



RESAT EGYPT WATER TREATMENT

**3 ALKHALEEG BUILDING ALMARUTIA
PYRAMIDS GIZA**

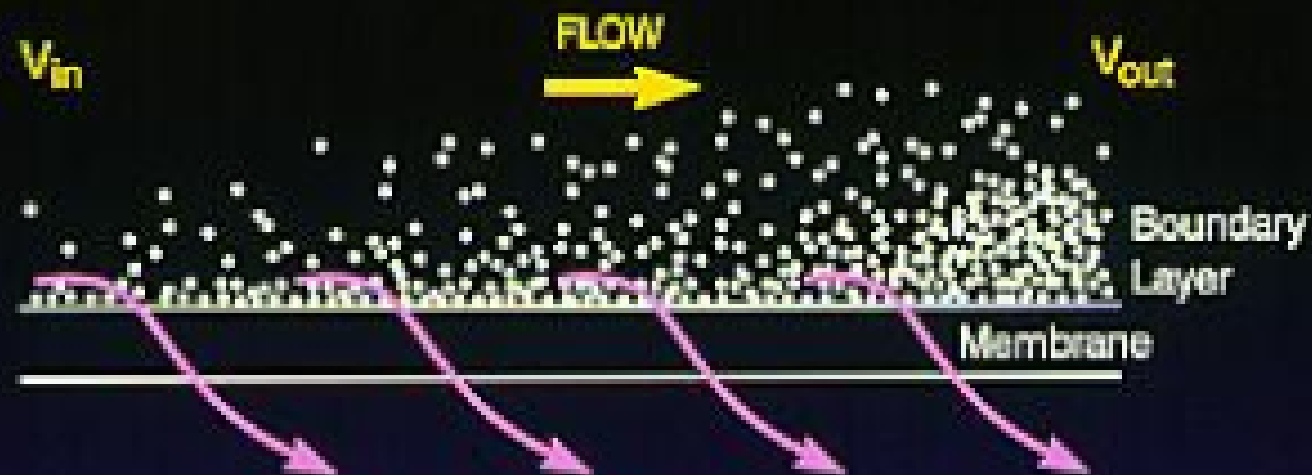
Telefax: 202 37447164 – 0101480286

Membrane Cleaning

**By Chemist
Ayman Awny Mahmoud**

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SALT CONCENTRATION IN THE BOUNDARY LAYER



