TOTAL WATER MANAGEMENT FOR INDUSTRIAL WATER CONSERVATION

WELCOME TO WORKSHOP ON "WHAT CAN INDUSTRY DO TO CONSERVE WATER & REUSE" ORGANISED BY SAUDI ARABIAN WATER ENVIRONMENT ASSOCIATION (SAWEA)

AT HOTEL HOLIDAY INN, AL KHOBAR

ON 6TH DECEMBER, 2006

PRESENTOR: ION EXCHANGE (INDIA) LIMITED

LOCAL ASSOCIATES: H.K. GROUP OF CORPORATION

ABOUT ION EXCHANGE (INDIA) LIMITED

- ✓ Incorporated in 1964 as a subsidiary of the UK-based Permutit which became a fully Indian owned company in 1985.
- ✓ First Company in India to start manufacturing World-Class Ion Exchange Resins.
- ✓ More than 40,000 installations in India and Abroad. Over 400 installations in Industries like Nuclear, Power, Fertilizer,Oil & Gas, Petrochemical, Pharma, Pulp& Paper, Chlor-Alkali.
- ✓ All operating units are ISO 9000: 2000 certified; Resin & Chemical manufacturing units are ISO 14000 certified.

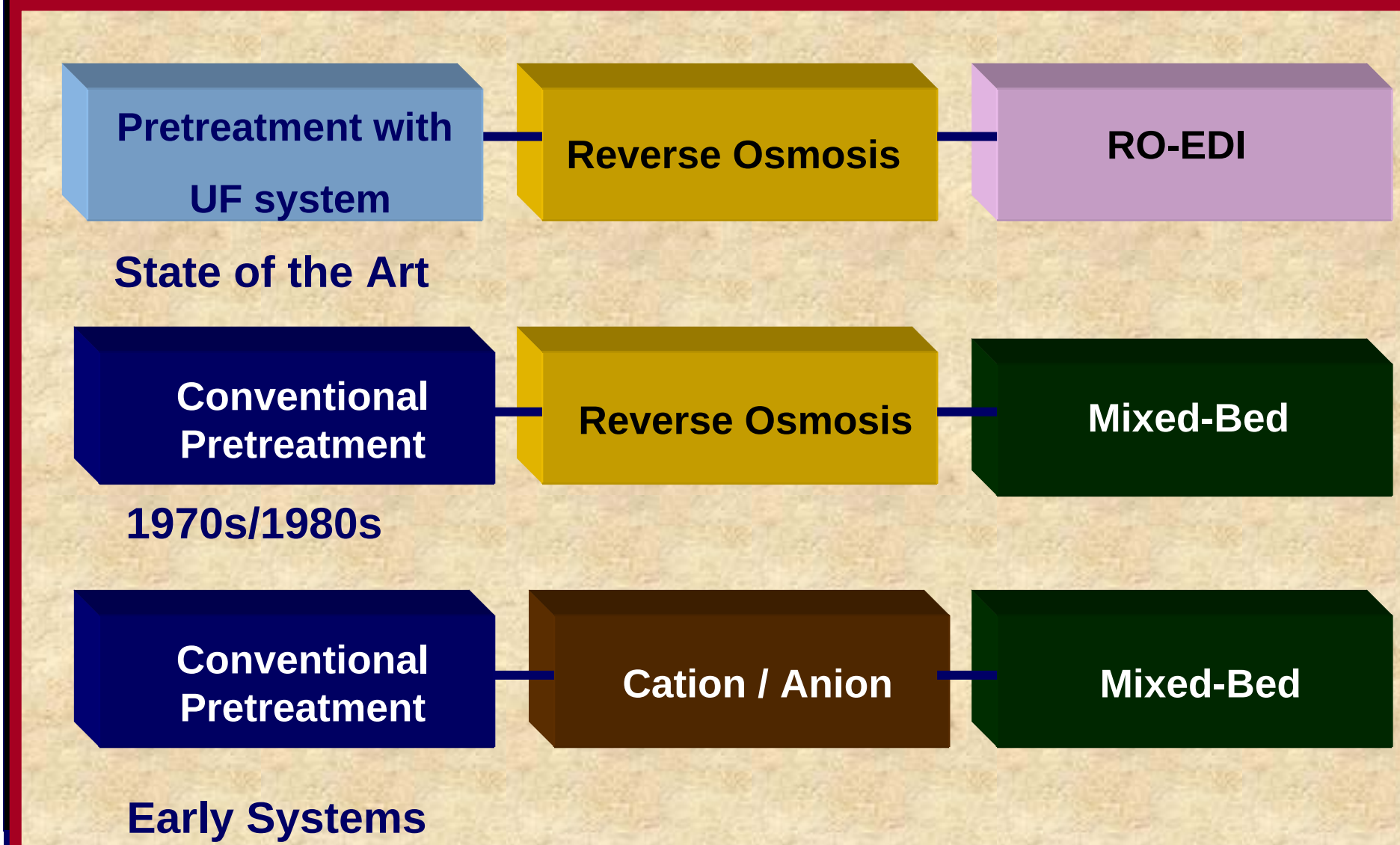
APPROACH


Total Solutions for
Industry, Homes, Communities
Drinking Water Purification
Water Treatment
Post Treatment
Pre-Treatment
Waste Water Treatment
Total Water Management
Total Service Support
Resins Membranes Chemicals
Water Recycle
Sullage/ Sewage Treatment

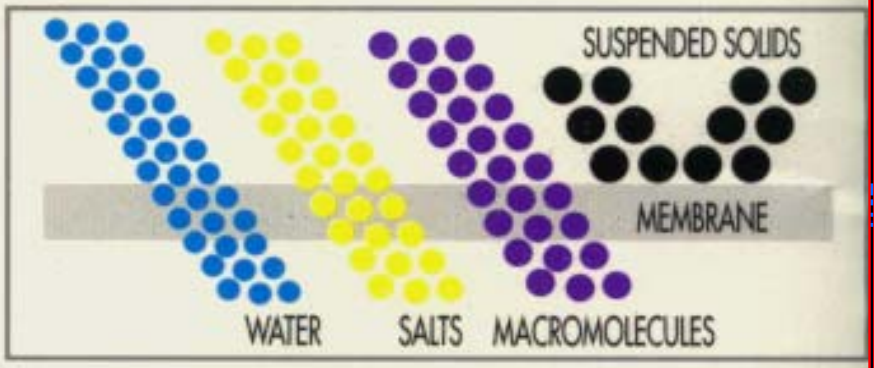
THE WIDEST PRODUCT RANGE INTERNATIONALLY…

- ✓ **INDUSTRIAL WATER & WASTE WATER TREATMENT PLANTS**
- ✓ **ION EXCHANGE RESINS**
- ✓ **WATER TREATMENT CHEMICALS**
- ✓ **HOUSEHOLD / INSTITUTIONAL WATER TREATMENT EQUIPMENT**

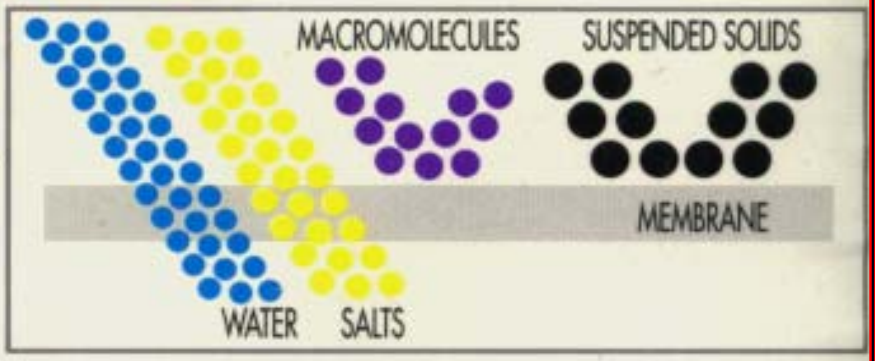
Water Technology Development Chart



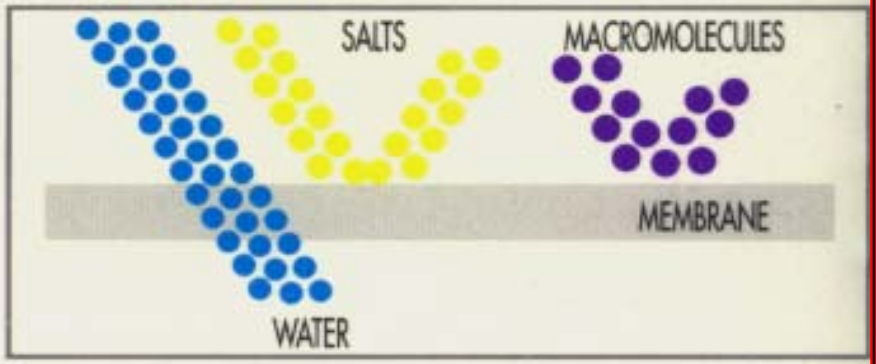
• **MICROFILTRATION** is a low pressure membrane process for separating suspended solids from a feed stream. Water, salts, and select macromolecules pass through a semi-permeable membrane, while suspended solids are retained and progressively concentrated.



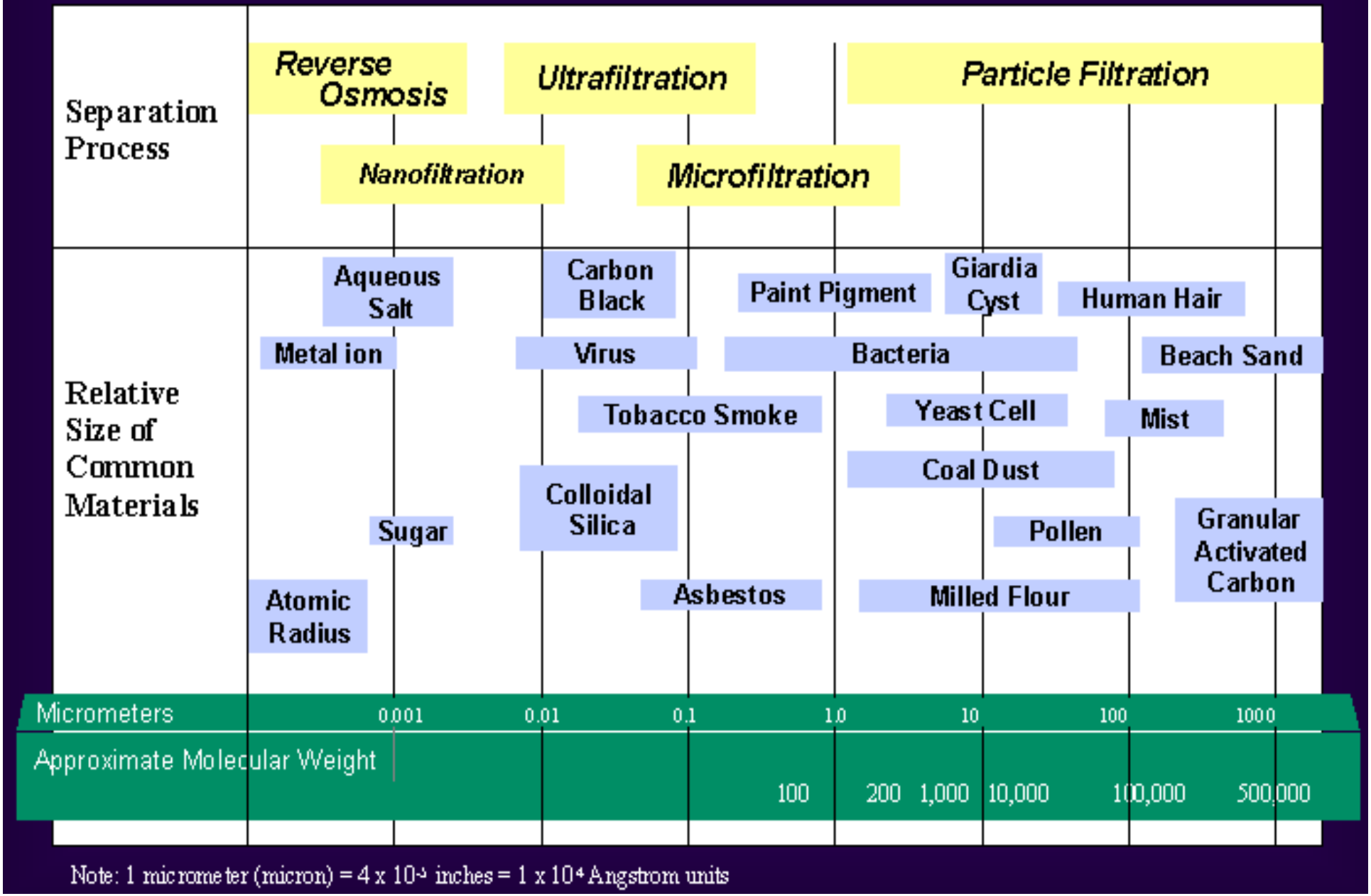
• **ULTRAFILTRATION** is a low pressure membrane process for separating high molecular weight species from a feed stream. Water, salts, and low molecular weight species selectively pass through a semi-permeable membrane, while macromolecules and suspended solids are retained and progressively concentrated.



• **REVERSE OSMOSIS** is a high pressure membrane process for separating low molecular weight species from a feed stream. Water selectively passes through a semi-permeable membrane, while salts and macromolecules are retained and progressively concentrated.



