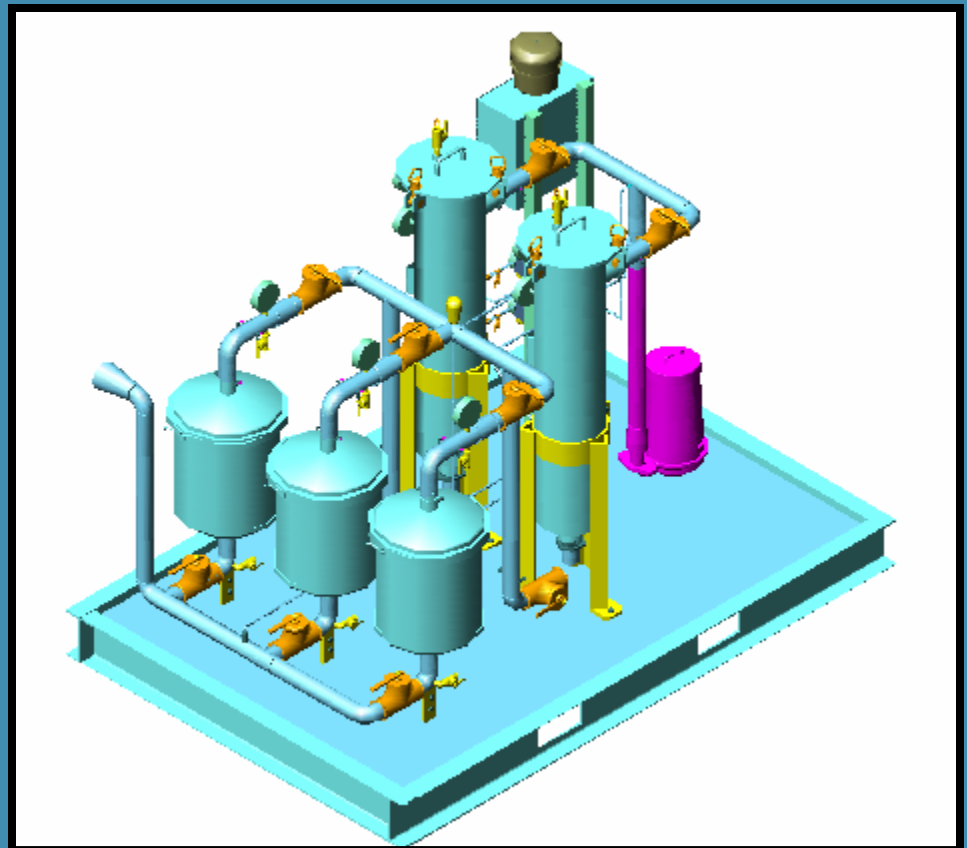


SYSTEMS AND EQUIPMENT

- 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 ≤ 5 mg/L BOD₅ – 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



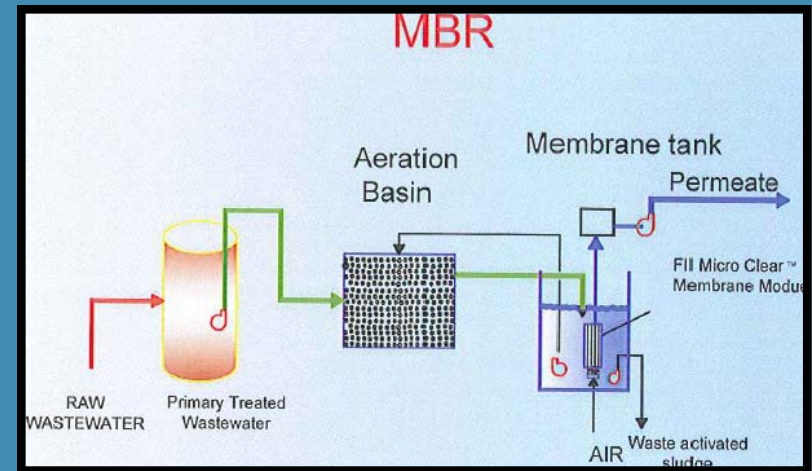
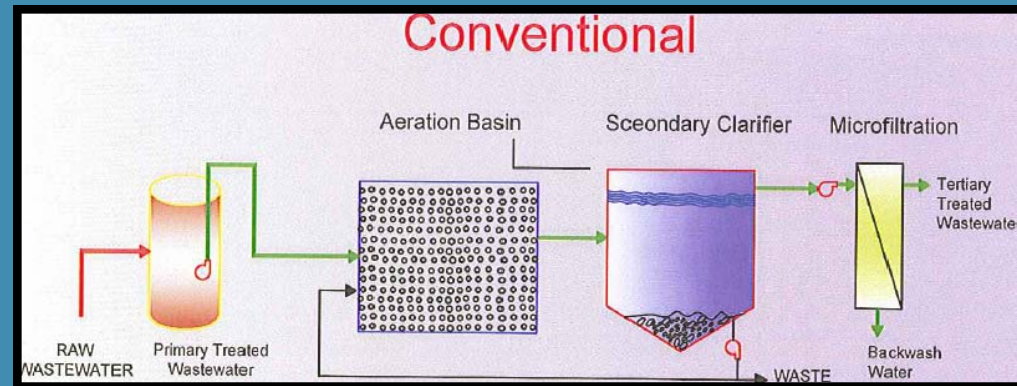
Left side: FII MicroClear MBR effluent - $\text{BOD}_5 < 5 \text{ mg/L}$, $\text{TSS} < 1 \text{ mg/L}$, turbidity $< 1 \text{ N.T.U.}$