Velocity : $V_{in} > V_{out}$
Salt Conc. : $TDS_{in} < TDS_{out}$

Poor Permeate Quality



FOULING

Low Water Production

Membrane Damage

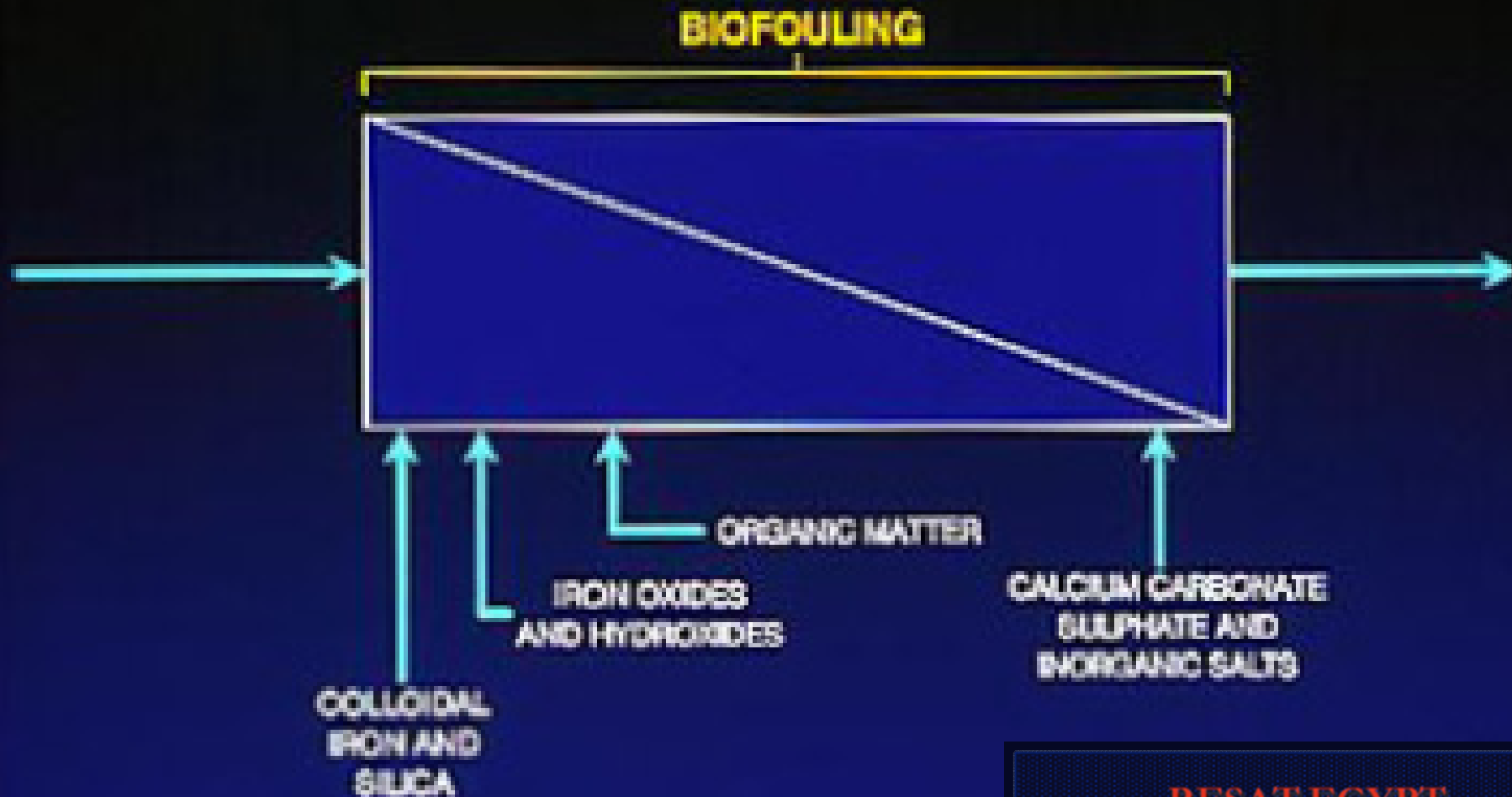
Frequent Cleaning

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PRINCIPLE FOULING LOCATIONS



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Fouling Indicators

Permeate Flow	Salt Passage	Diff. Pressure	Direct Cause	Indirect Cause	Corrective Measure
↓↓	↑	↑	Scaling	Poor Scale Control	Cleaning; Scale Control
↓↓	↑	↑	Colloidal Fouling	Insufficient Pretreatment	Cleaning; Improve Pretreatment
↓	→	↑↑	Biological Fouling	Feed water; Insufficient Pretreatment	Cleaning; Biocide; Improve Pretreatment
↓↓	→	→	Organic Fouling	Polymer Overfeed; Humics; Oil	Cleaning; Improve Pretreatment

