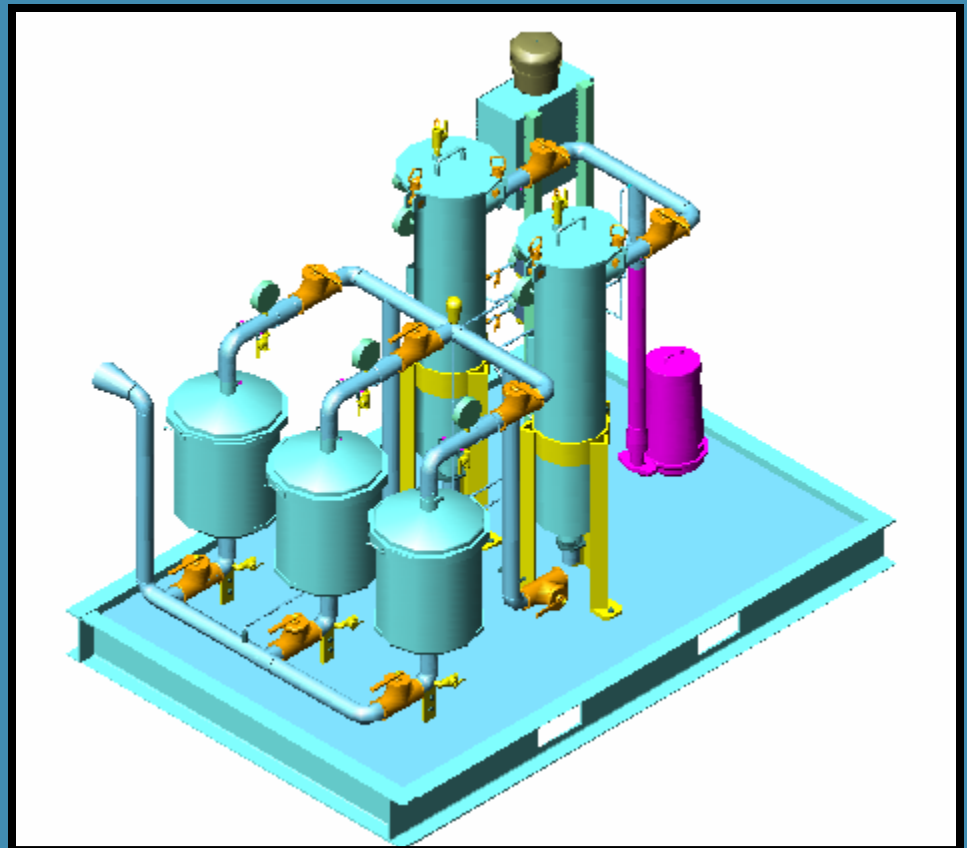


## SYSTEMS AND EQUIPMENT

- FII MicroClear™ MBR (membrane biological reactor)
- Scrubbers / Odour control system
- Activated carbon
- Ultrafiltration (UF) systems
- Air strippers
- Automatic flushing filters
- Bag and cartridge filters
- DAF (dissolved air flotation)
- Self indexing filters
- Coalescers (oil-water separators)
- Coalescing Oil & Polishing System
- Pump and treat systems
- Odor control systems
- Chemical Treatment Systems





# OVERVIEW

## FII MicroClear™ MBR

## OVERVIEW – FII MicroClear™ MBR

### *Advantages*

- Exceptional treated effluent quality  $\leq 5$  mg/L BOD<sub>5</sub> – not achievable by any other technology
- Compact footprint – as compared to conventional sewage treatment plants

### *Immersed Flat-Sheet Membranes*

- No weekly/monthly maintenance cleaning required – as needed for hollow-fibre membranes

### *Membrane Modules*

- Cleaning during operation by backflushing – only backflushable flatsheet membrane modules in the marketplace
- Membrane sheet-to-backing sheet welding by laser – perfect welding, ensures no ingress of dirty wastewater into the clean permeate
- Patented special design of backing sheet surface – thus no need for a gauze between the membrane and backing sheets to prevent adhesion
- FSD™ (full surface distribution) – full membrane surface utilization for permeate collection by multiple outflow points – thus no dead spaces anywhere
- Units supplied: septic tank insertions, fully containerized, larger plants with concrete tanks



# **WHY MBR**

## **14 MAJOR REASONS**

## INFLUENT SEWAGE VS. TREATED EFFLUENT QUALITY



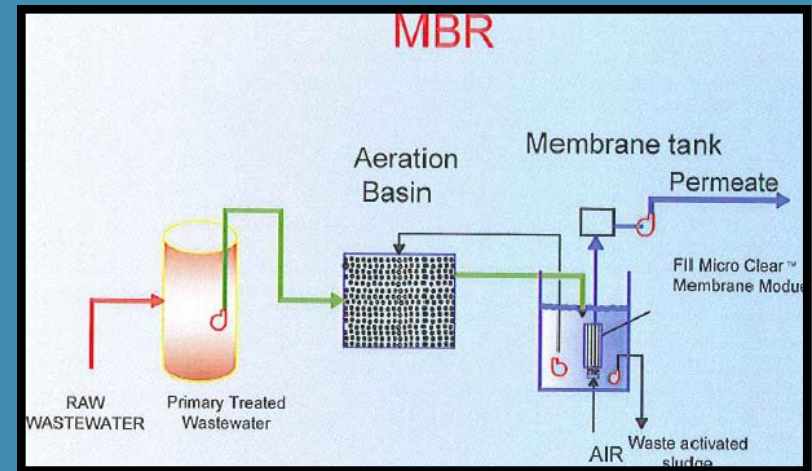
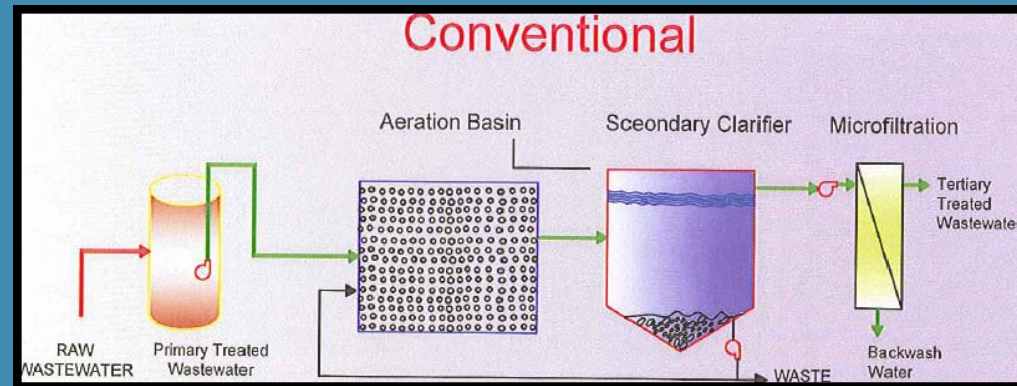
Left side: FII MicroClear MBR effluent -  $\text{BOD}_5 < 5 \text{ mg/L}$ ,  $\text{TSS} < 1 \text{ mg/L}$ , turbidity  $< 1 \text{ N.T.U.}$