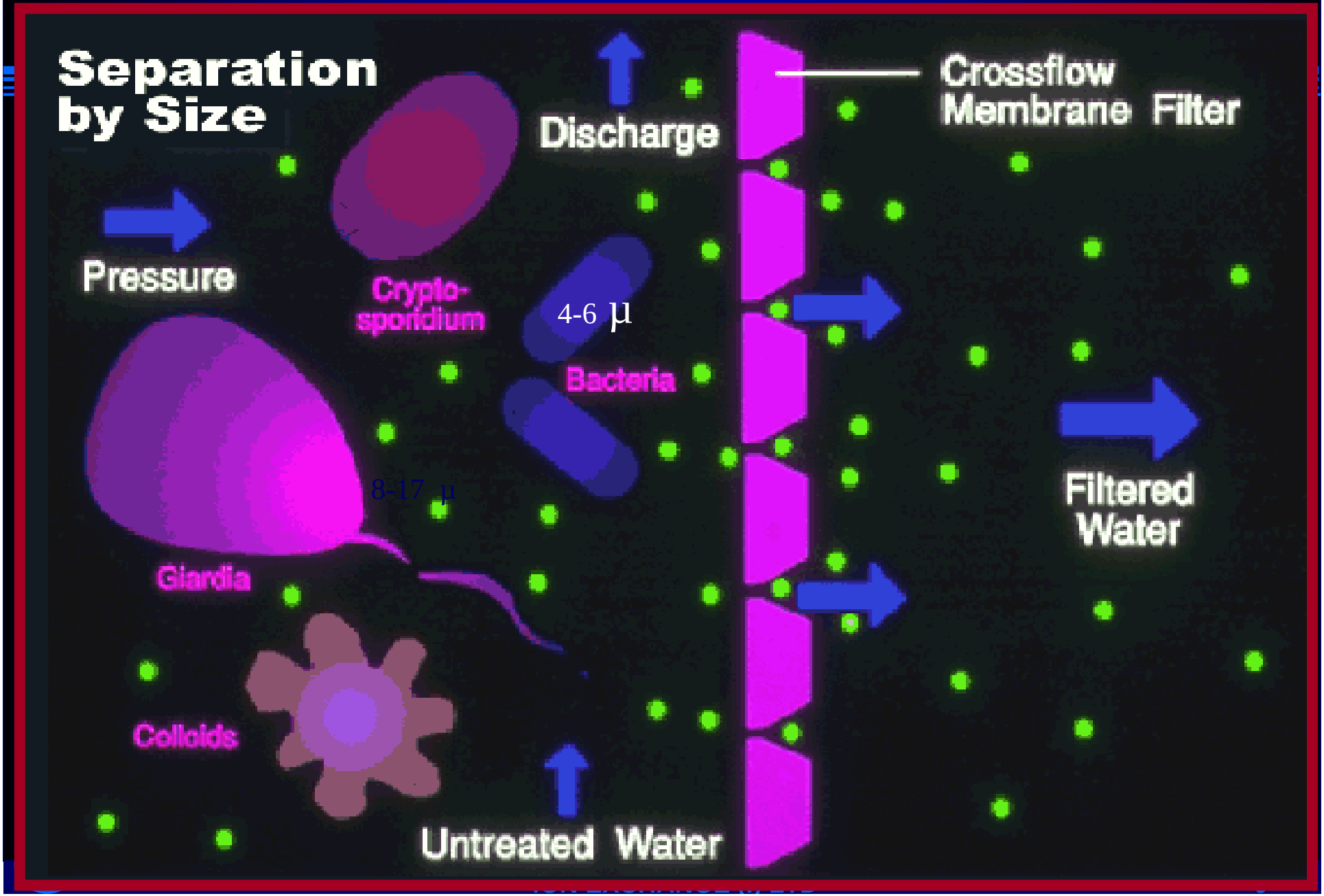
Membrane Filtration Spectrum



Note: 1 micrometer (micron) = 4×10^{-5} inches = 1×10^{4} Angstrom units

ULTRA
FILTRATION

Separation By Ultrafiltration



Ultrafiltration

What Can UF Remove?

- Silicates
- Colloids
- Particulate Matter
- Algae
- Bacteria
- Coliform
- Viruses
- Giardia
- Cryptosporidium
- Oils and Grease
- Proteins

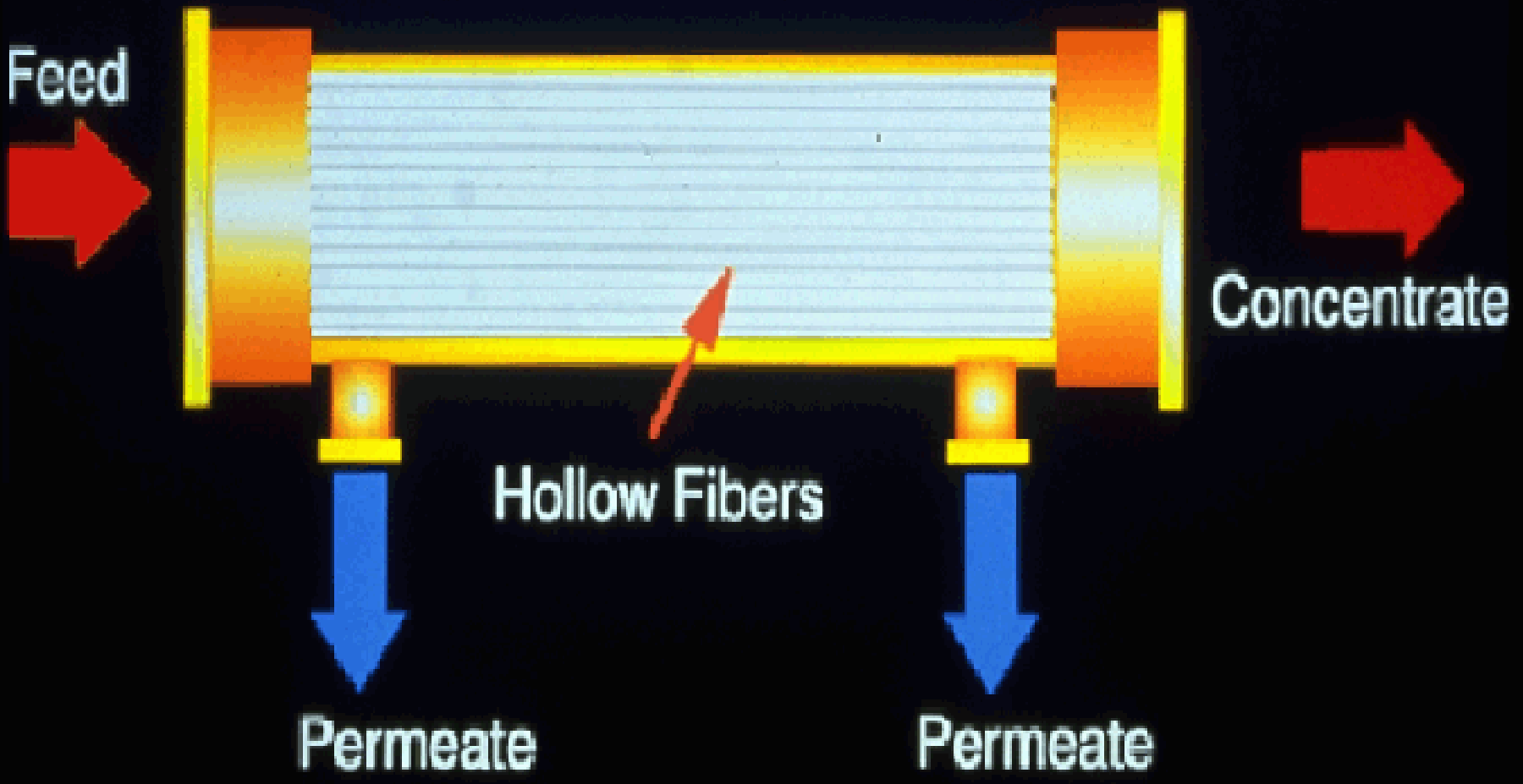
What can UF reduce?

- Total Organic Carbon
- Color components

What can UF not remove?

