

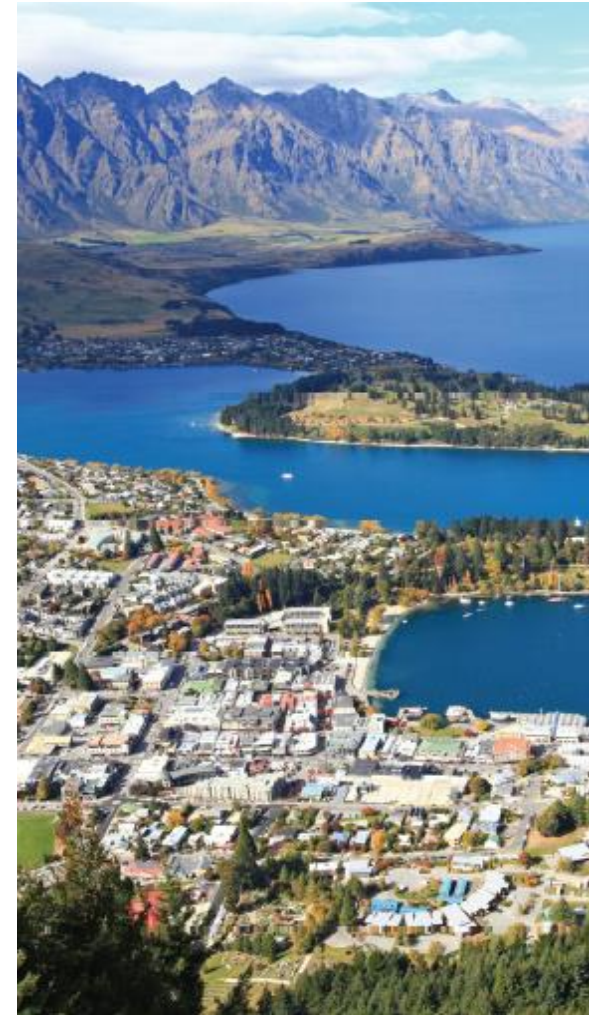
A close-up photograph of a person's hands cupping water flowing from a faucet. The water is clear and cascades into a blue pool below. The background is a blurred green landscape with yellow flowers.