Right side: Sewage during treatment  
Raw sewage:  $\text{BOD}_5 > 200 \text{ mg/L}$ ,  $\text{TSS} > 200 \text{ mg/L}$

What a quality! Not achievable by any other technology!

## 14 MAJOR REASONS

1. Eliminates secondary clarifier and tertiary sand filter
2. HRT<sup>1</sup> of MBR aeration tank - 4 to 8 hours vs. 16 to 24 hours for CASP<sup>2</sup>
3. MBR sludge yield – typically, 20 to 40% less than CASP
4. MBR footprint – typically, 25 - 35% of CASP due to high concentration of bugs
6. Effective barrier against chlorine-resistant pathogenic organisms – *Cryptosporidium* and *Giardia Lamblia*



<sup>1</sup>HRT – hydraulic retention time

<sup>2</sup>CASP – conventional activated sludge process

## 14 MAJOR REASONS

6. Effluent TSS concentration  $< 1$  mg/L as compared to 5 – 20 mg/L for secondary clarifier effluent
7. Membrane can retain soluble material with a high molecular weight - improving its biodegradation in the bioreactor
8. Simple, yet sophisticated, with remote monitoring
9. Perfectly suited for onsite wastewater treatment – MBRs can be placed directly in the septic tank
10. Ideal for upgrading existing systems – by replacing secondary clarifier

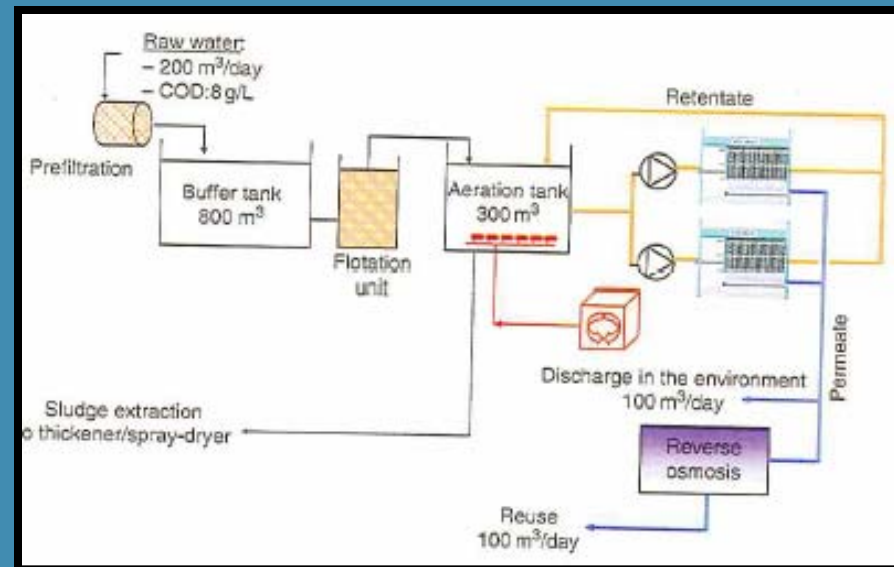
FII MicroClear™  
MEMBRANE AGGREGATE



## 14 MAJOR REASONS

11. Longer retention of nitrifying bacteria results in greater nitrification.
12. Lower post-disinfection demand for chlorine/UV/Ozone – due to complete solids removal by membranes
13. Modular expandability – for future expansions
14. RO can be plugged directly after MBR for producing demineralized water

sMBR<sup>4</sup> followed by RO for boiler feed makeup water treatment



sMBR<sup>4</sup> – sidestream MBR

### **TYPICAL TREATMENT OBJECTIVES**

- **To meet bathing water standards**
- **To improve the effluent quality – for wastewater re-use for irrigation, or feed to RO for boiler feedwater**
- **To meet effluent discharge limits – sewer-use bylaw, or specific stream standards**
- **To minimize overloading of the tile-bed for septic tank applications**
- **To minimize space for installation – for high value real estate, or constrained space in an industrial plant**
- **For upgrading the existing overloaded wastewater treatment plants**

## EVER STRICTER DISCHARGE LIMITATION STANDARDS!

| Parameter                     | Units      | Current Effluent Limits           |                                  | Projected Effluent Limits         |                                  |
|-------------------------------|------------|-----------------------------------|----------------------------------|-----------------------------------|----------------------------------|
|                               |            | Average 30 Consecutive Day Sample | Average 7 Consecutive Day Sample | Average 30 Consecutive Day Sample | Average 7 Consecutive Day Sample |
| BOD <sub>5</sub> <sup>1</sup> | mg/L       | 20                                | 30                               | 10                                | 20                               |
| TSS <sup>2</sup>              | mg/L       | 20                                | 30                               | 10                                | 20                               |
| Ammonia-N                     | mg/L       | -                                 | -                                | 1                                 | 2                                |
| Total-N <sup>3</sup>          | mg/L       | -                                 | -                                | 10                                | 10                               |
| Total-P <sup>4</sup>          | mg/L       | -                                 | -                                | ≤ 1                               | 2                                |
| Fecal coliform                | No./100 mL | 200                               | 400                              | 100                               | 200                              |
| pH                            |            | Shall remain between 6.0 and 9.0  | Shall remain between 6.0 and 9.0 | Shall remain between 6.0 and 9.0  | Shall remain between 6.0 and 9.0 |