- Salts
- Gasoline
- Sugars
- Alcohols
- Low Molecular Weight Molecules

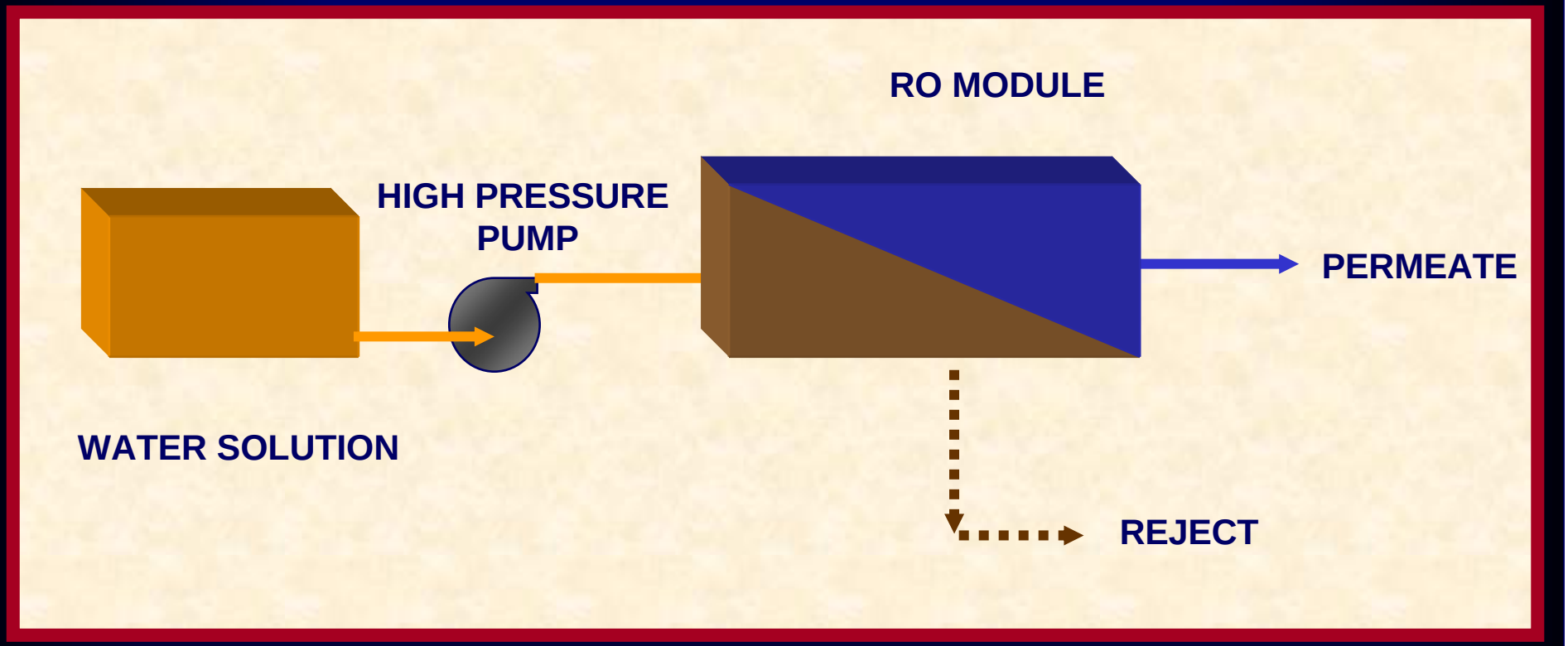
Indion Ultrafiltration System



REVERSE OSMOSIS SYSTEM

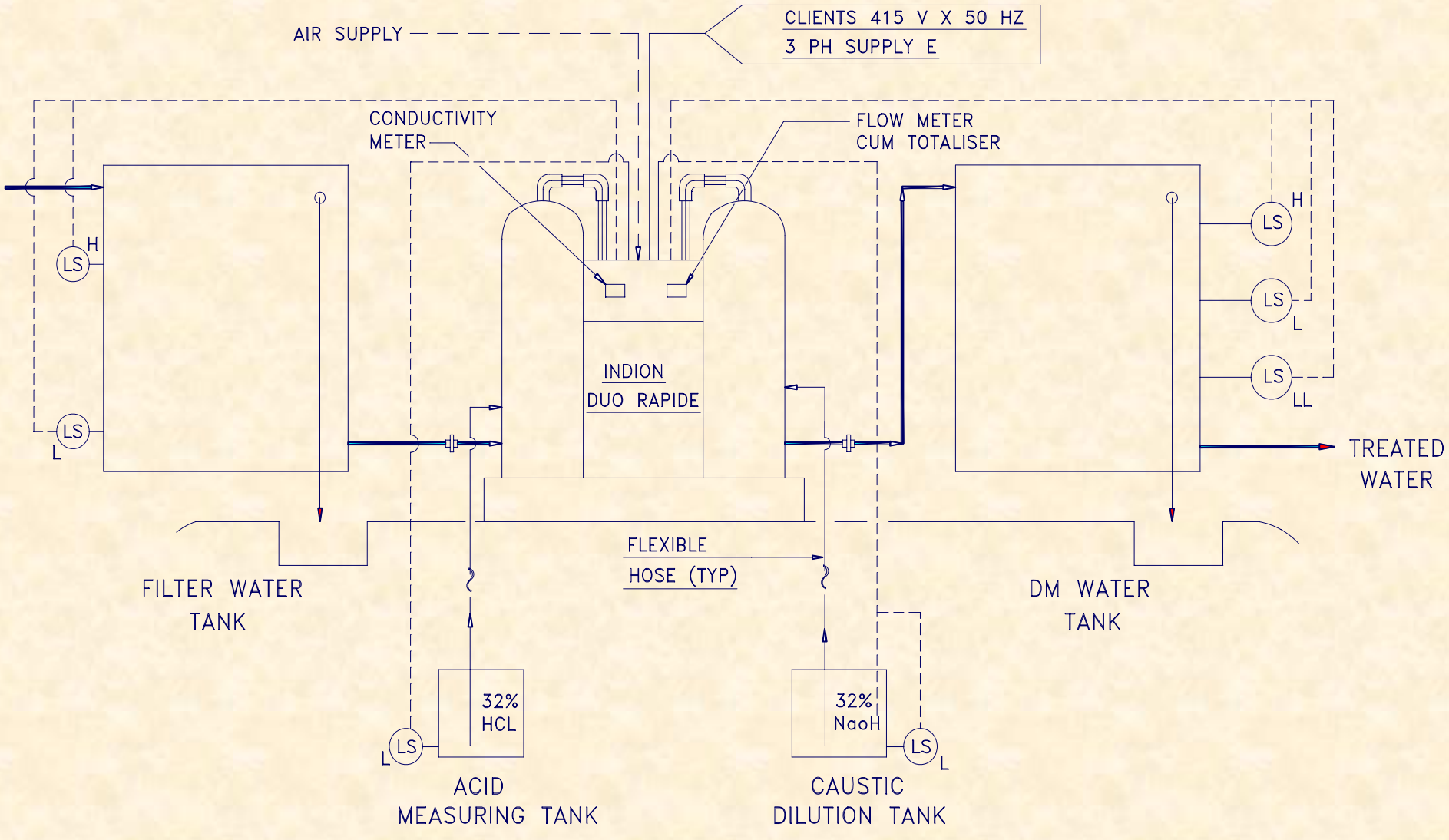
Principle

- SCHEMATIC REPRESENTATION OF TYPICAL REVERSE OSMOSIS SYSTEM



INDION DUO RAPIDE AUTOMATIC DEMINERLIZER

Indion Duo Rapide



Conventional DM Vs Indion Duo Rapide

- Service - Min 8 Hours
- Regeneration Time - 180 mins
- Semi-Automatic
- 10 to 30 ms/cm Conductivity
- Non neutral effluent
- Civil Work required
- Treated water tank size required for min 3 hours

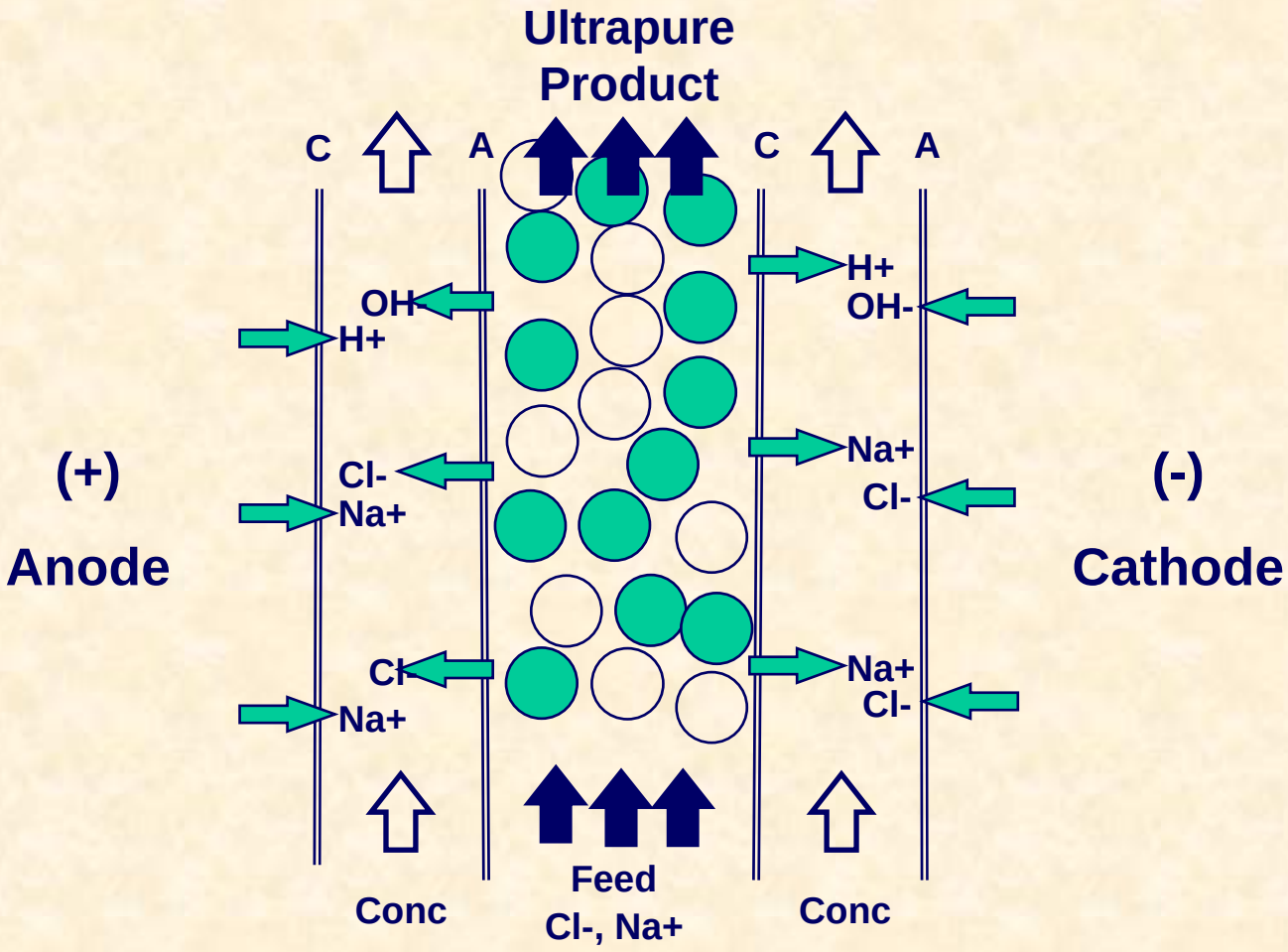
- Service - Min 3 Hours
- Regeneration Time - 35 mins
- Fully Automatic
- Less than 5 or 1 ms/cm Conductivity
- Near neutral effluent
- Civil Work not required
- Reduction in tank size by 60 %

- **FRONT VIEW**
- **(WITH DISPLAY SCREEN)**

REAR VIEW
(WITH CATION POLISHER)

INDION ELECTRODEIONISATION SYSTEM

EDI Technology




XL
EDI

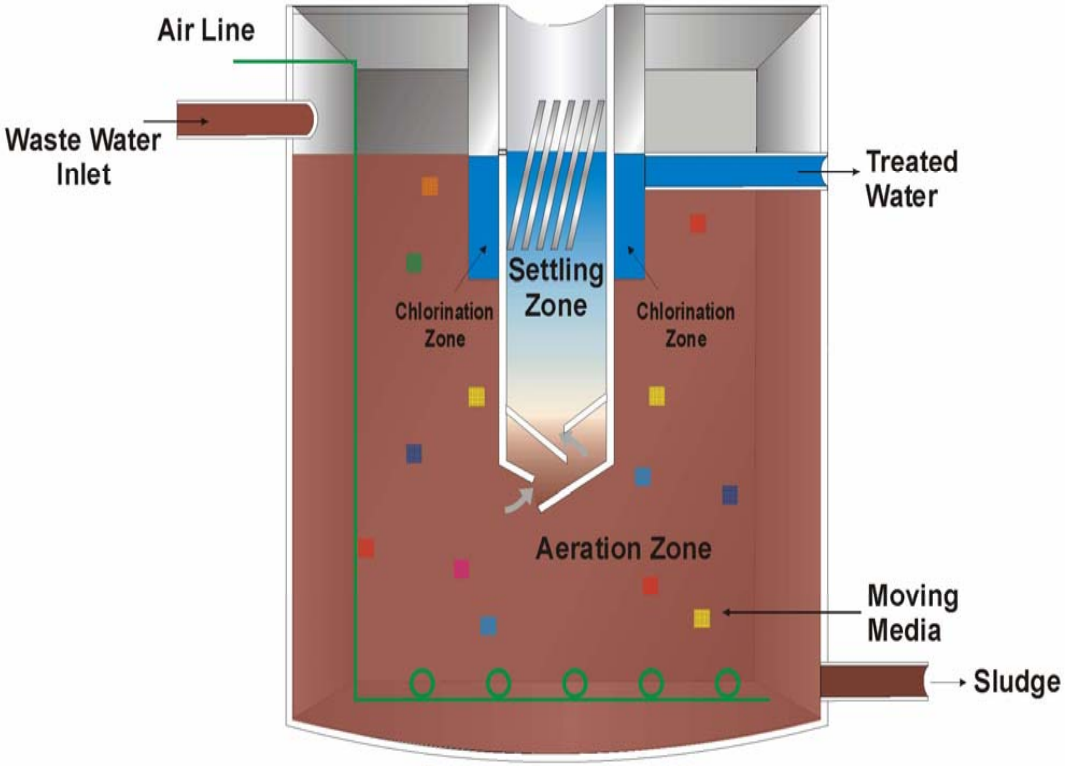
FMR

(Fluidised Media Reactor)

EMERGING TECHNOLOGIES IN DECENTRALISED WASTE WATER TREATMENT

Fluidised Media Reactor (FMR)

- **COMPACT SINGLE TANK DESIGN**
- **Attached Growth**
- **Aeration tank with patented media**
- **Lamella Settler**
- **Chlorine Contact Tank**