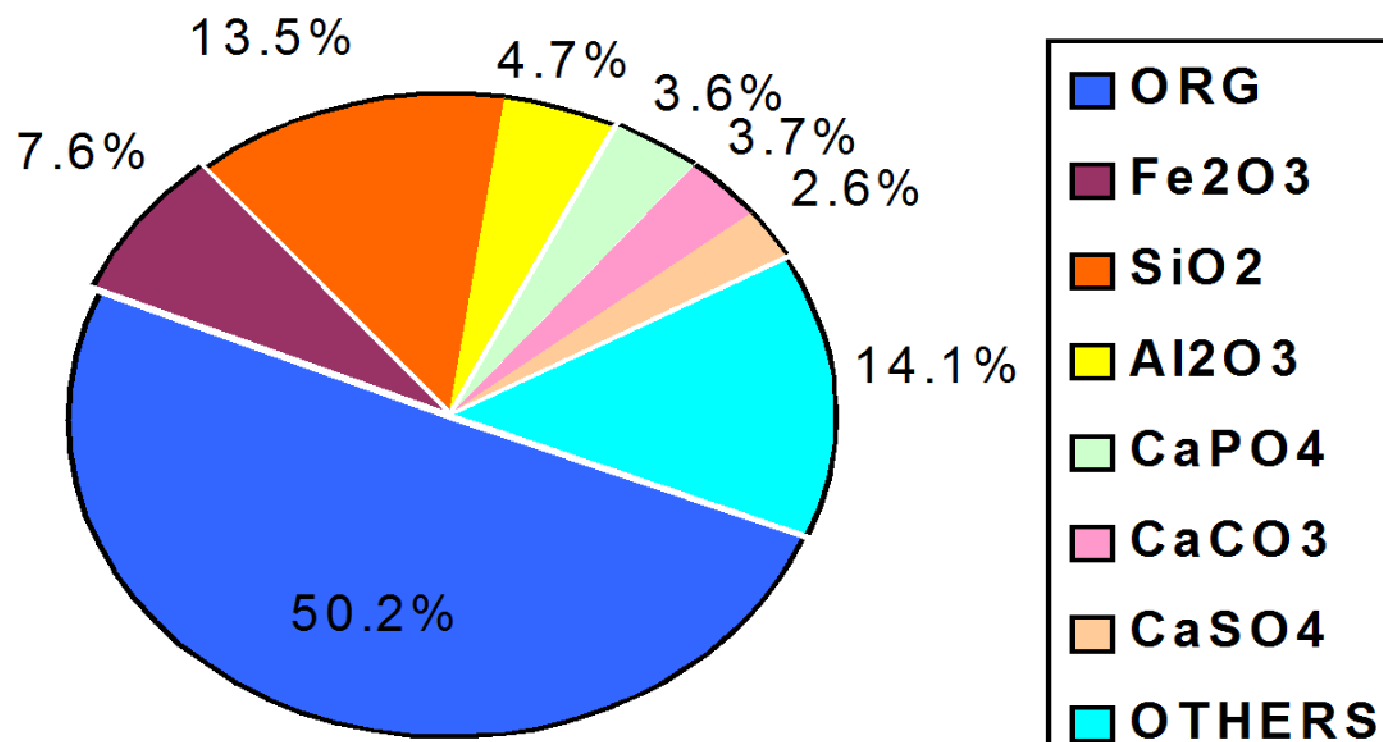
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Common Fouling Risks