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. HRT¹ of MBR aeration tank - 4 to 8 hours vs. 16 to 24 hours for CASP2
3. MBR sludge yield – typically, 20 to 40% less than CASP
4. MRB footprint – typically, 25 - 35% of CASP due to high concentration of bugs
6. Effective barrier against chlorine-resistant pathogenic organisms – *Cryptosporidium* and *Giardia Lamblia*



¹HRT – hydraulic retention time

²CASP – 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

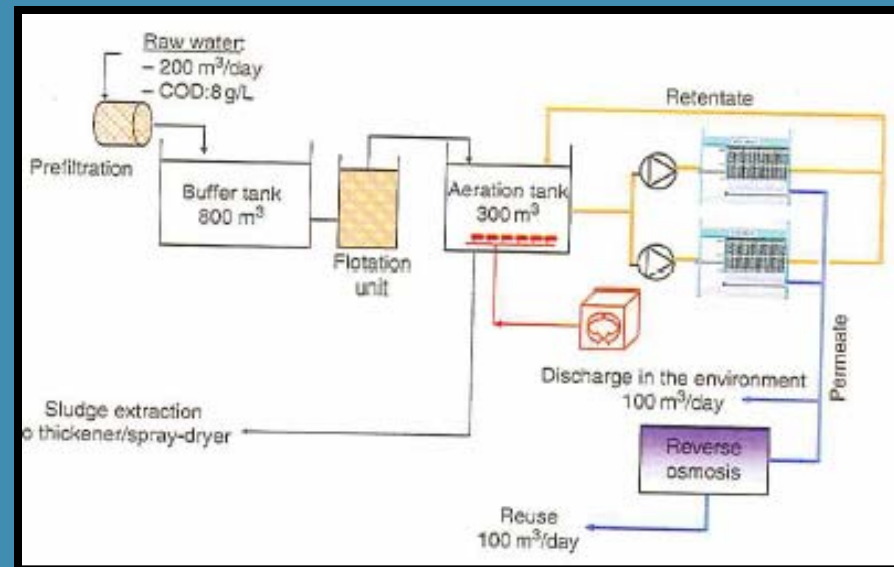
FII MicroClear™
MEMBRANE AGGREGATE



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

sMBR⁴ followed by RO for boiler feed makeup water treatment



sMBR⁴ – 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 ₅ ¹	mg/L	20	30	10	20
TSS ²	mg/L	20	30	10	20
Ammonia-N	mg/L	-	-	1	2
Total-N ³	mg/L	-	-	10	10
Total-P ⁴	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