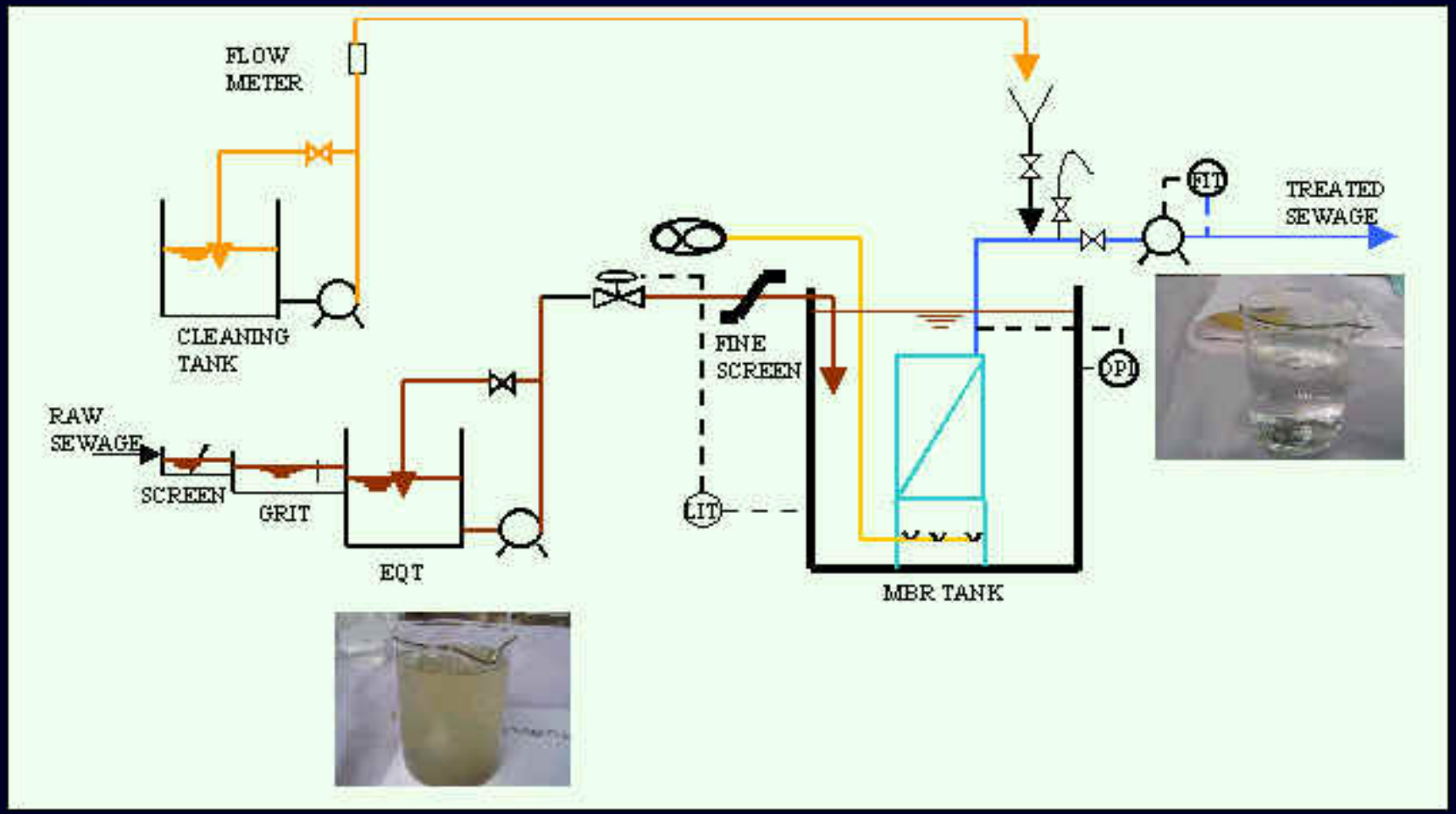


EMERGING TECHNOLOGIES IN DECENTRALISED WASTE WATER TREATMENT

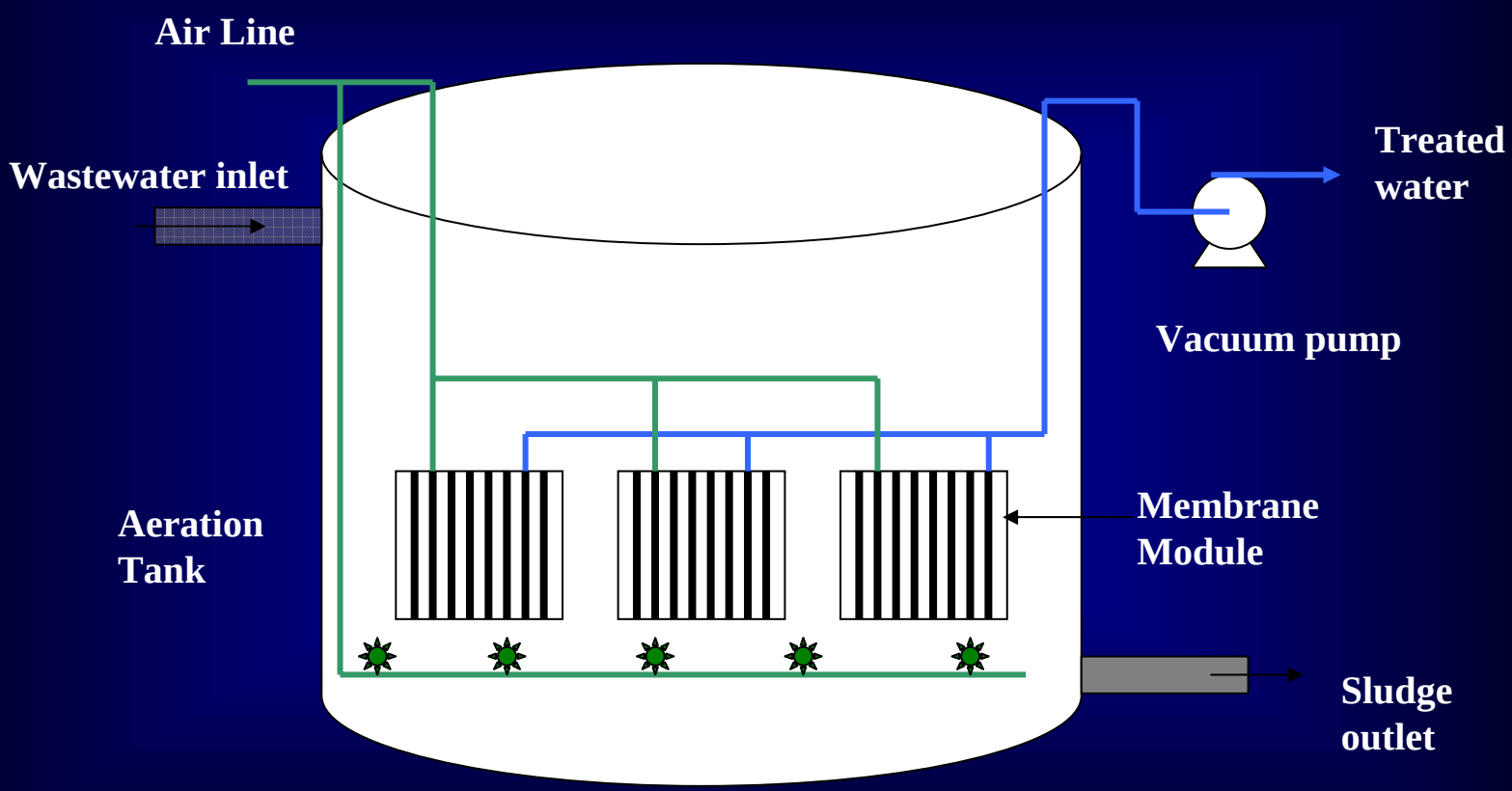
MBR

(Submerged Membrane Bio-Reactor)

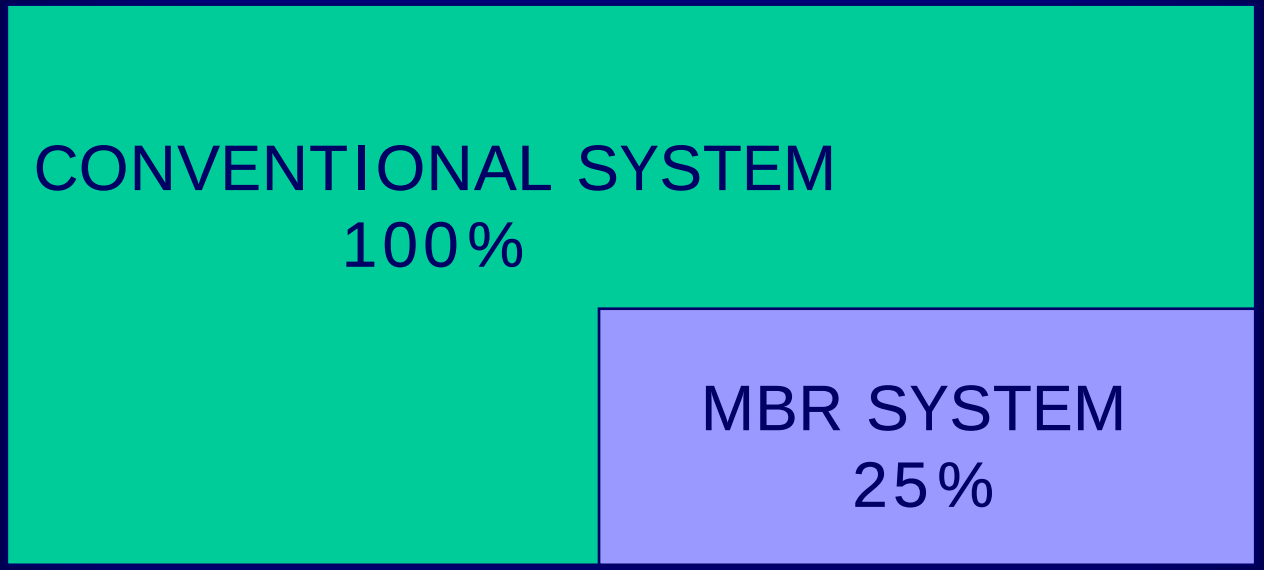
Separation by MBR



MBR PROCESS

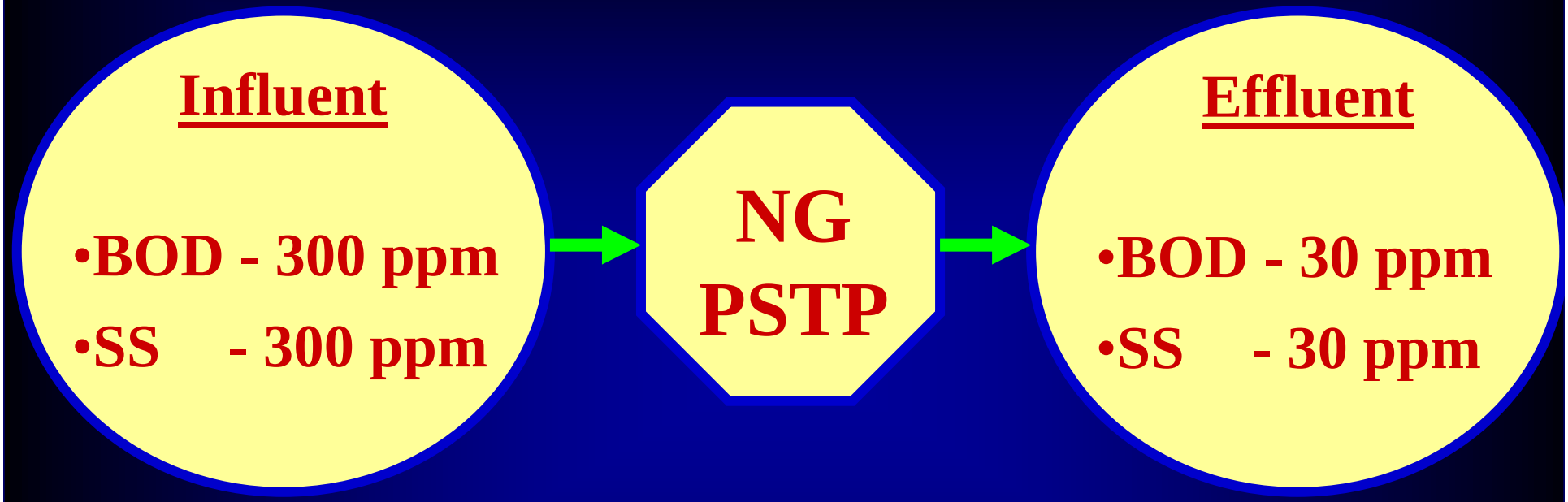

Air Line
Wastewater inlet
Treated water
Vacuum pump
Aeration Tank
Membrane Module
Sludge outlet

Conventional System V/s MBR



INDION
NEW GENERATION
PACKAGE SEWAGE TREATMENT PLANT
(NG PSTP)

Effluent Quality

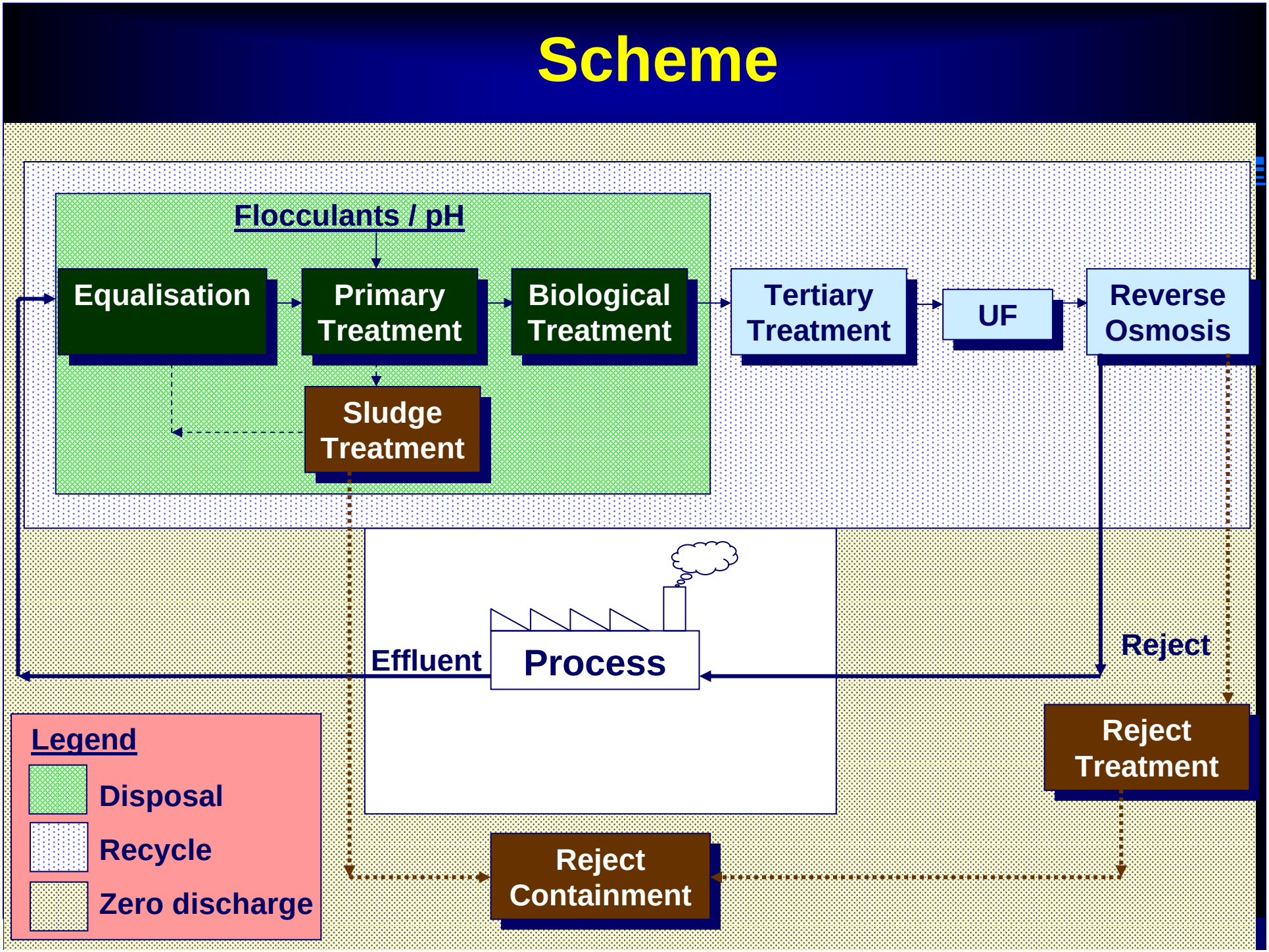



FST
Aerotor
PST

Wastewater treatment scheme selection

- Disposal (Under Pollution Control Board norms)
- Water Scarcity (Need for Recycle)
- Zero Discharge Norms (Goverment Regulations)
- Common Effluent Treatment Plants
- Process products recovery

Scheme


Flocculants / pH
Equalisation
Primary Treatment
Biological Treatment
Tertiary Treatment
UF
Reverse Osmosis
Sludge Treatment
Effluent
Process
Reject
Reject Treatment
Reject Containment
Legend
Disposal
Recycle
Zero discharge