Survey of 150 Membrane Autopsies

AVERAGE FOULANT DISTRIBUTION
WORLDWIDE



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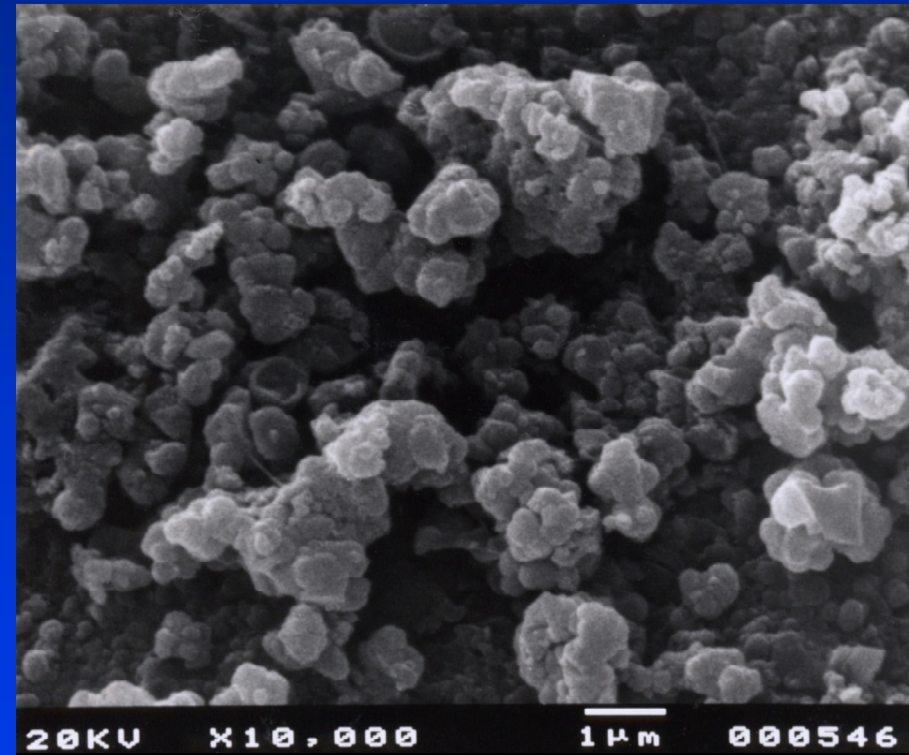
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Calcium