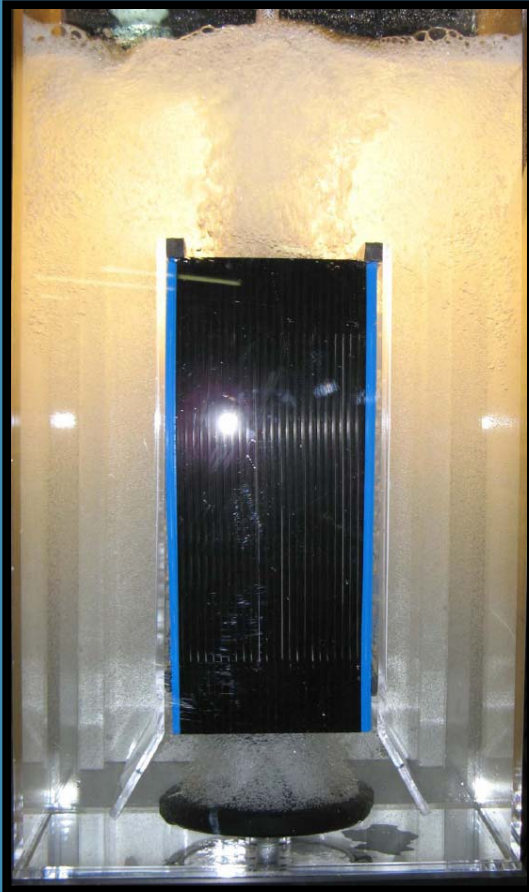
¹ BOD₅ – 5-day biochemical oxygen demand ² TSS – total suspended solids ³ Total-N – includes organic, ammonia, nitrite, and nitrate nitrogens ⁴ Total-P – includes organic and inorganic phosphorus