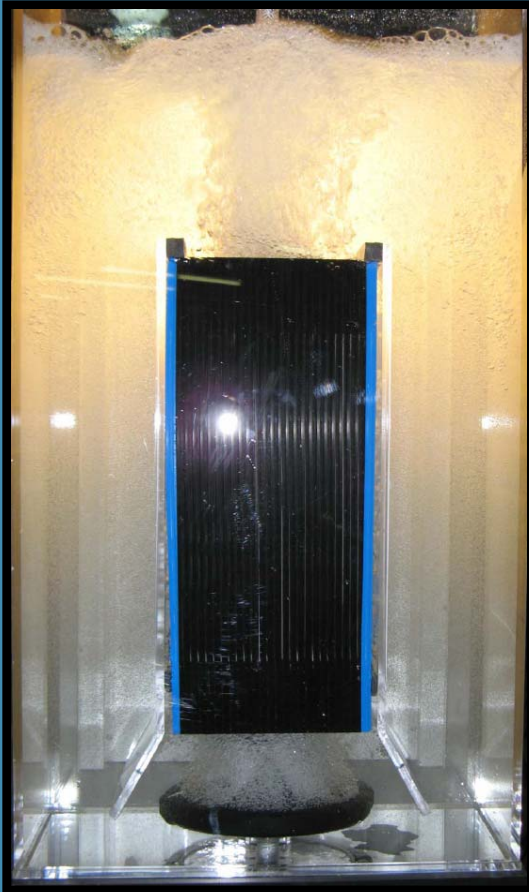
<sup>1</sup> BOD<sub>5</sub> – 5-day biochemical oxygen demand    <sup>2</sup> TSS – total suspended solids    <sup>3</sup> Total-N – includes organic, ammonia, nitrite, and nitrate nitrogens    <sup>4</sup> Total-P – includes organic and inorganic phosphorus