Sulfate Scaling on the Vexar spacer

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Silica Fouling



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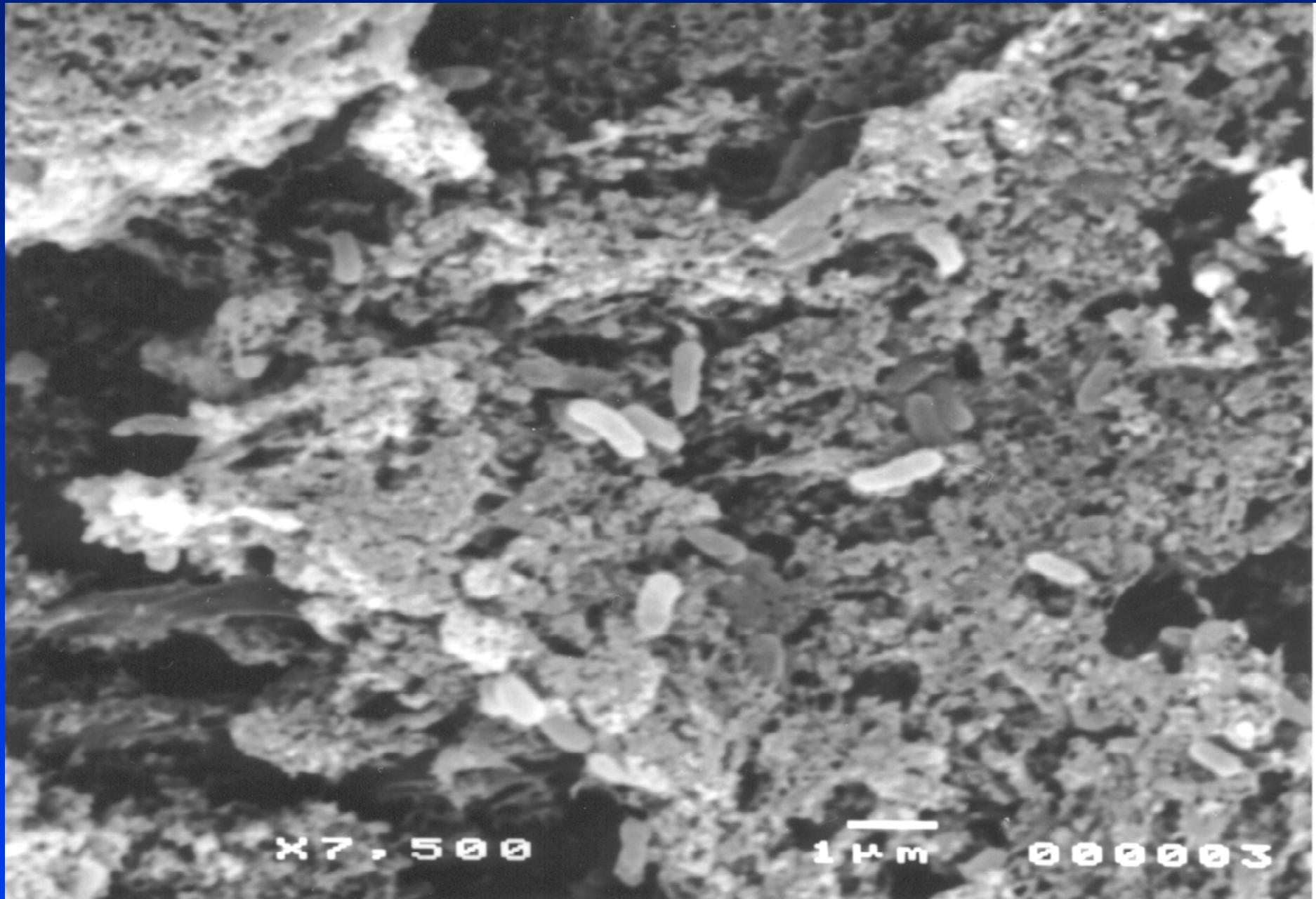
BIOFOULING