FII MicroClear™ IMMERSED MEMBRANE FILTRATION



MicroClear™ Immersed Membrane Filtration



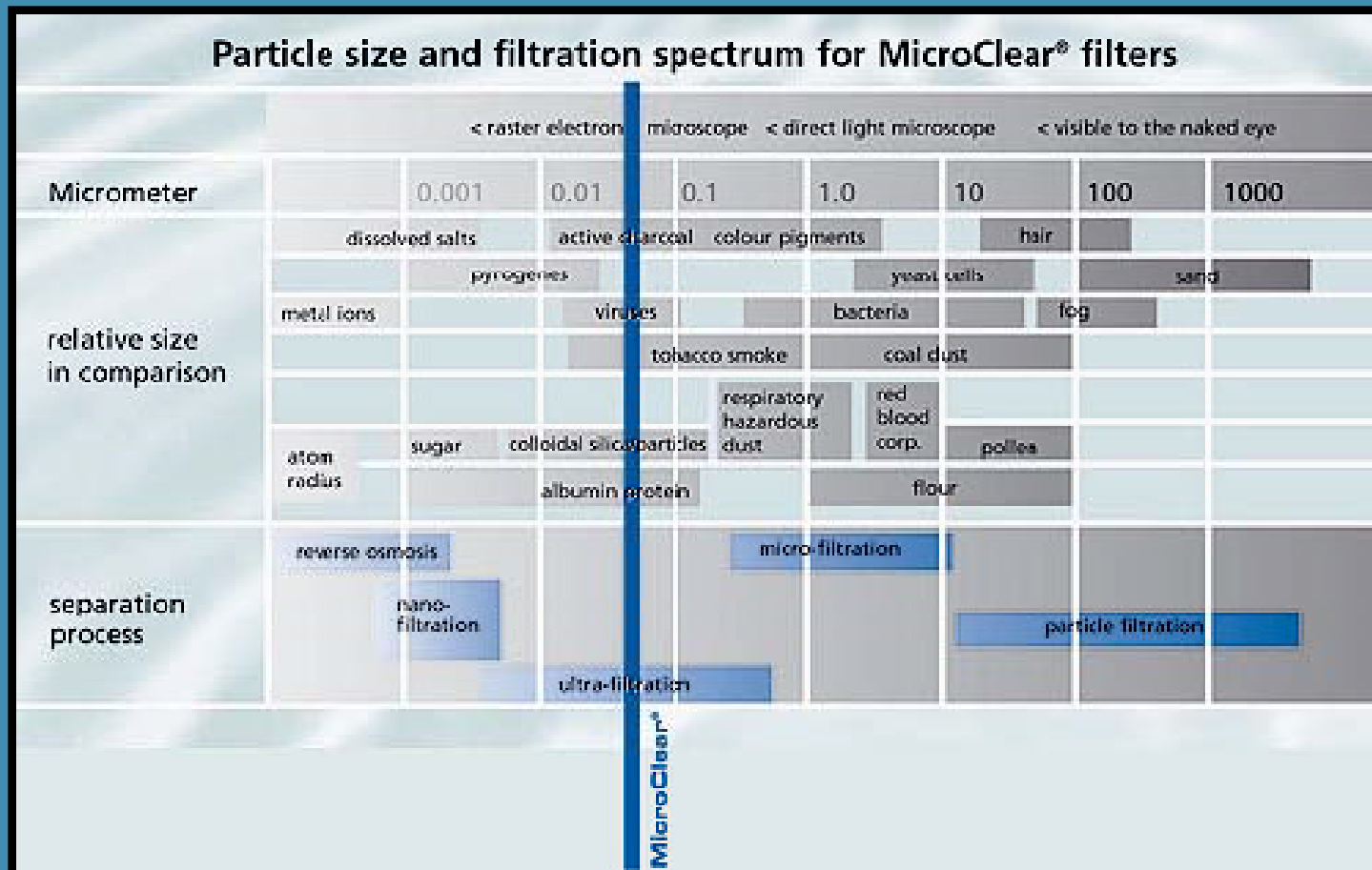
DISPLAY MODEL

**FII MicroClear™
MEMBRANE MODULE
INSIDE**



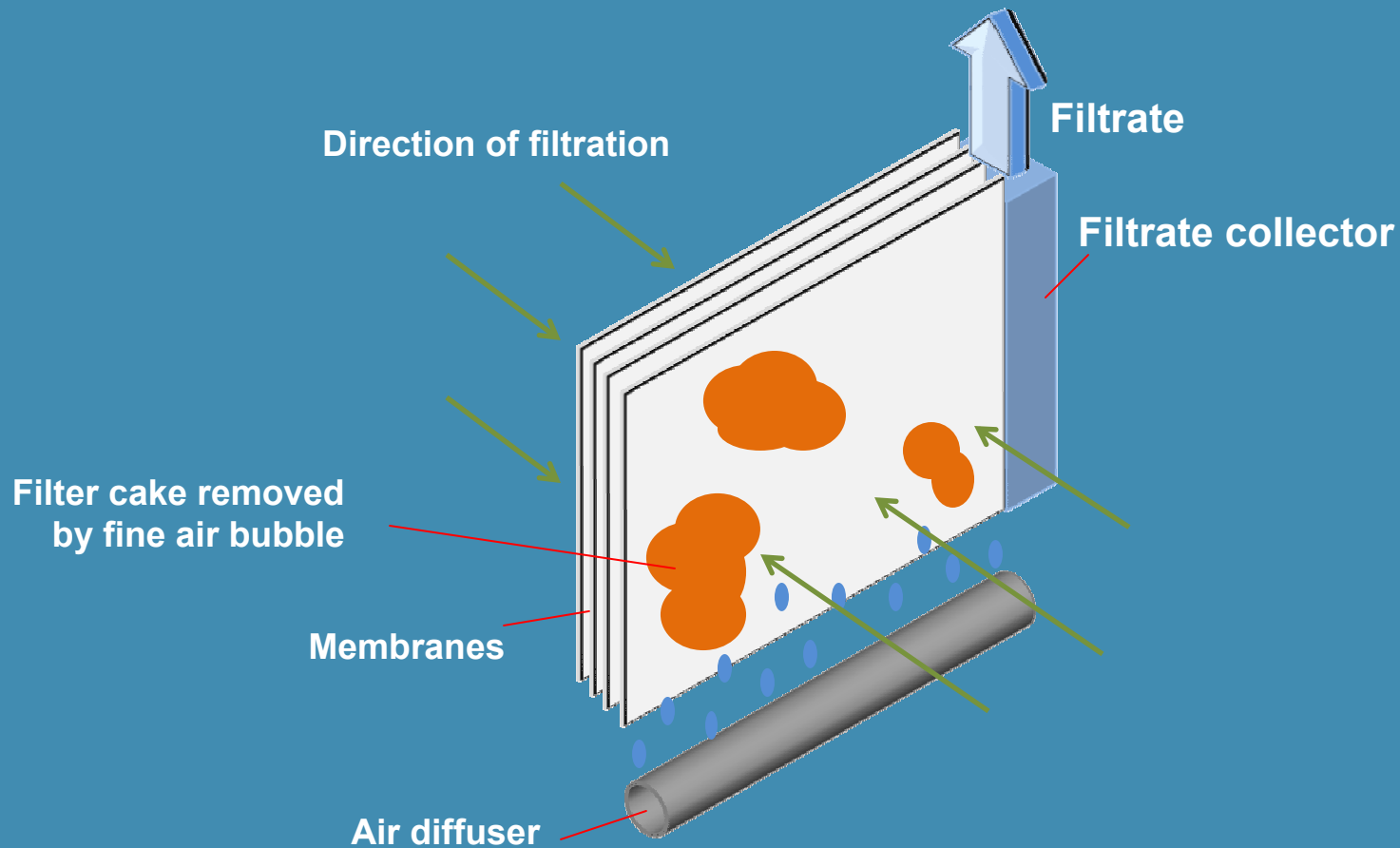
MicroClear™ Immersed Membrane Filtration