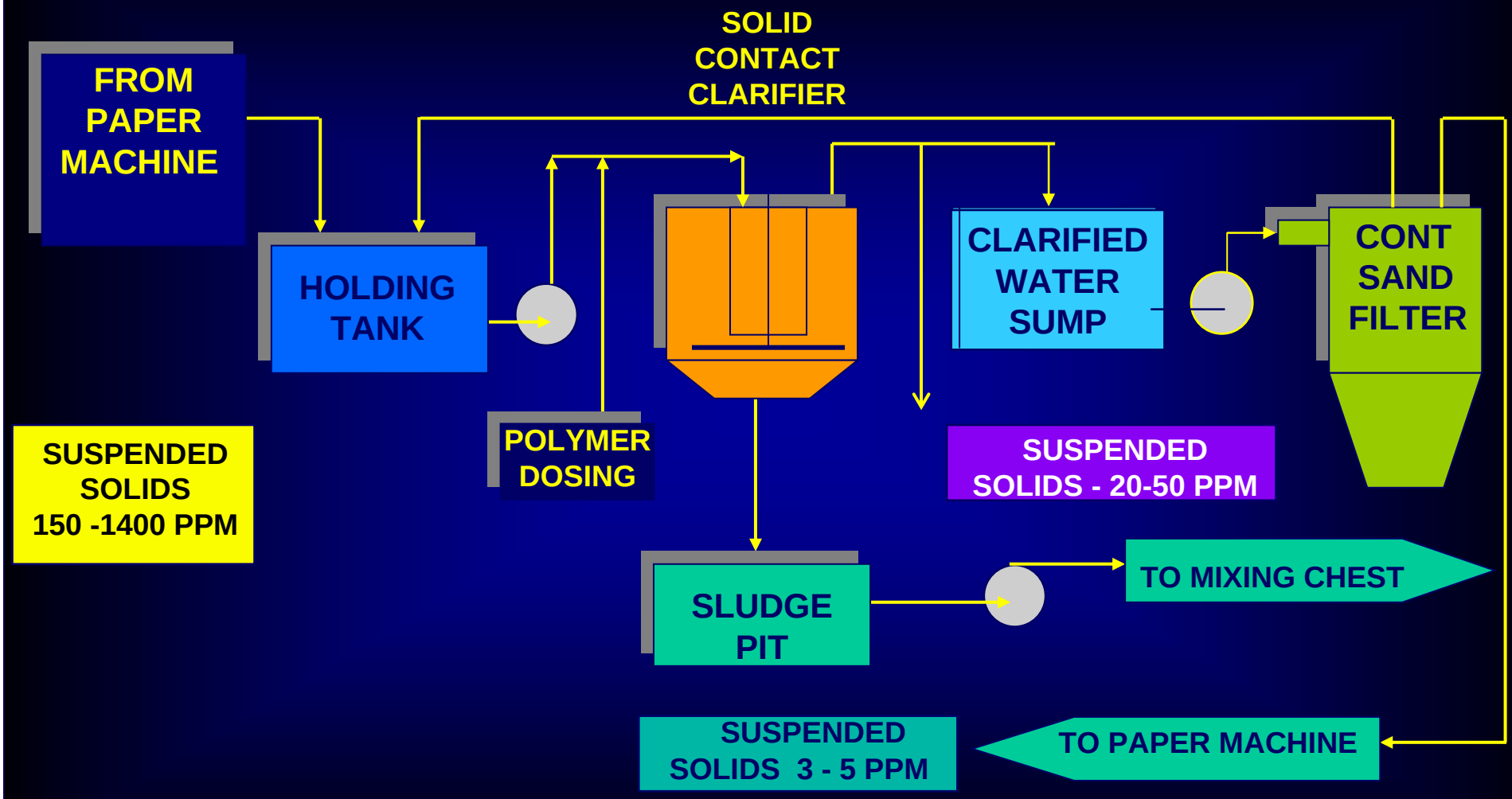
CASE STUDIES

- WATER CONSERVATION
- WATER RECYCLE
- WATER QUALITY IMPROVEMENT

PULP AND PAPER INDUSTRY

- Total treatment capacity - 11000 cu.m. Per day ; water recovery 98% and fibre recovery 99%
- Influent suspended solids - 1400 ppm. Reduced to less than 5 ppm.
- A new process for recycling utilising the gravity settling principle using high rate solids contact clarifier and continuous sand filter
- Capital pay back in two years

White water recycle in Paper industry

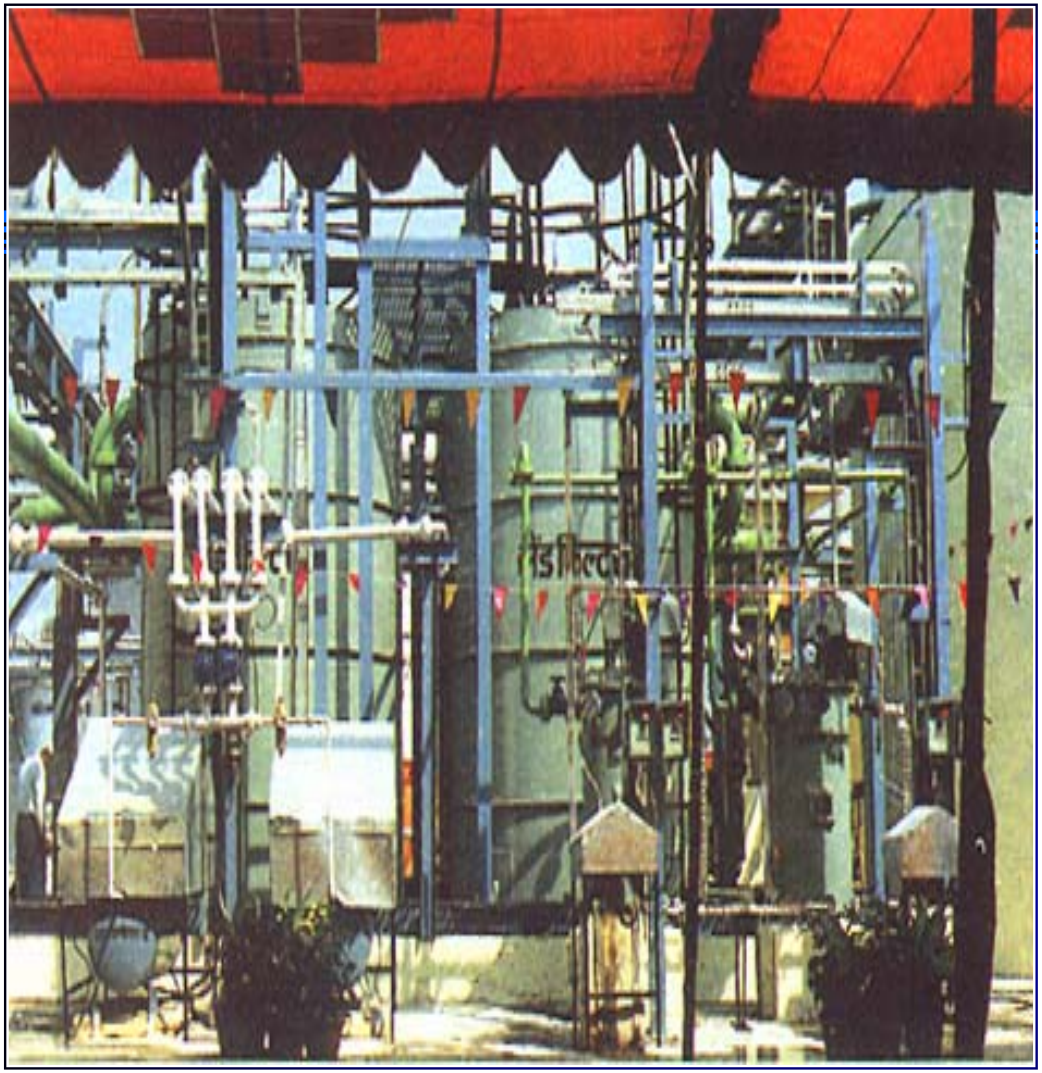


TEXTILE INDUSTRY

- A textile industry in southern India
- Discharge of effluents, cost and availability of raw water was the problem
- Discharges 500 Cu.M. Per day of waste water having dissolved solids of 3600 ppm.
- Isolated wash water from total coloured effluent (dye)
- 75% of the waste water recovered and reused
- Treatment incorporates reverse osmosis for reduction of dissolved solids
- Treated effluent TDS < 200 ppm.

FERTILISER INDUSTRY

- A fertiliser industry in northern India
- Water conservation was the objective
- Discharges 4200 cu.M. Per day of waste water having dissolved solids of 2600 ppm and silica of 120 ppm.
- 85% of the waste water recovered
- Incorporates silica removal by physico chemical process followed by reverse osmosis system
- Treated effluent TDS < 400 ppm.



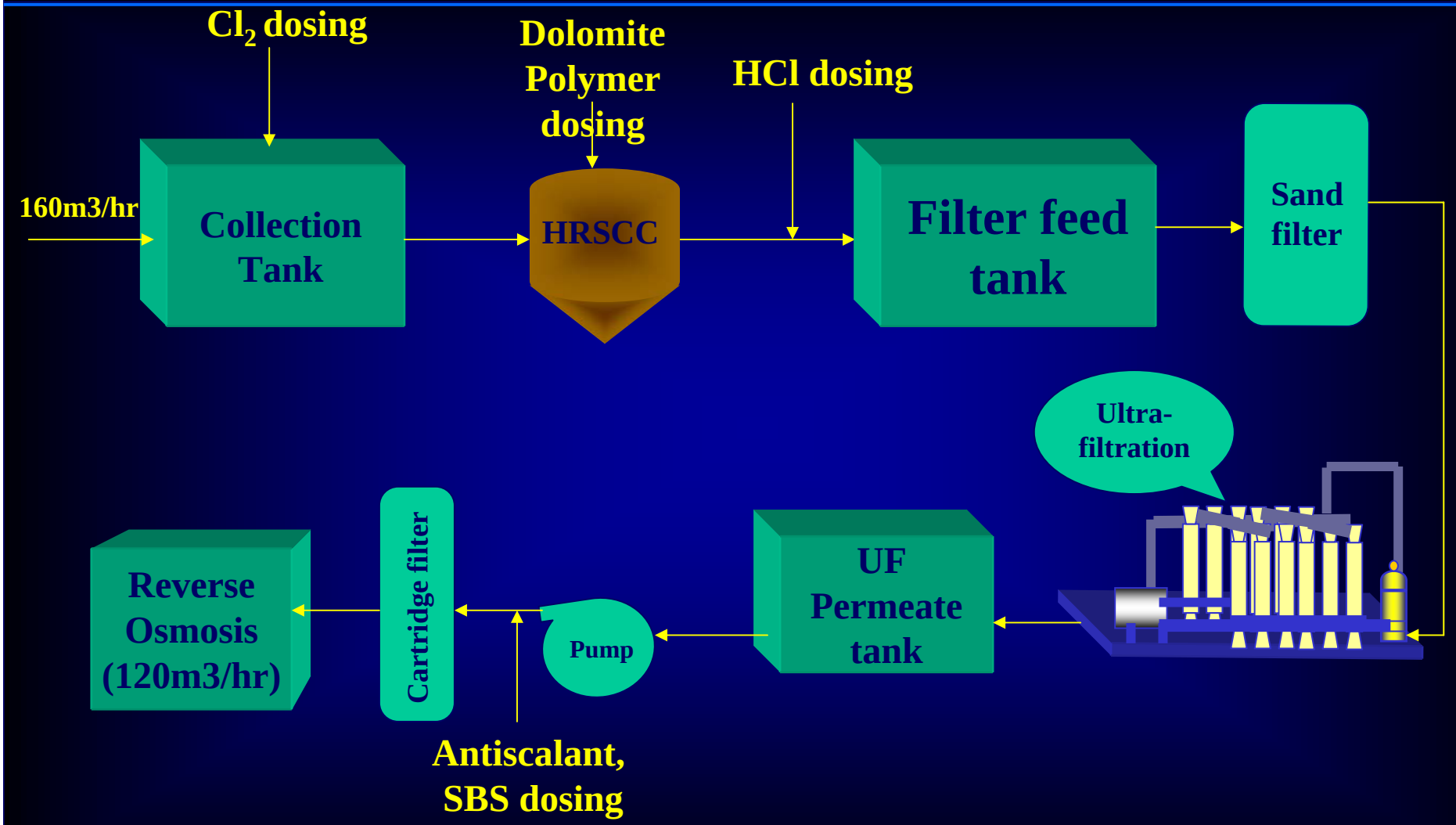
WATER TREATMENT PLANT

REVERSE OSMOSIS PLANT

COOLING WATER BLOWDOWN RECYCLE

- **Customer : Madras Fertilisers Ltd.,**
- **Problem : Repeated problems with the existing RO plant – frequent choking leading to cleaning and downtime**
-
- **Capacity : Treatment flow 160 m3/hr of Cooling Tower Blow down**
-
- **Solution : Effluent treated through Ultrafiltration for Feeding to the existing RO plant**