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SEM: Biomass and Rod Shaped Bacteria



When do I clean?

- When any ONE of the following changes:
 - ✓ **Differential Pressure** by 15%
 - ✓ **NPF** by 15%
 - ✓ **Salt Passage** by 15%
- Exceeding these limits may be irreparable
- Start planning your strategy at the 1st indication of a minimum change!

Maintenance Cleaning

- RO's need to be Cleaned!

- Typically:

√ **SDI 3 -5**

Cleaning 4 /year

√ **SDI 1- 3**

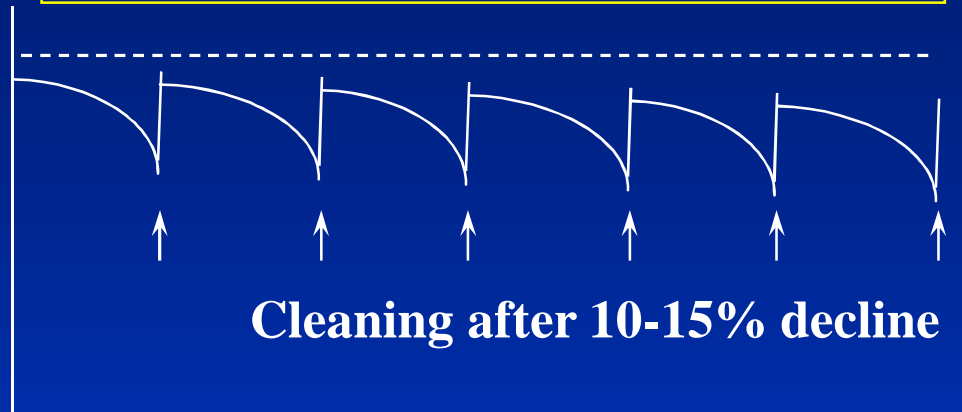
Cleaning 2 /year

√ **SDI < 1**

Cleaning 1 /year

Proper Cleaning Maintenance

Normalized
Permeate
Flowrate



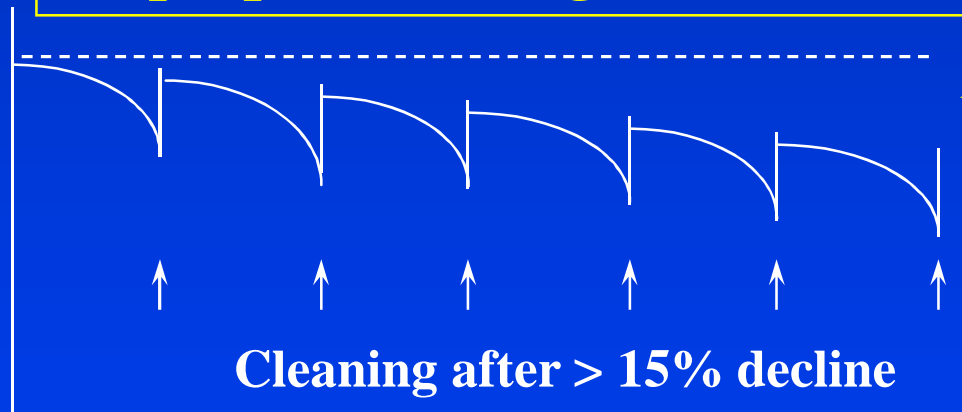
Cleaning after 10-15% decline

Time

Cleaning after a
10-15% decline
maximizes RO
performance

Improper Cleaning Maintenance

Normalized
Permeate
Flowrate



Cleaning after > 15% decline

Time

Waiting too
long
to clean reduces
RO
performance

Telescoped membrane due to high differential pressure

Operator waited too long before cleaning



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Permanent membrane damage

User did not clean in time

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Chemical Cleaning Products

- **Biocontrol-11: Non-oxidising Biocide**
- **RESAT-DE 22 PC-33: Chelating Agent**
- **Biocontrol-22: Non-oxidising Biocides**
- **Anti-chlorination : Cl₂ Release Sanitizer**

Chemical Cleaning Products

- **RESAT-DE-67: Mild Alkaline Surfactant**
- **RESAT-DE-77: Weak Acid**
- **RESAT-DE-87: Strong Mineral Acid**
- **RESAT-DE-99: Alkaline Surfactant**

Factors Influencing Cleaning

- **Plant Design - Ensure CIP tank & pump is correct size**
- **Plant Operation**
- **Membrane - Max pH/Temp limits**
- **Chemicals Selected**

Factors Influencing Cleaning

- Temperature
- pH
- Flow vs. Soaking
- Time
- Velocity

Cleaning Tips

- Pressure drop < 60 PSI
- Flow 35- 40 GPM per pressure vessel (8’')
- Cleaning Solution Volume: Use 8 - 10 Gallons Per 8’" element. Each pressure vessel = 50 gallons volume
- Use Alkaline cleaners first if organic fouling is suspected - acid can tighten organic foulant onto the membrane

Cleaning Tips

- **Max Solution Temperature advised by Membrane Manufacturer**
- **Soak Membranes - reduces cleaning solution channeling**
- **Clean “stage by stage”**
- **Replace Turbid Cleaning Solutions**
- **Keep good records**

Keep Good Records

CLEANING DATA COLLECTION SHEET

RO System: _____ Chemical _____

DATE: _____

Stage:

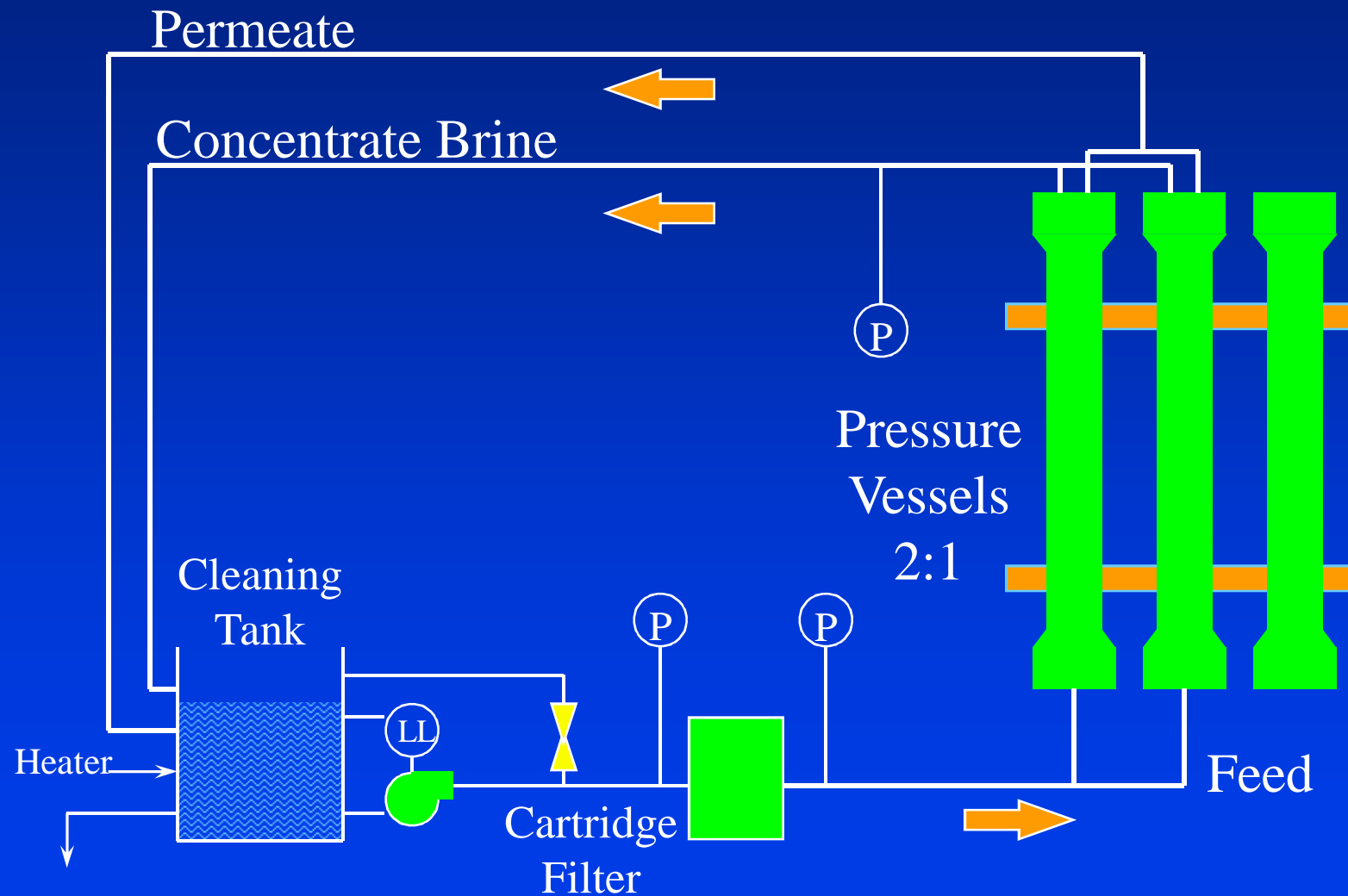
Tank Gallons: _____ **Volume or LBS.** _____

OPERATOR: _____

Minutes	0	15	30	45	1 hour	15	30	45	2 hours	15	30	45
pH												
Flow												
Temperature												
Comments												

Minutes	3 hours	15	30	45	4 hours	15	30	45	5 hours	15	30	45
pH												
Flow												
Temperature												
Comments												

Cleaning Skid



Membrane Preservation

- Preserve if out of service >24 hrs
- Sodium Bisulfite - 1%
- RESAT-DE 55 or / 56 - 0.05%
- Formaldehyde - NO – carcinogenic
- Glutaldehyde - NO - membrane damage

Membrane Flushing

- Permeate flush if system shuts down
- Acts as a “mini clean” and removes concentrate
- Reduces fouling and scaling