# **FII MicroClear™ IMMERSED MEMBRANE FILTRATION**



# ***MicroClear™ Immersed Membrane Filtration***



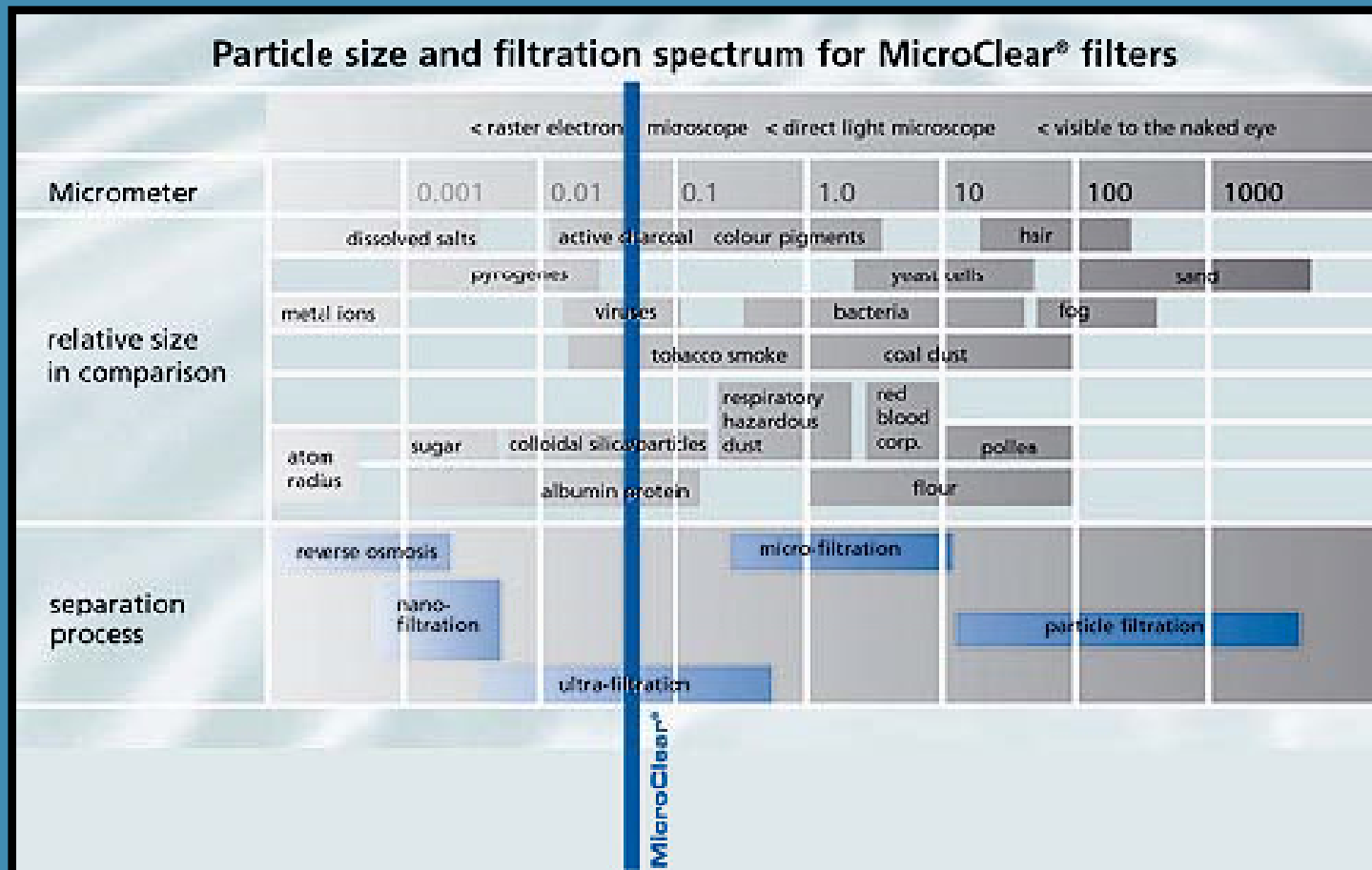
**DISPLAY MODEL**

**FII MicroClear™  
MEMBRANE MODULE  
INSIDE**



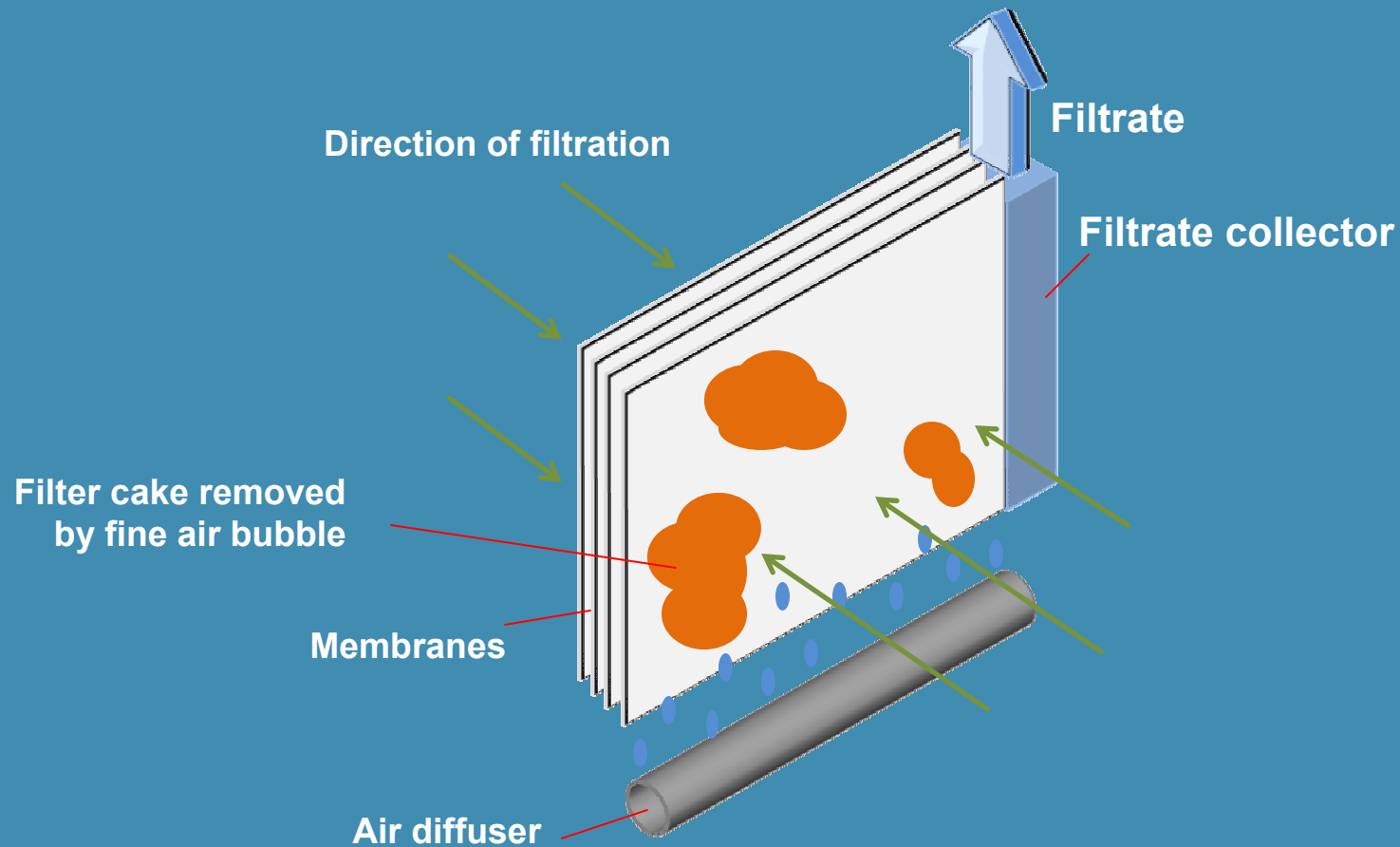
# MicroClear™ Immersed Membrane Filtration