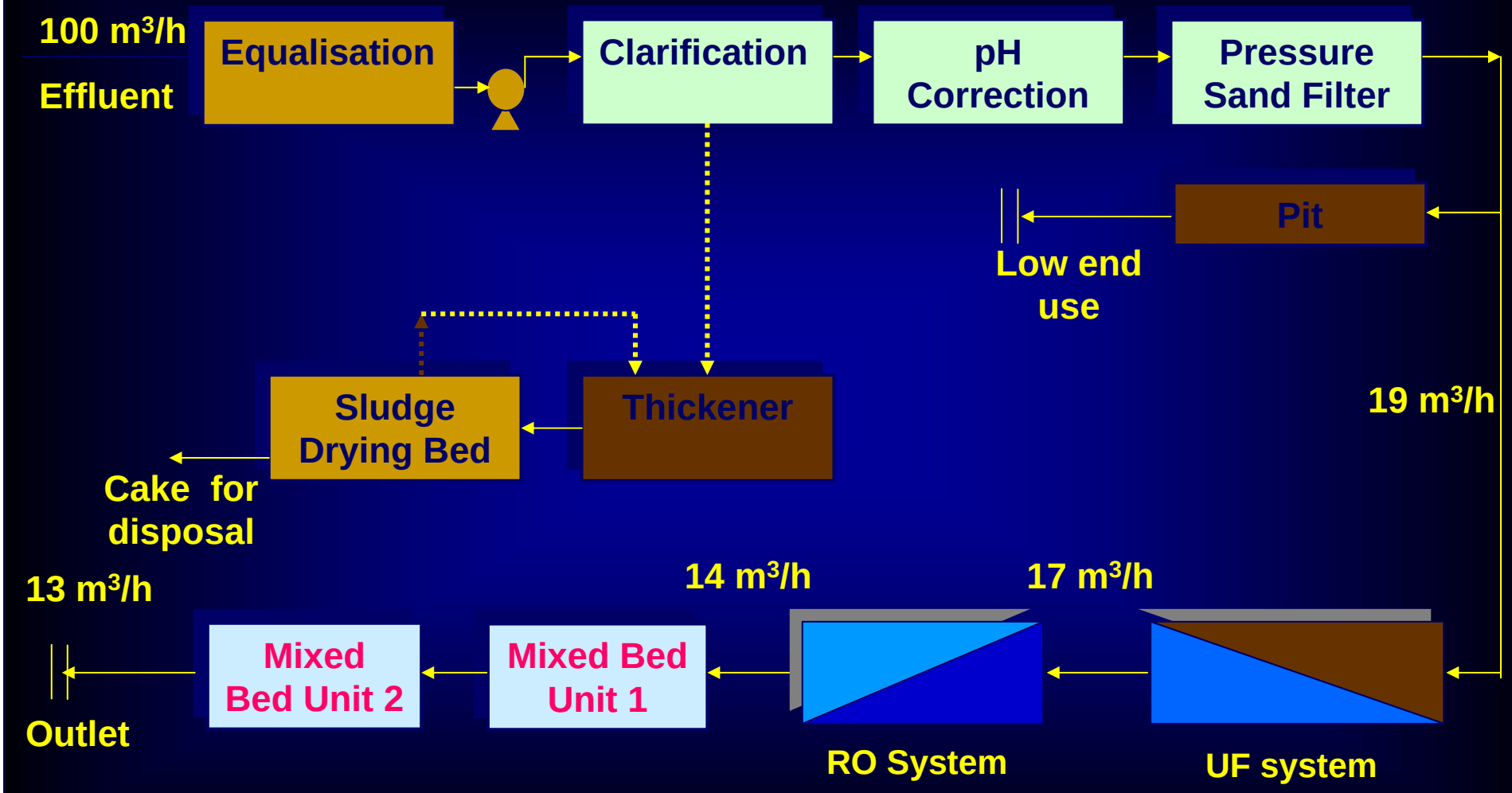
COOLING WATER BLOWDOWN RECYCLE



ELECTRONICS INDUSTRY

- Recycled effluent to produce treated water for low end application & treated water having Resistivity > 10 meg. Ohm. Cm
- Influent suspended solids - 1400 ppm. Reduced less than 5 ppm.
- A complete reuse system with clarification, filtration, Ultrafiltration, Reverse Osmosis and De - ionizers installed successfully

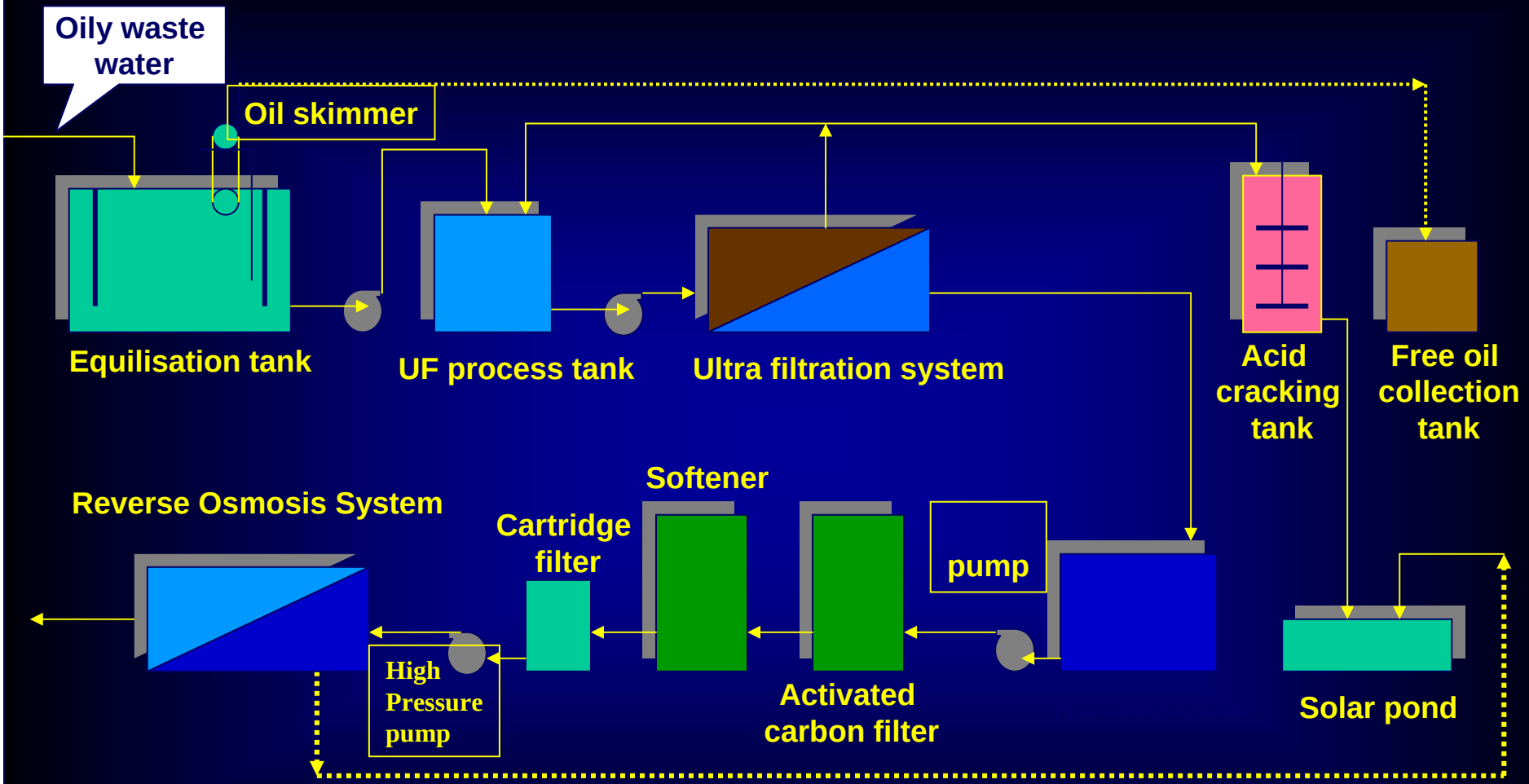
Recycling in Electronics Industry



OILY WASTE RECYCLE

- A heavy engg. Industry
- Discharge of oily waste effluents was the problem
- Combined effl. COD - 10000 TO 20000 ppm. Emul. Oil - 5000 to 20000 PPM. TDS - 5000 to 10000 ppm.
- Treatment incorporates membrane processes - Ultrafiltration and Reverse Osmosis
- Emulsified oil concentrated from 0.5% TO 40% BY UF AND COD REDUCED IN PERMEATE TO 100 ppm. Volume 2% of influent qty.
- UF permeate treated by Reverse Osmosis for reduction of dissolved solids.
- Treated effluent TDS < 500 ppm.

Oily Waste Water Recycle



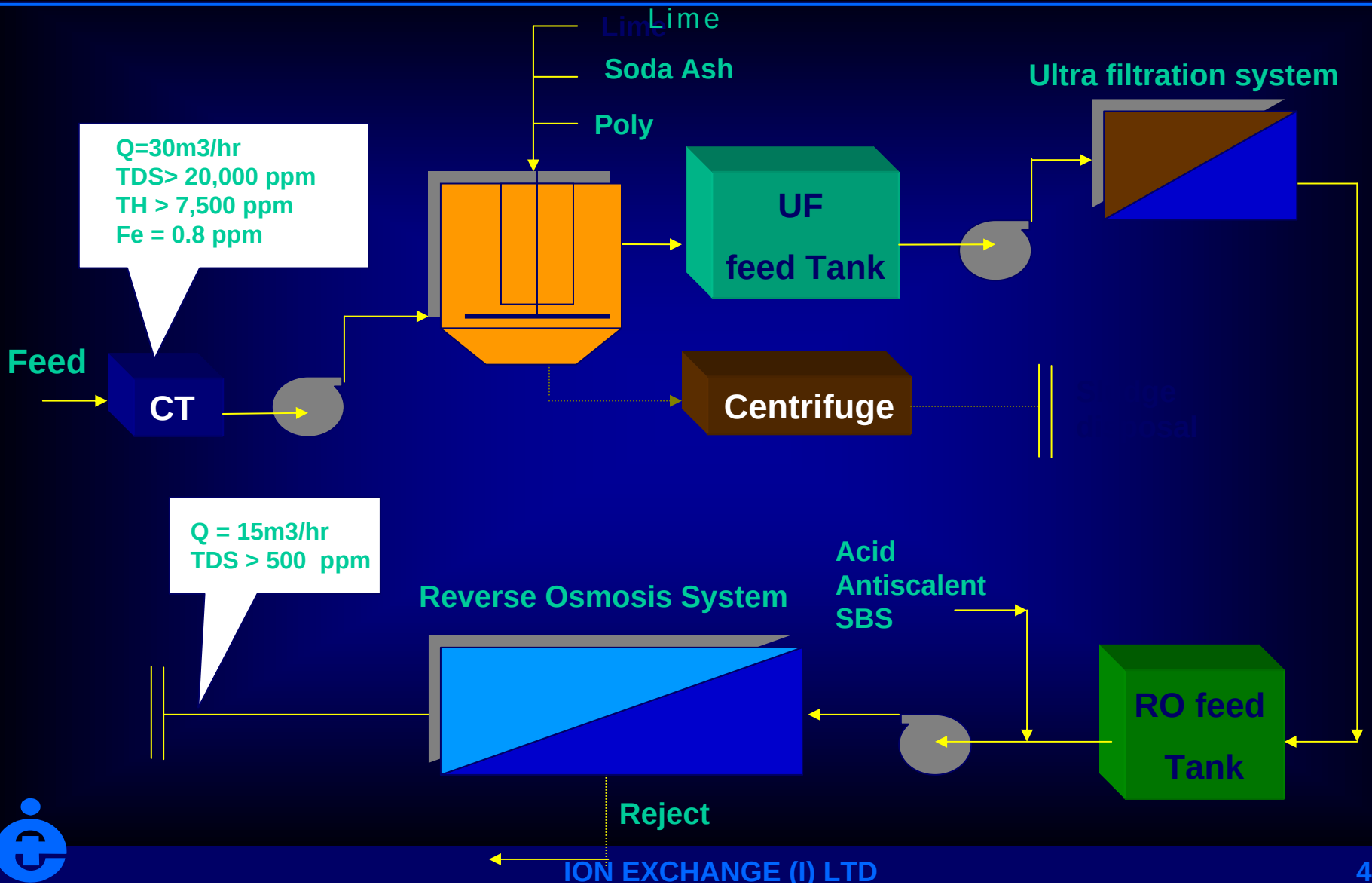
Zero Discharge in Engineering Industry

- A multinational compressor manufacturer in northern India
- Zero discharge is the objective
- Incorporates state of art membrane separation technologies in the scheme
- Oily effluent treated by UF
- UF permeate + non oily effluent+cooling tower blowdown recycled by RO system to produce water for process
- Reject from RO used for treatment of raw water + reject from RO used for effluent treatment is recycled through sea water RO
- Overall recovery of RO plants is 93%

CHEMICAL INDUSTRY

- Severe problem of water scarcity and discharge of complex effluent
- Discharged30 m3/hr effluent of TDS - 20000 ppm, COD - 50 ppm
- Treatment incorporates high rate solid contact clarifier & membrane processes like Ultrafiltration and Reverse Osmosis
- 40 - 50 % of effluent recovered with recycle system of 15 m3/hr
- Treated effluent TDS < 500 ppm, SDI < 1

Recycling in Chemical industry



FATTY ACID MANUFACTURING INDUSTRY

- **Customer : Leading Fatty acids/Soap manufacturer in Mumbai**
- **Problem : Severe space constraint to treat and discharge complex soap effluents.**
- **Solution : INDION Membrane Bio-Reactor (MBR) for treatment of process effluents and Utility effluent streams.**
-
- **Quantitative : This will be the 1st company in India to install *INDION Membrane Bio-Reactor (MBR)* system to overcome the above problem and to treat**