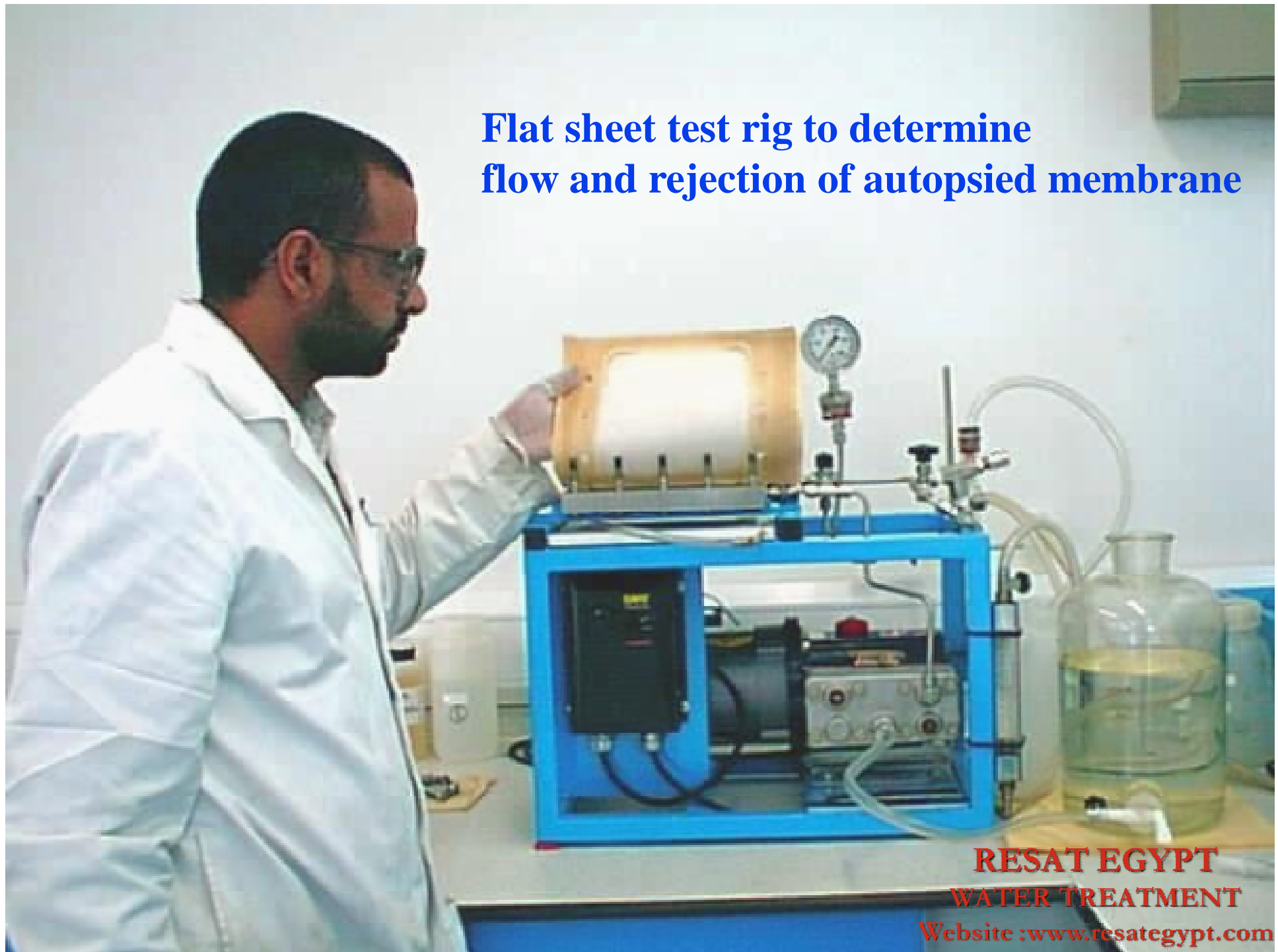
Membrane Autopsy Service

- **Destructive procedure consisting of observations and analytical tests on used membrane**
- **Determines cause of failure or poor performance**
- **Results used to develop site specific custom cleaning program**



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**Flat sheet test rig to determine
flow and rejection of autopsied membrane**



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**Flat sheet testing will ensure most effective
cleaning program is developed & used**

Use RESAT-DE Autopsy as a preventative tool

See RESAT-DE Autopsy Report Example

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Thank You Questions

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