## PORE SIZE OF MicroClear™ MEMBRANES

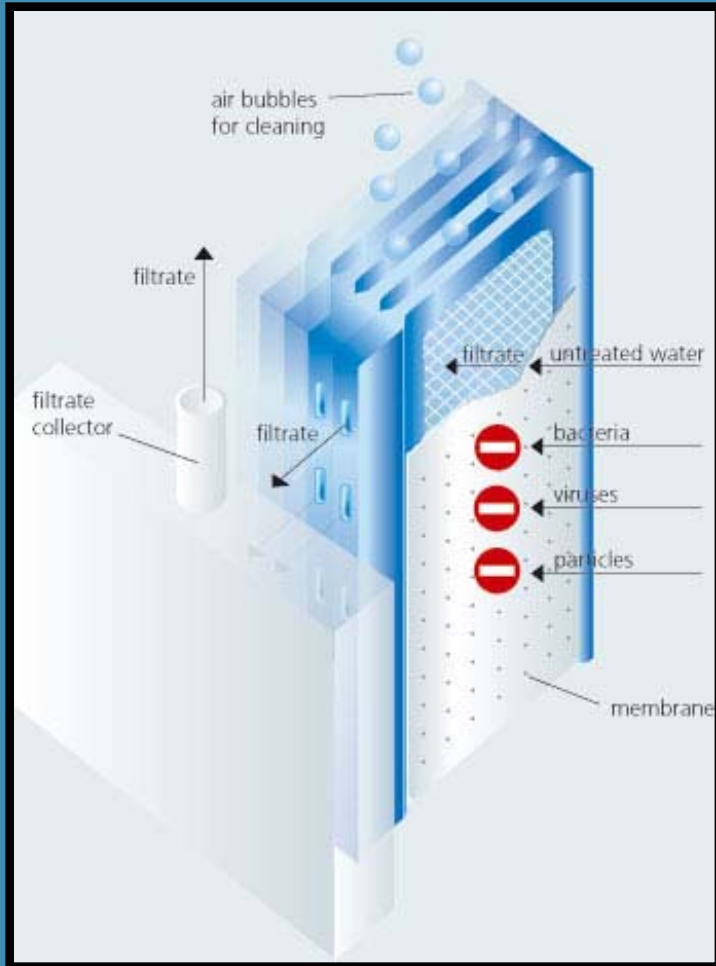


# *MicroClear™ Immersed Membrane Filtration*

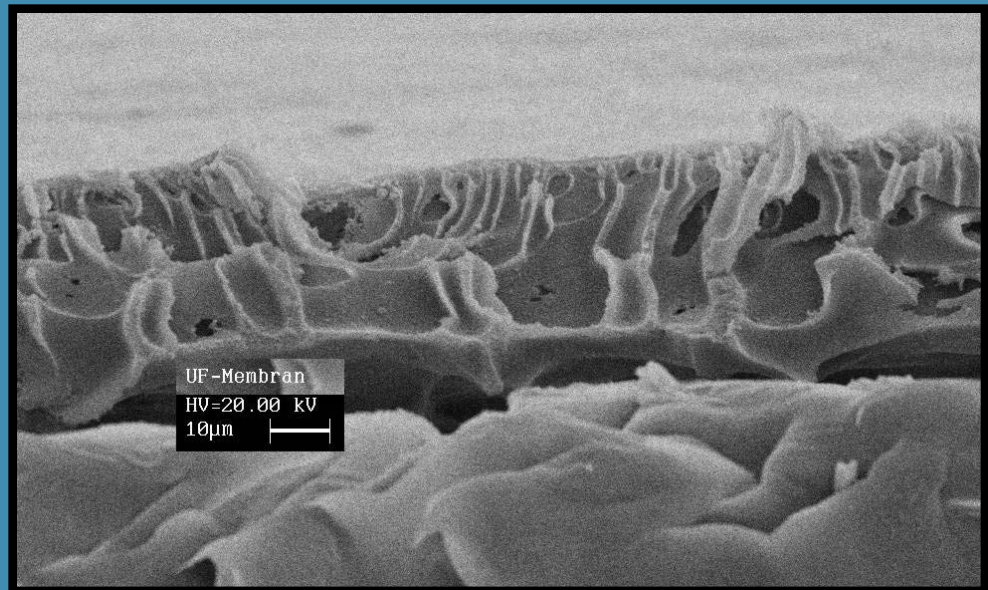
## MicroClear™ MEMBRANE FILTER OPERATION



# MicroClear™ Immersed Membrane Filtration

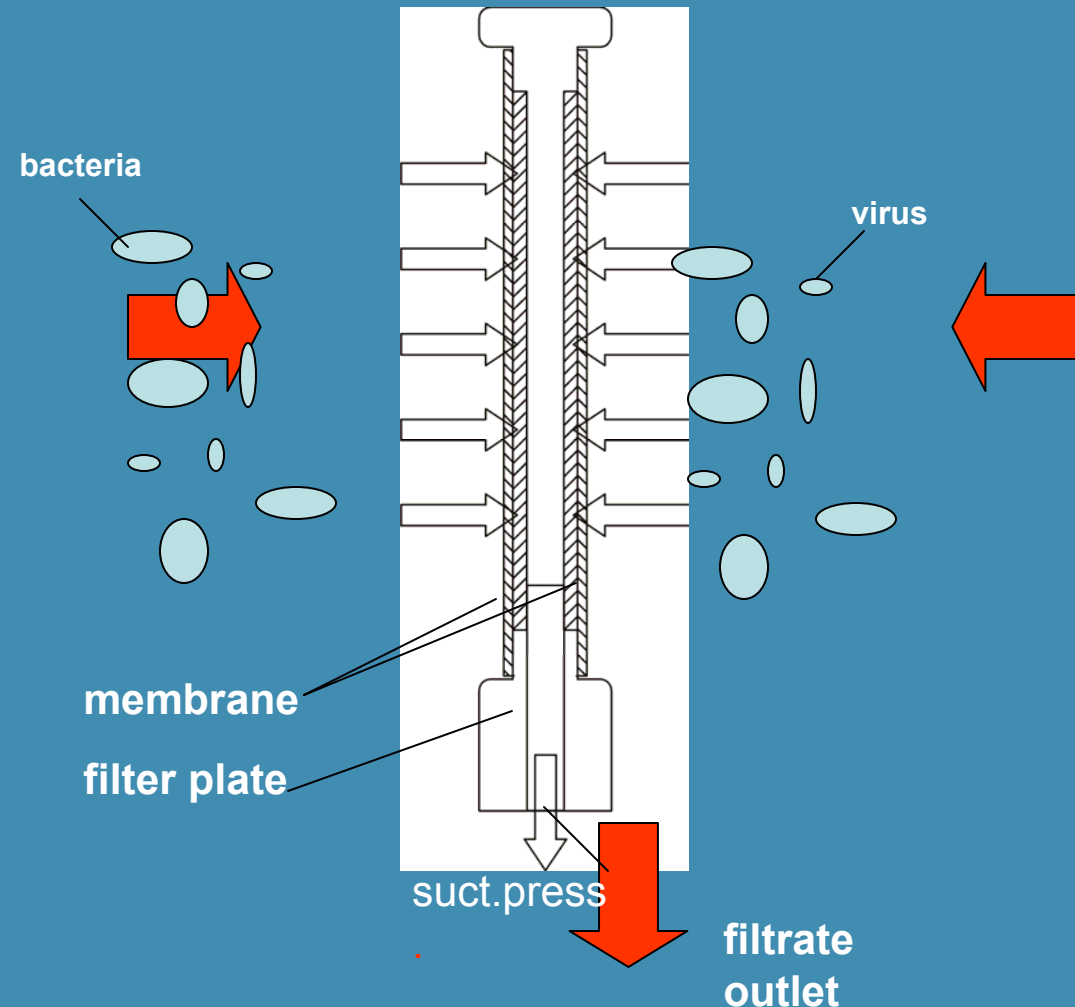


Rising air bubbles between the membrane plates impart a shear force on the dirt particles, thus constantly removing build-up from the membrane



# MicroClear™ Immersed Membrane Filtration

Filtration principle: out-in



- UF MicroClear™ membranes with a molecular weight cut-off of 150 kDalton, equivalent to a pore size of 0.05  $\mu\text{m}$
- Leaves out any bacteria (1 – 2  $\mu\text{m}$ ) and parasites (5 – 50  $\mu\text{m}$ ) passing through the membranes
- Virus removal – 99.9999 %



**FII MicroClear™ MBR**

**VERSUS**

**CASP**

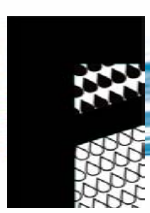
## COMPARISON OF TREATED EFFLUENT RESULTS

| Parameter                    | Unit       | Typical Wastewater Inlet Quality | Treated Effluent Quality      |                                       |
|------------------------------|------------|----------------------------------|-------------------------------|---------------------------------------|
|                              |            |                                  | FII Micro Clear™ MBR Effluent | Conventional Activated Sludge Process |
| TSS (total suspended solids) | mg/L       | 100 - 200                        | < 1                           | 10 - 30                               |
| Turbidity (N.T.U.)           | N.T.U.     | 57                               | < 1                           |                                       |
| BOD <sub>5</sub>             | mg/L       | 150 - 200                        | < 5                           | 10 - 20                               |
| CFU <sup>1</sup> (No./mL)    | No./mL     | 300,000                          | 1 - 1000                      | 10,000                                |
| E.Coli (No./100 mL)          | No./100 mL | 2,000,000                        | Almost nil                    | 20,000                                |
| Coliforms (No./100 mL)       | No./100 mL | 4,000,000                        | Almost nil                    | 30,000                                |