FATTY ACID MANUFACTURING INDUSTRY

- **1) PROCESS EFFLUENT STREAMS**
- **Treatment capacity - 295 m3/day**

- **Treatment scheme - Free oil removal using Tilted Plate Interceptor**
- **and removal of emulsified oil by DAF →**
- **Biological treatment in Bio Tower →**
- ***INDION MBR* with enhanced oxidation using**
- **PAC for COD reduction (< 100 ppm)**

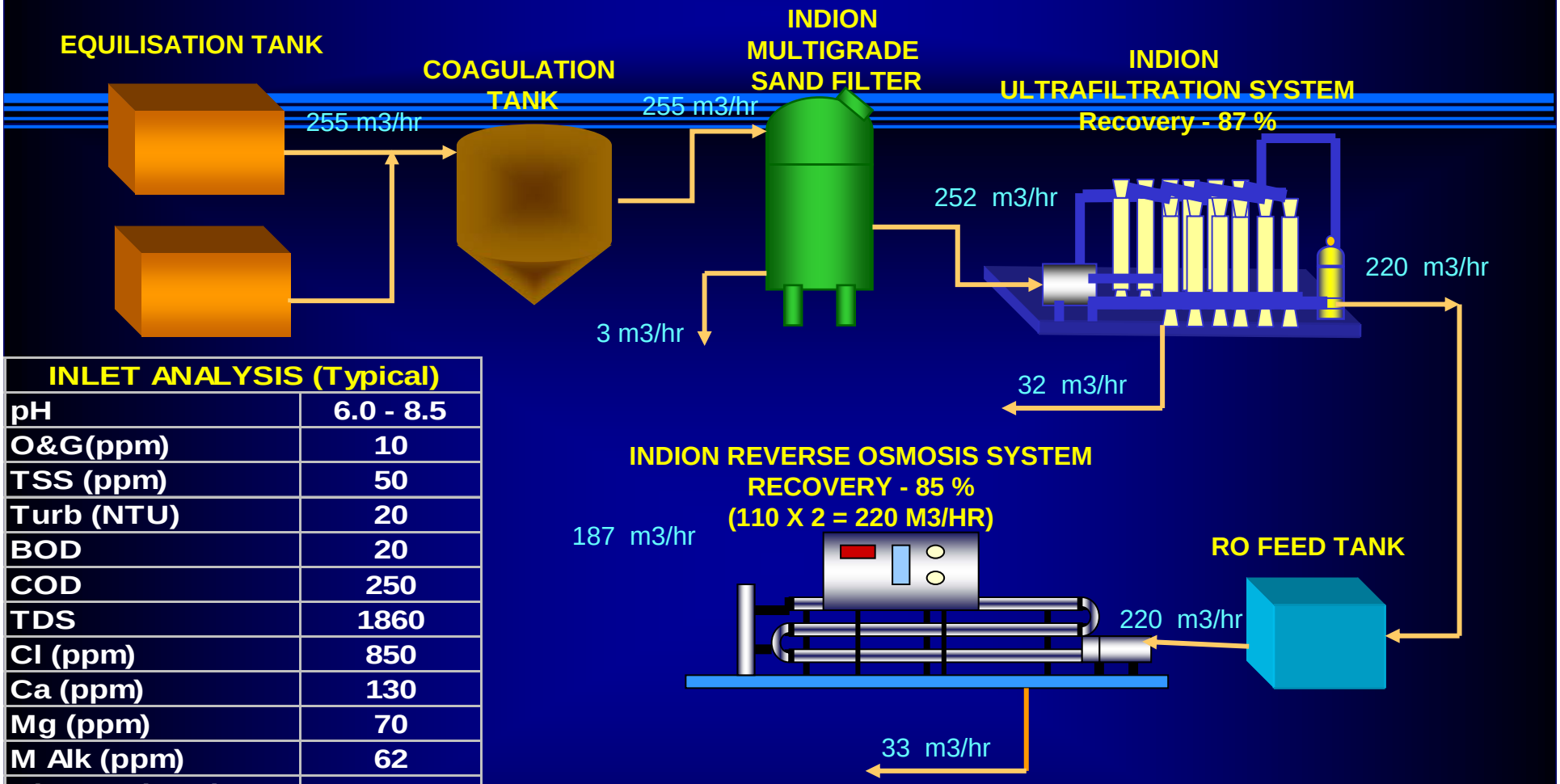
- **TREATED EFFLUENT QUALITY**

- **TSS - < 2 ppm, O& G – Nil, BOD - < 20 ppm, COD - < 100 ppm,**
- **TDS - 425 ppm**

OIL REFINERY

- **Customer** : **Chennai Petroleum Corporation Limited (CPCL)**
- **Problem** : **Acute water scarcity in the region which led to shutdown of refinery few years back.**
- **Quantitative** : **Zero discharge 200 m3/hr capacity Effluent treatment & recycling plant**
- **Inlet TDS : 1860 ppm, BOD : 20 ppm, COD : 250 ppm,**
- **Solution** : **Zero effluent discharge effluent treatment plant was designed with 252 m3/hr capacity UF plant followed by 220 m3/hr RO plant.**
- **Outlet Quality :** **TDS < 40 ppm, BOD : Below detectable limit**
- **COD : Below detectable limit**

ZERO EFFLUENT DISCHARGE IN REFINERY INDUSTRY

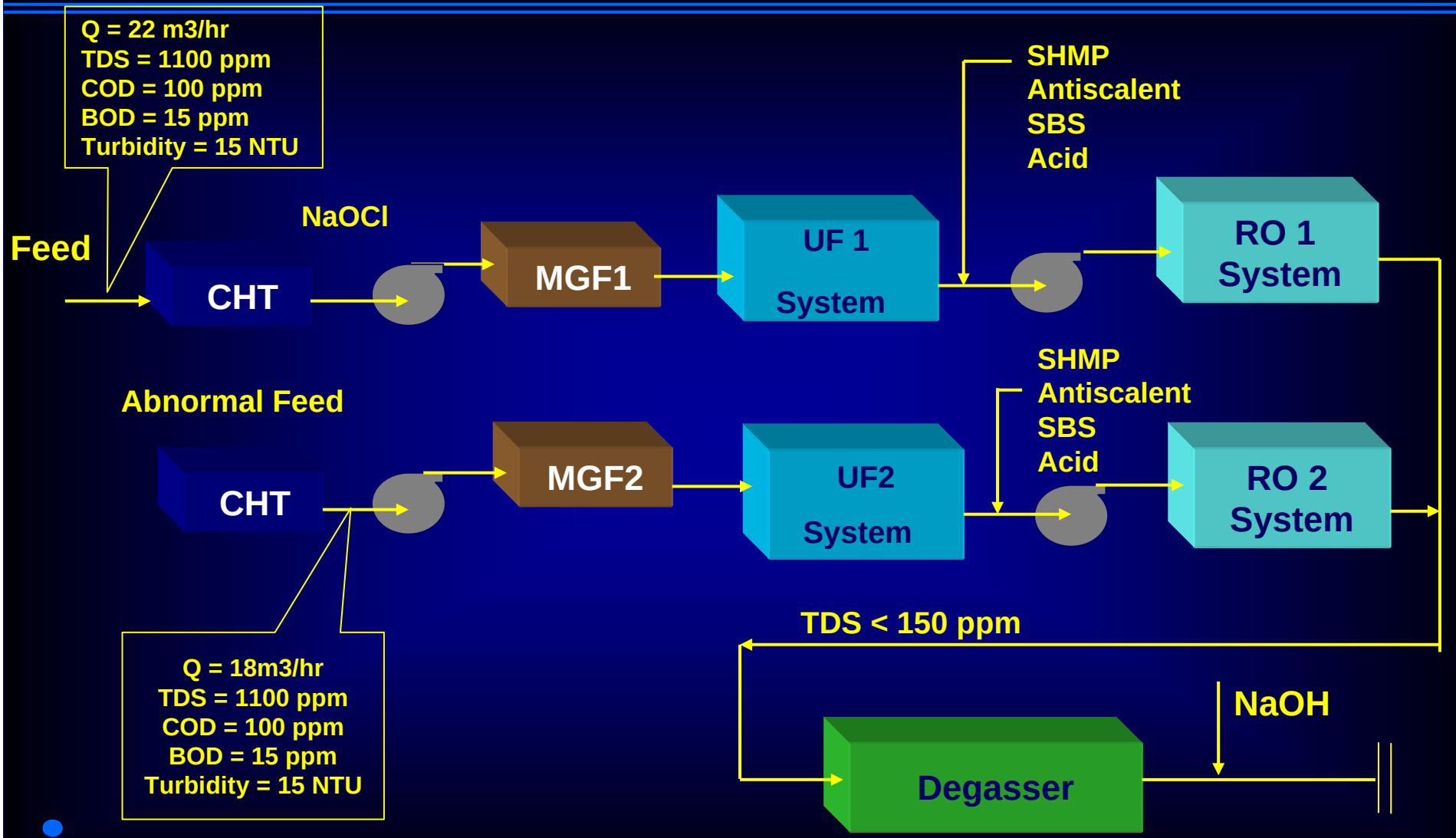


INLET ANALYSIS (Typical)	
pH	6.0 - 8.5
O&G(ppm)	10
TSS (ppm)	50
Turb (NTU)	20
BOD	20
COD	250
TDS	1860
Cl (ppm)	850
Ca (ppm)	130
Mg (ppm)	70
M Alk (ppm)	62
Nitrates (ppm)	20
Phosphates (ppm)	5
Si (ppm)	15
Coll Si	7.2
Fe (ppm)	3
SO4 (ppm)	300
Phenols (ppm)	1
SDI	> 6

AUTOMOBILE INDUSTRY

- **Customer : Hyundai Motors Limited, Chennai**
- **Problem : Water scarcity, Customer was buying tanker water. Reject TDS could not be more than 2100 ppm to meet disposal norms.**
- **Quantitative analysis : 22 m3/hr capacity Sewage Recycle Plant**
  Permeate TDS < 50 ppm
  Recycle TDS < 2100 ppm for disposal
- **Solution : Two sewage recycle plants each with ultra-filtration as pretreatment to RO to ensure RO feed with SDI < 1.0, Nil - Organics and Turbidity < 0.1 NTU. Under abnormal water scarcity situation customer to get treated sewage in tankers to be recycled in the UF-RO system.**

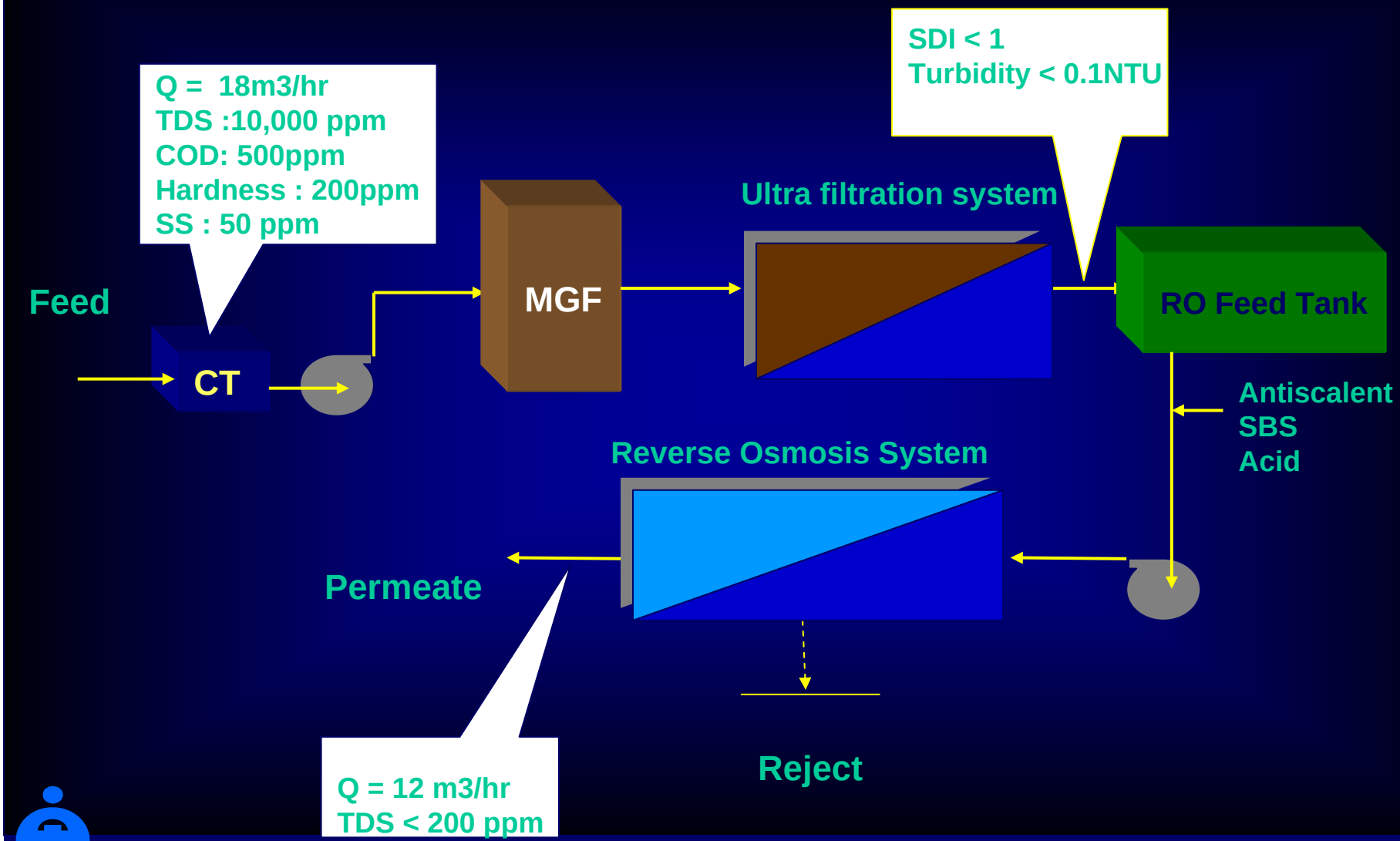
AUTOMOBILE INDUSTRY



CHEMICAL INDUSTRY

- Multinational manufacturer of organic pigments
- High cost of raw water & disposal cost to CETP
- Discharged 50 m3/hr effluent of TDS - 10000 ppm, COD - 500 ppm, silica - 25 ppm
- Treatment incorporates state of the art membrane processes like Ultrafiltration and Reverse osmosis
- Total treatment capacity - 18 m3/hr capacity recycle system
- Treated effluent TDS < 200 ppm