INDUSTRIAL RO SYSTEM PRE-TREATMENT BEST PRACTICES

Building Sustainable IMPACT

We help customers do more with less

We Impact world's growing demands for



ECOLAB Overview

\$13 BILLION ANNUAL SALES

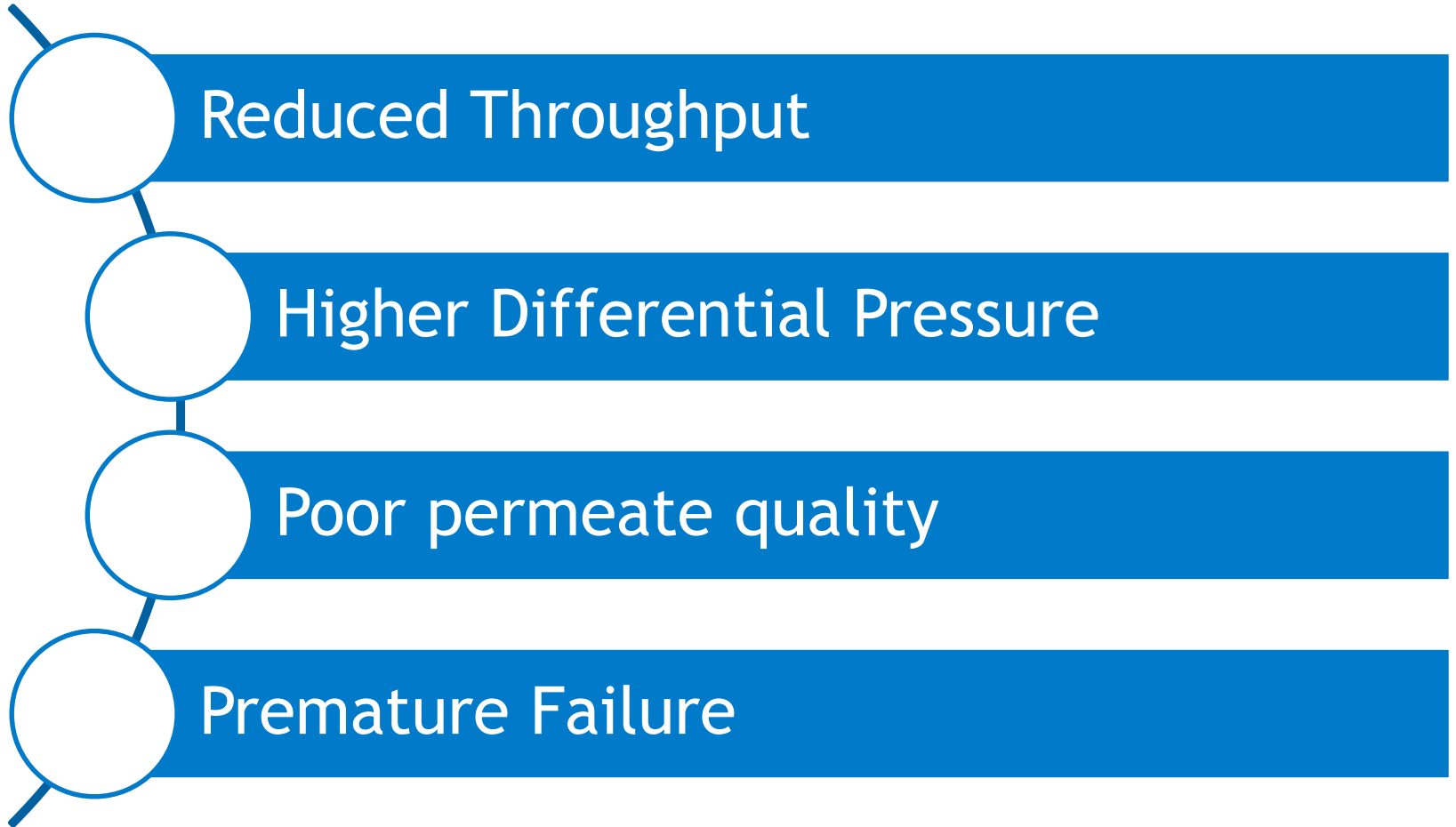
44,000
ASSOCIATES

1.3 MILLION
CUSTOMERS

SERVING CUSTOMERS IN
171 COUNTRIES

6,300 Patents

Challenges - as we face it



The Infamous Five

Biofouling



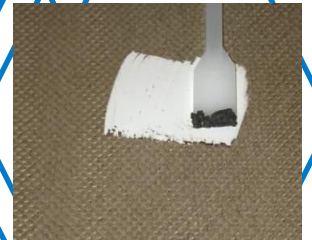
Organic Fouling

Scaling



Colloidal Fouling

Particulate Fouling



Pre-Treatment Goals

Controlling Particulate Fouling

- Target is to maintain turbidity < 1 NTU & SDI < 5
- Can be reduced by clarification / filtration

Controlling Biofouling

- Assimilable Organic Carbon (AOC) to be < 5 (DOW)
- Involves corrective and protective arrangement

Controlling Organics / Color

- TOC < 3 ppm, FOG < 0.1 ppm - True Color < 3 APHA
- Standard approach includes clarification, ACF, NF

Pre-Treatment Goals

Controlling Scaling

- Antiscalant chemistry & LSI management
- Saturation model for treatment design

Controlling Metals

- Fe / Al & Co (from SMBS) should be < 0.1 ppm
- Iron can be tolerated by lowering pH & reducing O₂

Controlling Hydrogen Sulfide

- Keeping the RO feed water free of oxygen
- Removal by iron filter / other arrangements

Silent Assassins

Diatoms / Algal Fouling

- Unicellular diatoms are difficult to control
- Traditional bio-management doesn't work

Aluminum Fouling

- Uncontrolled addition of Al coagulant / natural
- pH management in pre-treatment is the key

Silica Fouling

- Colloidal silica / pre-formed silica / diatoms
- Leads to fouling & abrasion damage

Questions & Answers



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