# **FII MicroClear™ MEMBRANE MODULES**

## **LASER WELDING**

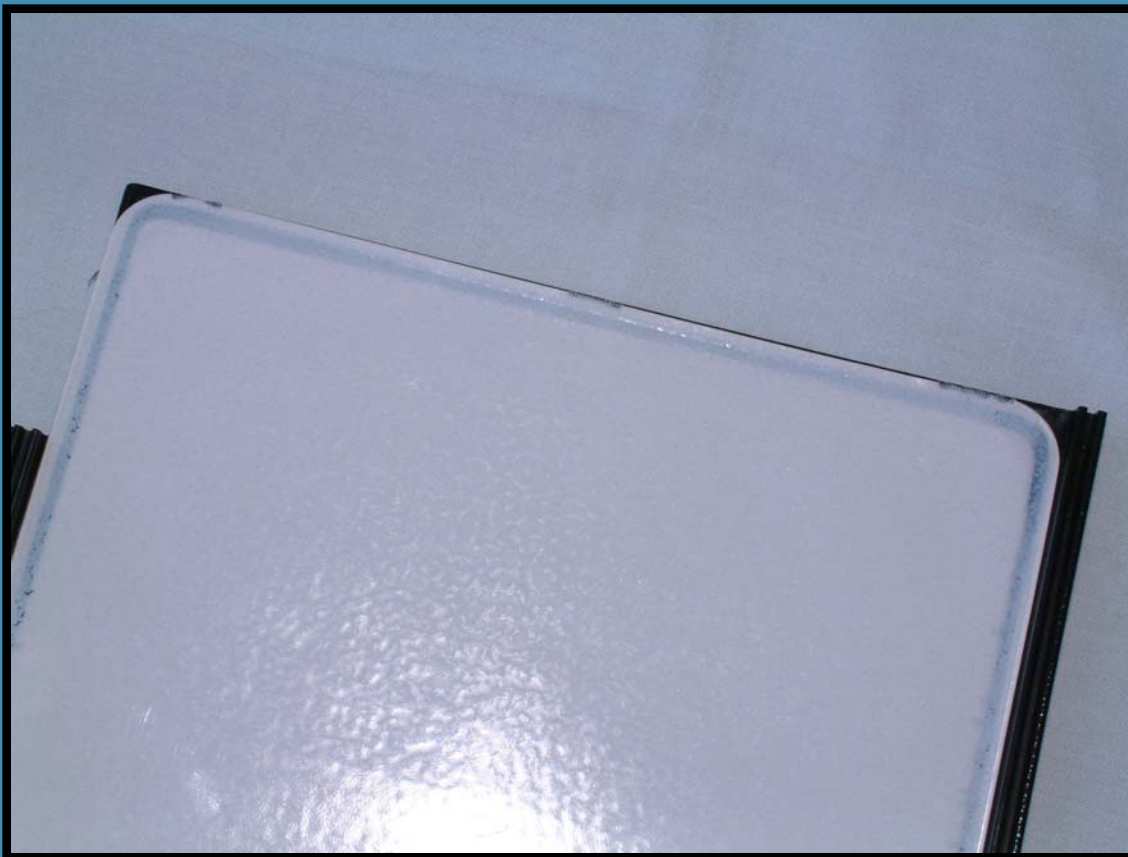


# ***FII MicroClear™ Membrane Modules Laser Welding***

- **State of the art technology**
- **Gives a stronger bond than any other available technology**
- **Laser is focussed on interface between plate and membrane backing and thus weld is effected without melting membrane surface**
- **Lowest risk of ‘melt through’**



# ***FII MicroClear™ Membrane Modules Laser Welding***



Even and uniform laser welding, and the membrane sheet remains undamaged during welding

**MC03 MEMBRANE PLATE**



**MicroClear™**

**FII IMMERSED MEMBRANE MODULES**



# ***FII MicroClear™ Immersed Membrane Modules***

## **FII MicroClear™ MBR COMPACT MODULES**

**FII MicroClear™ MCO3 MODULE  
FOR MBR**  
3.5 m<sup>2</sup> membrane area



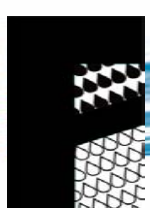
**FII MicroClear™ MCXL MODULE  
FOR MBR**  
7 m<sup>2</sup> membrane area





# **MicroClear™ MMERSED**

## **MEMBRANE AGGREGATES**



# ***FII MicroClear™ Immersed Membrane Aggregates<sup>1</sup>***

## **FII MicroClear™ MBR**

**FII MicroClear™ MEMBRANE  
AGGREGATE FOR MBR  
315 m<sup>2</sup> membrane area**



**FII MicroClear™ MCXL MEMBRANE  
AGGREGATE FOR MBR  
525 m<sup>2</sup> membrane area**



<sup>1</sup>Membrane aggregate: membrane modules complete with housing and air diffusers



# ***FII MicroClear™ Immersed Membrane Aggregates<sup>1</sup>***

## **FII MicroClear™ MBR**

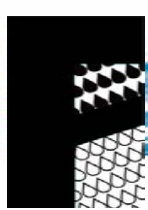
**FII MicroClear™ MEMBRANE  
AGGREGATE FOR MBR**  
28 m<sup>2</sup> membrane area



**FII MicroClear™ MCXL MEMBRANE  
AGGREGATE FOR MBR**  
210 m<sup>2</sup> membrane area



<sup>1</sup>Membrane aggregate: membrane modules complete with housing and air diffusers