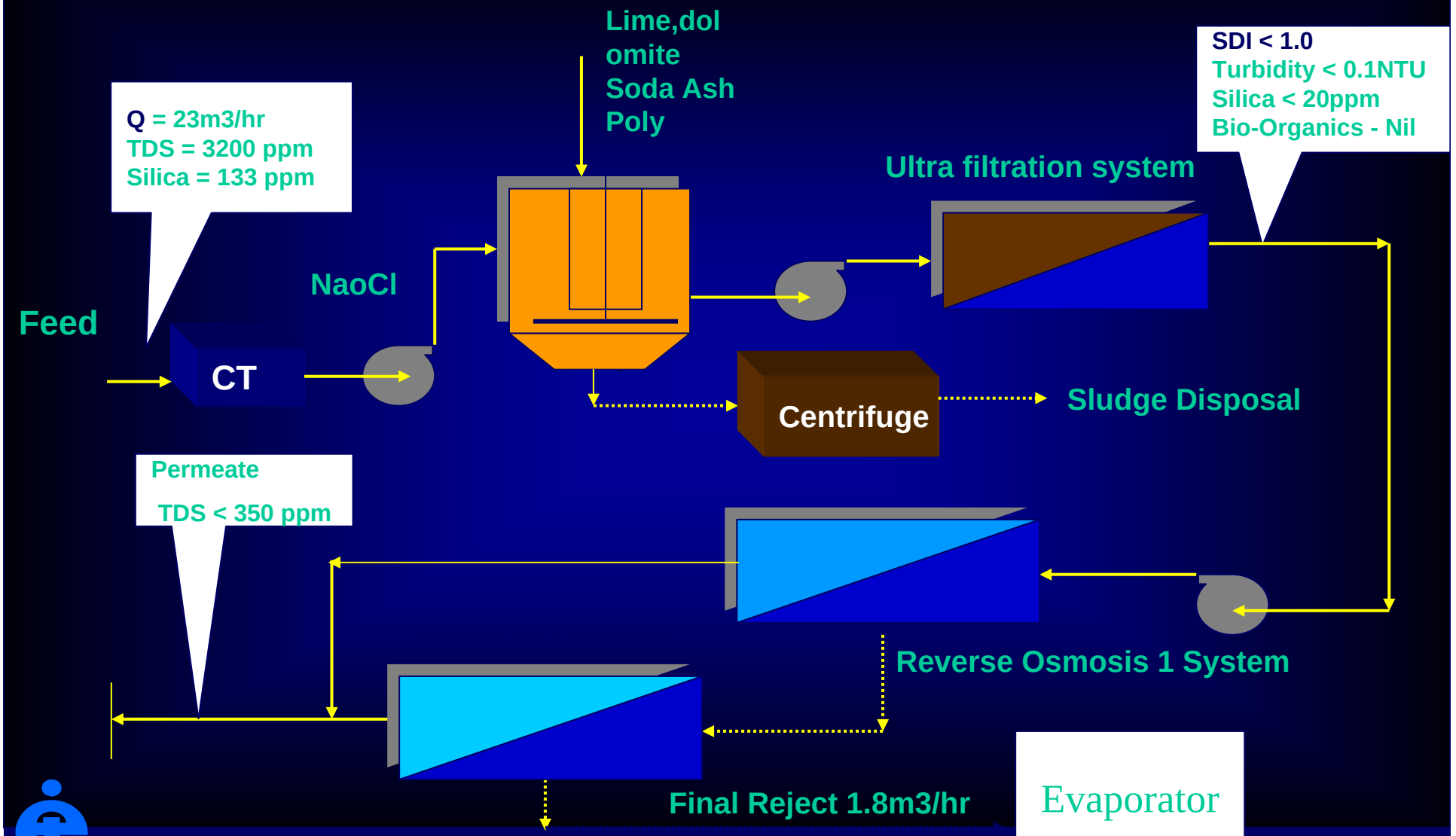
Recycling in Chemical Industry



CEMENT INDUSTRY

- **Water scarcity was a problem and zero discharge of effluent was the objective**
- **Discharged 530 m3/day effluent from cooling tower blowdown and DM waste of TDS - 3200 ppm , Silica - 130 ppm.**
- **Treatment incorporates TDS & silica removal by physico-chemical process followed by Ultra-filtration & Reverse Osmosis**
- **90 % recovery having TDS < 350 ppm, SDI < 1, turbidity - < 0.1 NTU**

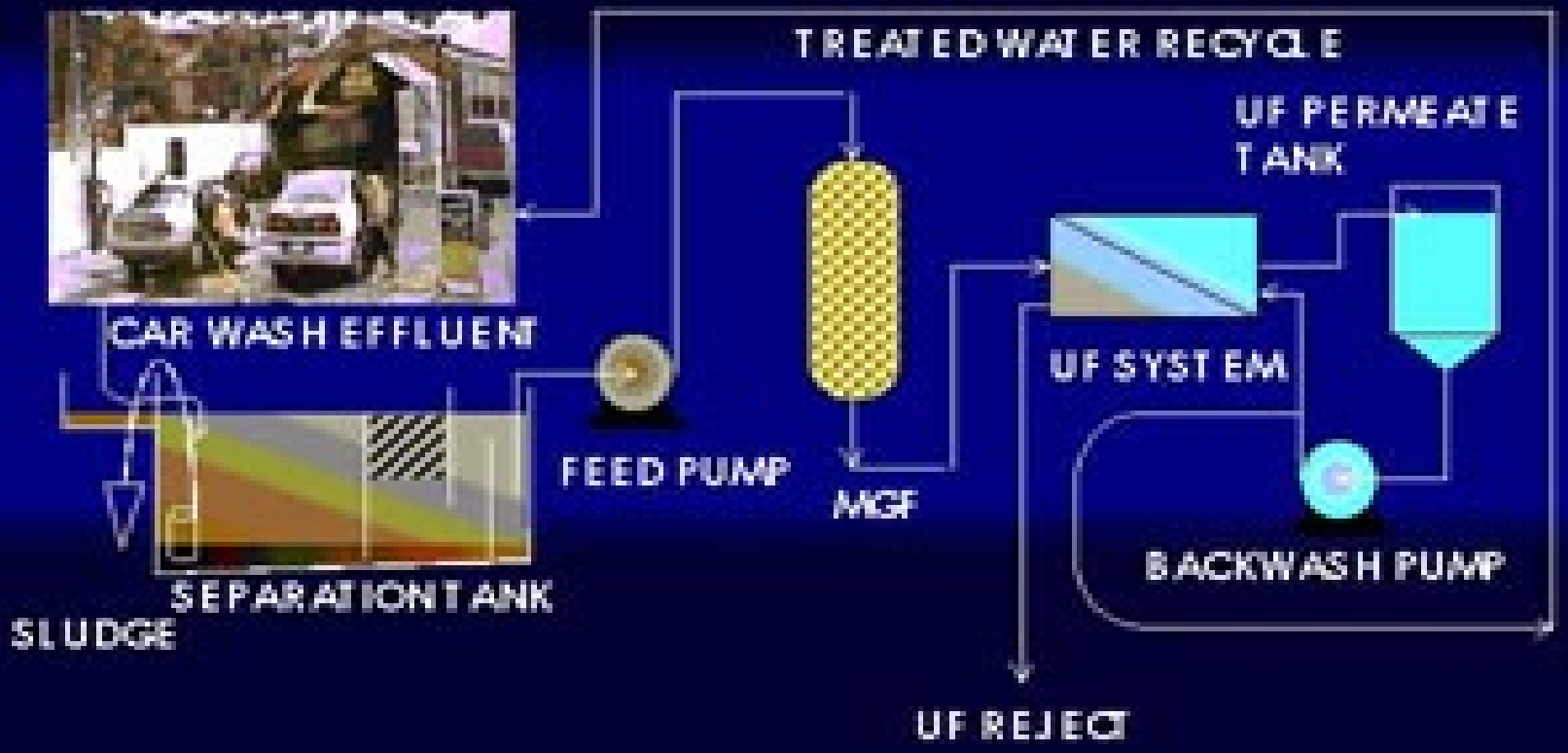
Recycling in Cement industry



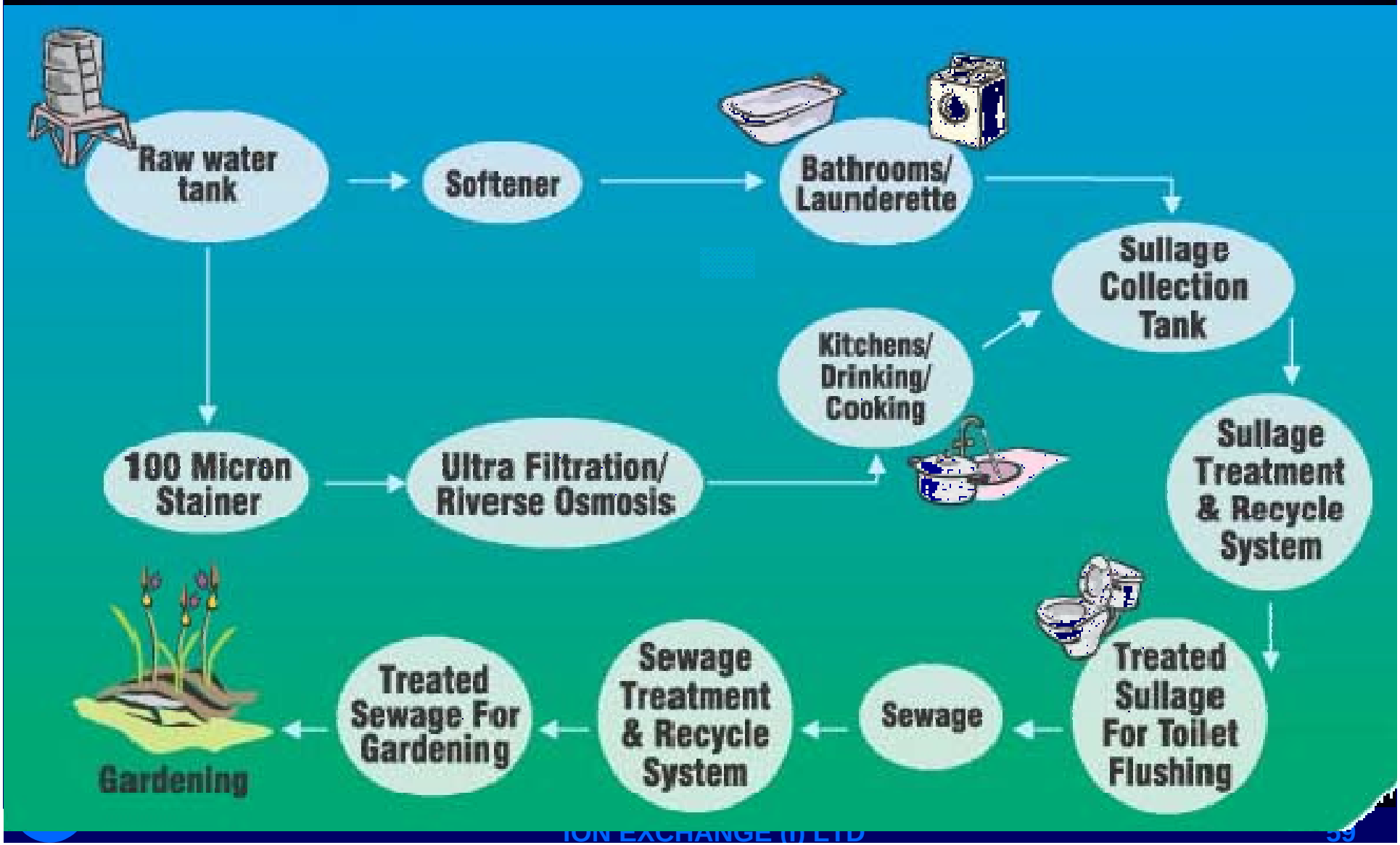
Recycling in Carwash industry

- Strict discharge norms from PCB
- Scarcity of bore well water
- Cost of raw water is high

CARWASH RECYCLE SYSTEM



SEWAGE RECYCLE IN RESIDENTIAL COMPLEXES



DELHI WATER BOARD

We have installed Reverse Osmosis (RO) plant after MBR during our pilot studies to make quality of water equivalent to drinking quality. During the visit to our pilot plant, Chief Minister of Delhi, Ms. Sheila Dixit drank the treated water after RO plant in the presence of large gathering of Indian & Overseas delegates. This is a great testimony to the quality of water that we can produce using MBR.