration as possibilities recycle-method

Process details

- Regenerant: NaCl
- Regenerant contact time: 10-60 minutes
- Infiltration flow: < 60 m/h
- Regenerant flow rate: 2 – 4 BV/h
- Water usage regeneration: 1 – 5 %
- Bed depth: > 800 mm
- Resin: 0,4 – 1mm

oaseo

TU Delft