# ***FII MicroClear™ Immersed Membrane Aggregates<sup>1</sup>***

## **FII MicroClear™ MBR**

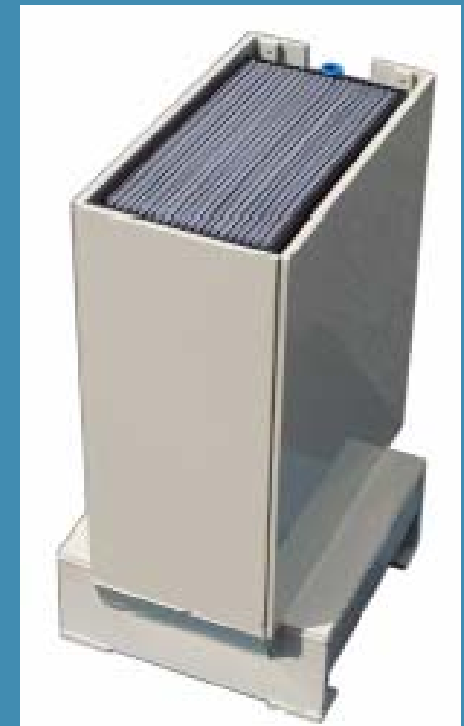
**FII MicroClear™ MC03  
MEMBRANE AGGREGATE  
FOR SEPTIC TANK INSERTION**  
3.5 m<sup>2</sup> membrane area



**FII MicroClear™ MC03  
MEMBRANE AGGREGATE  
FOR SEPTIC TANK INSERTION**  
7 m<sup>2</sup> membrane area



**FII MicroClear™ MCXL  
MEMBRANE AGGREGATE  
FOR SEPTIC TANK INSERTION**  
7 m<sup>2</sup> membrane area



<sup>1</sup>Membrane aggregate: membrane modules complete with housing and air diffusers



# **CONTAINERS FOR FII MicroClear™ MBR EQUIPMENT**



# ***FII MicroClear™ MBR Containers for Equipment***

## **CONTAINERIZED FII MicroClear™ MBR IN OPERATION AT A SITE**



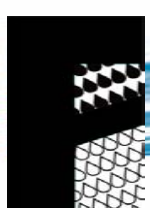
# ***FII MicroClear™ MBR Containers for Equipment***

ISO modified shipping container has the following standard features:

- Exterior paint
- Lifting eyes on the upper corners
- Plywood floor
- Insulated walls and ceiling
- Paneled and painted wood interior
- Insulated floor
- Barn-style rear double doors
- One-man door
- Lighting
- Ventilation fan with thermostat and hood
- Heater with thermostat
- Passive vent louvers with hood
- Emergency stop switch
- All influent, effluent, and drain lines plumbed to outside of the container.



**FII MicroClear™ MBR IN A 30-FOOT  
CONTAINER**



# ***FII MicroClear™ MBR Containers for Equipment***

**CONTAINER OUTSIDE THE FII ASSMBLY PLANT**  
**SKID BELOW THE CONTAINER**





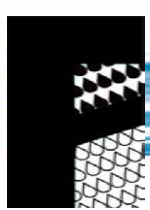
# **FII MicroClear™ MEMBRANE MAINTENANCE**



# ***FII MicroClear™ Membrane Maintenance***

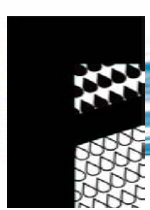
- Better resistance against clogging by fibrous substances - such as hair
- For small installations, individual modules can be lifted up by hand
- De-ragging & cleaning is easier as membrane modules can be opened up on one side to expose individual membrane plates to hose flushing





***FII MicroClear™ MBR  
Monitoring***

# **FII MicroClear™ MBR TELEMETRY SYSTEM**



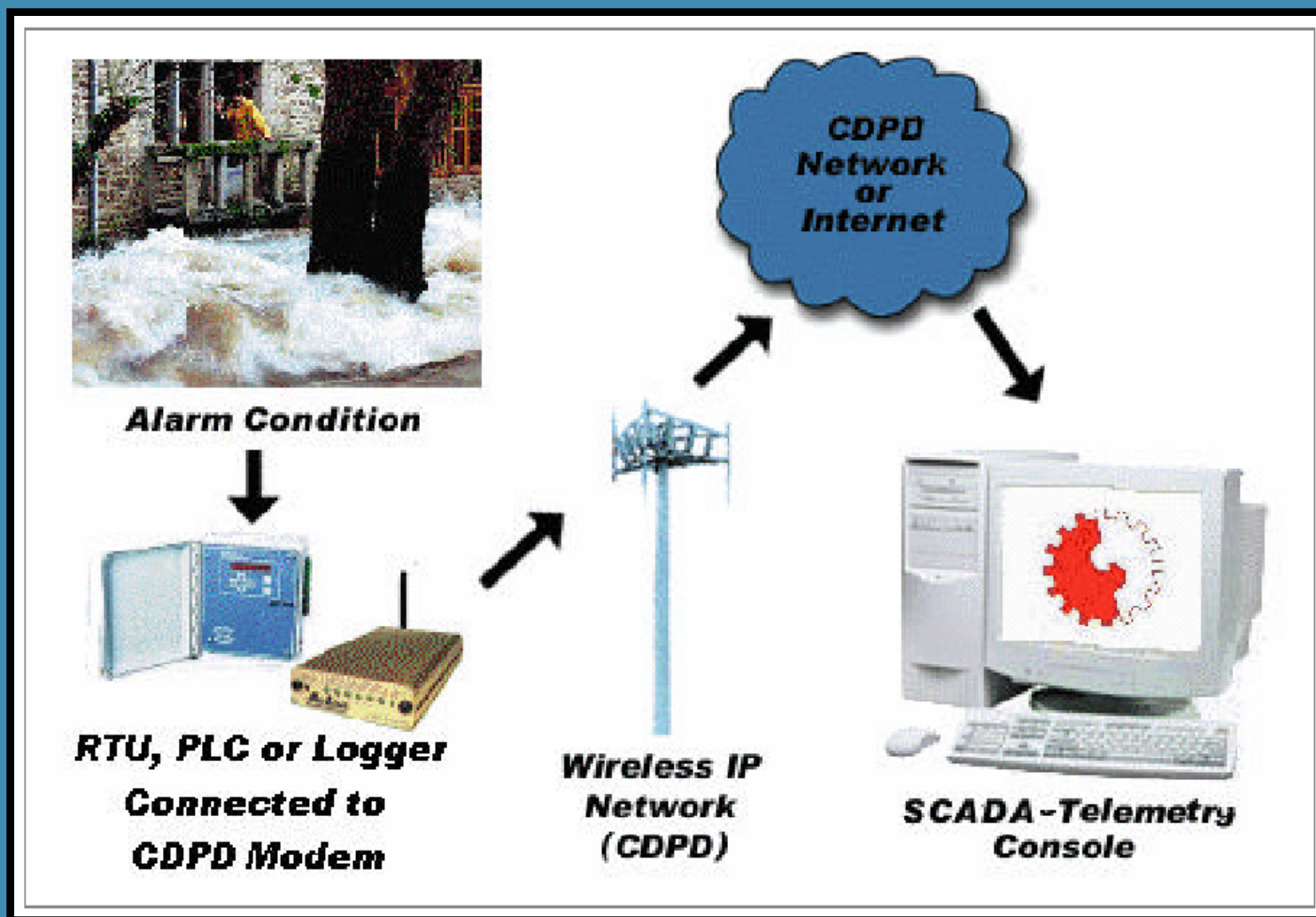
**FII MicroClear™ MBR**

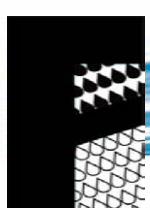
**TELEMETRY SYSTEM ADVANTAGES**

**Peace of mind for the owner as remote monitoring leads to:**

- 1. Remote operation control from anywhere**
- 2. Remote troubleshooting**
- 3. Ensures compliance with the regulatory standards**
- 4. Timely warning against theft and vandalism**

# FII MicroClear™ MBR Telemetry System

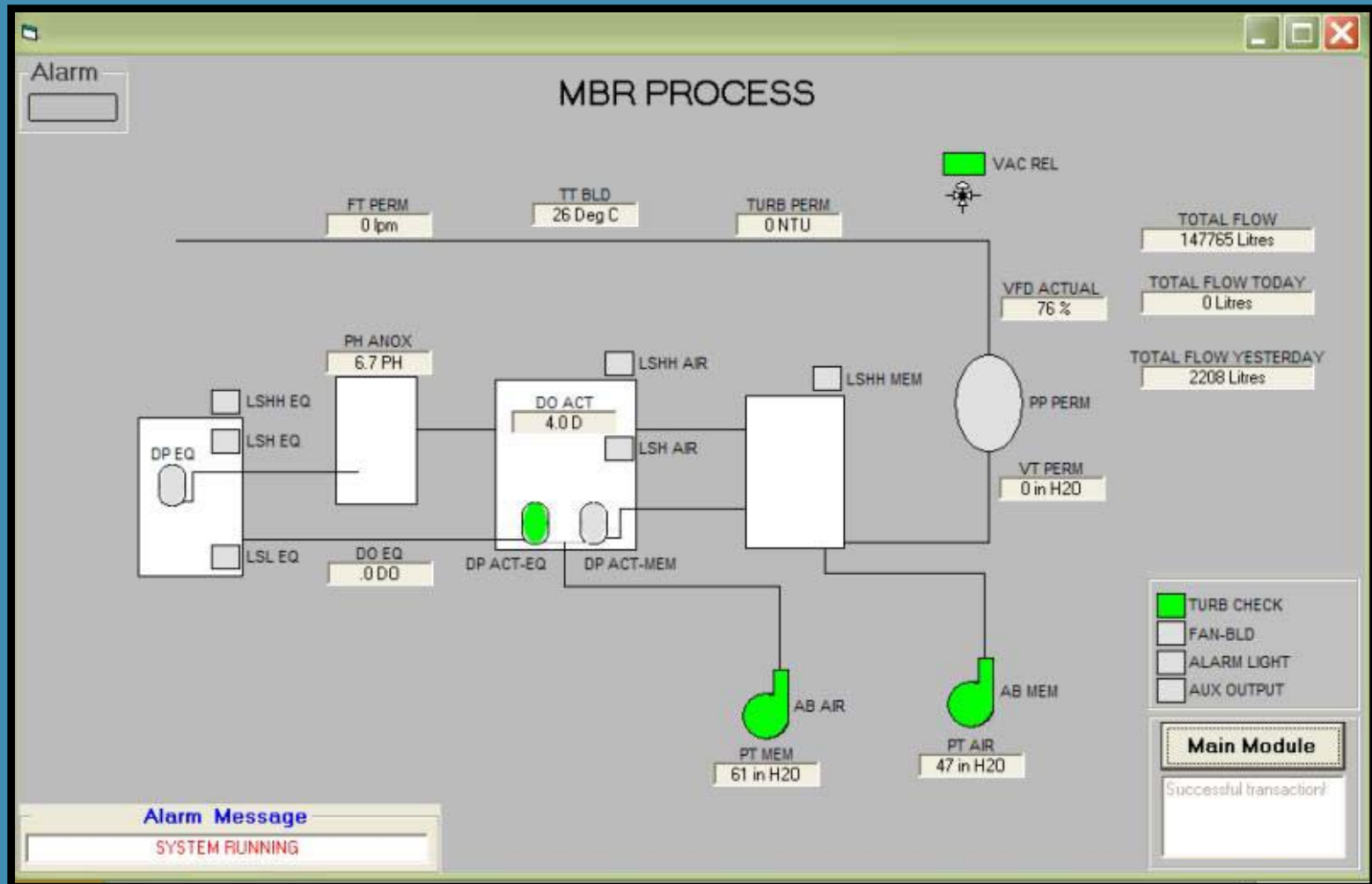




## **BASIC REMOTE TELEMETRY MODULE**

- **Allows monitoring and control of the system from a remote computer**
- **Operator can start/stop motors and pumps, view level switch status; monitor DO levels, turbidity, and permeate flow rate**
- **This interface can also be used for changing the operational set points and alarm set points**
- **The basic system requires that the customer provide a standard computer network cable to the control panel**
- **If the customer's computer network is accessible to internet, the system can also be monitored from any internet-enabled computer**

# FII MicroClear™ MBR Telemetry System



**We proudly attach this label to every system we supply:**



**744 Gordon Baker Road  
North York, Ontario, Canada  
M2H 3B4**

|                  |                                                                                             |
|------------------|---------------------------------------------------------------------------------------------|
| <b>Telephone</b> | <b>416 490 7848</b>                                                                         |
| <b>Fax</b>       | <b>416 490 0974</b>                                                                         |
| <b>Email</b>     | <b><a href="mailto:inquiries@filterinnovations.com">inquiries@filterinnovations.com</a></b> |
| <b>Web Site</b>  | <b><a href="http://www.filterinnovations.com">www.filterinnovations.com</a></b>             |