PORE SIZE OF MicroClear™ MEMBRANES

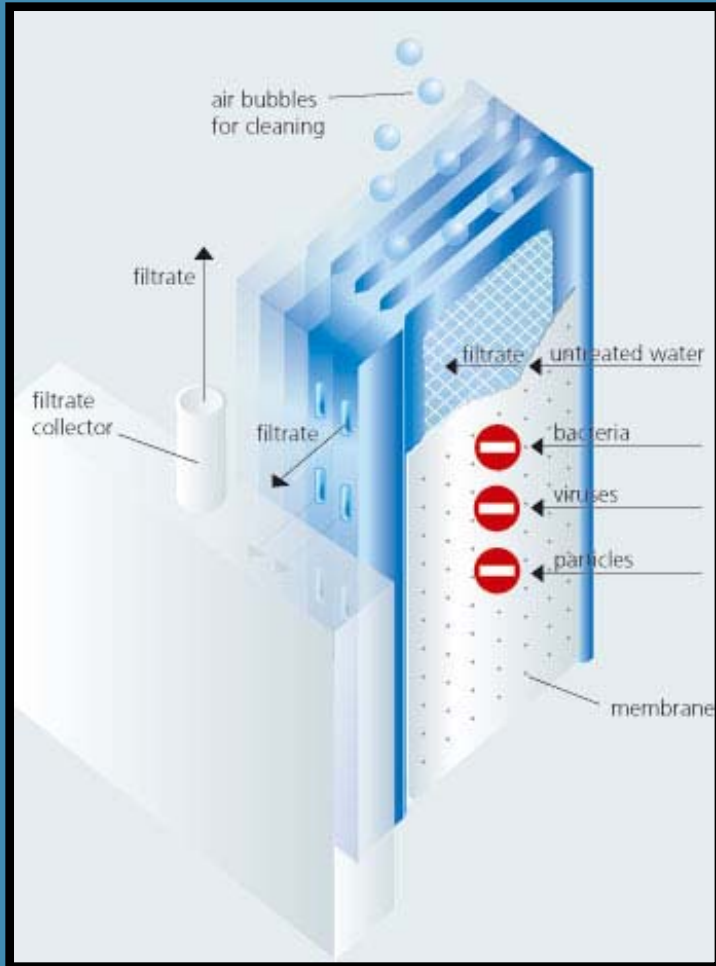


MicroClear™ Immersed Membrane Filtration

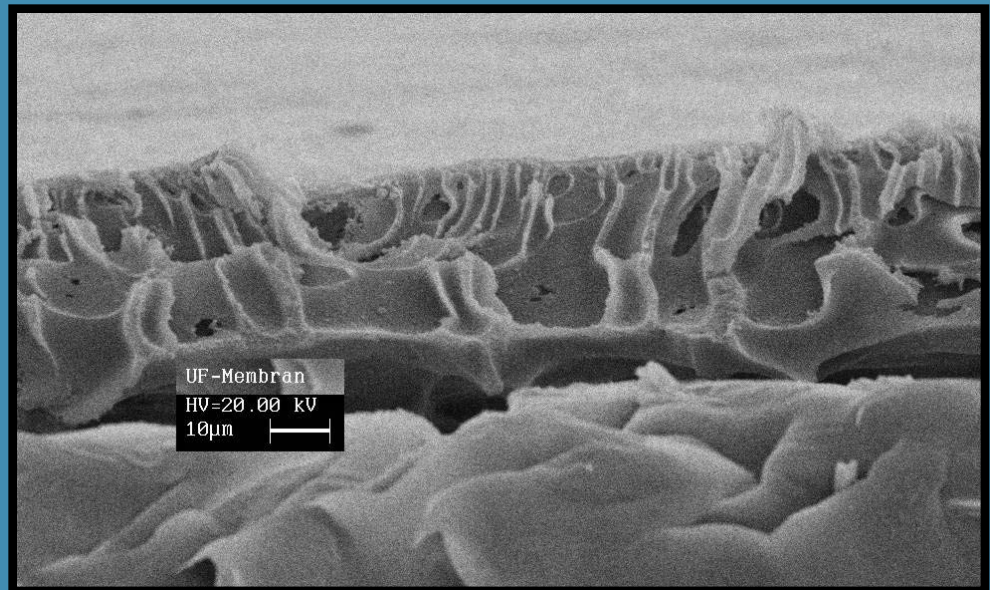
MicroClear™ MEMBRANE FILTER OPERATION



MicroClear™ Immersed Membrane Filtration

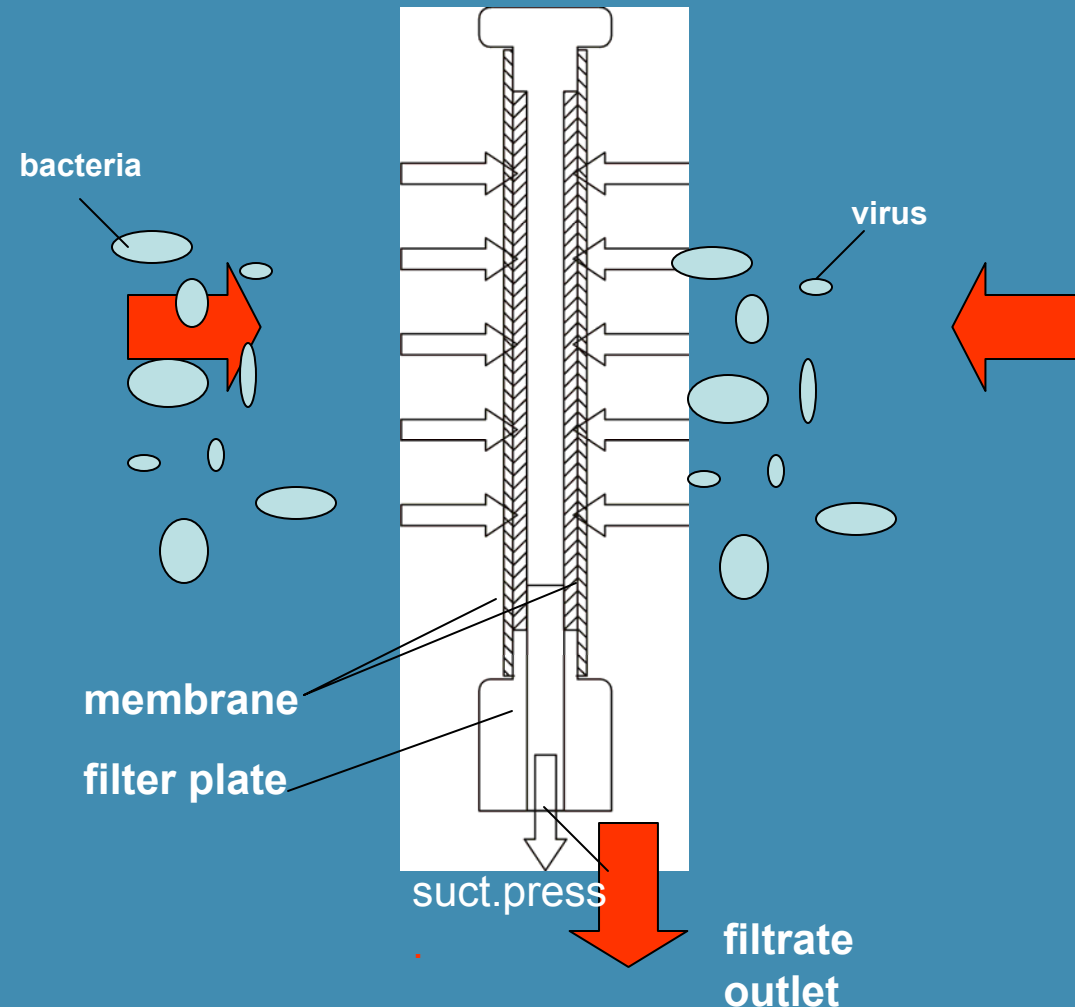


Rising air bubbles between the membrane plates impart a shear force on the dirt particles, thus constantly removing build-up from the membrane



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 μm
- Leaves out any bacteria (1 – 2 μm) and parasites (5 – 50 μm) passing through the membranes
- Virus removal – 99.9999 %



FII MicroClear™ MBR

VERSUS

CASP

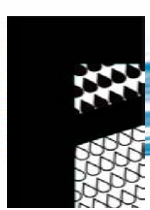
COMPARISON OF TREATED EFFLUENT RESULTS

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 ₅	mg/L	150 - 200	< 5	10 - 20
CFU ¹ (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



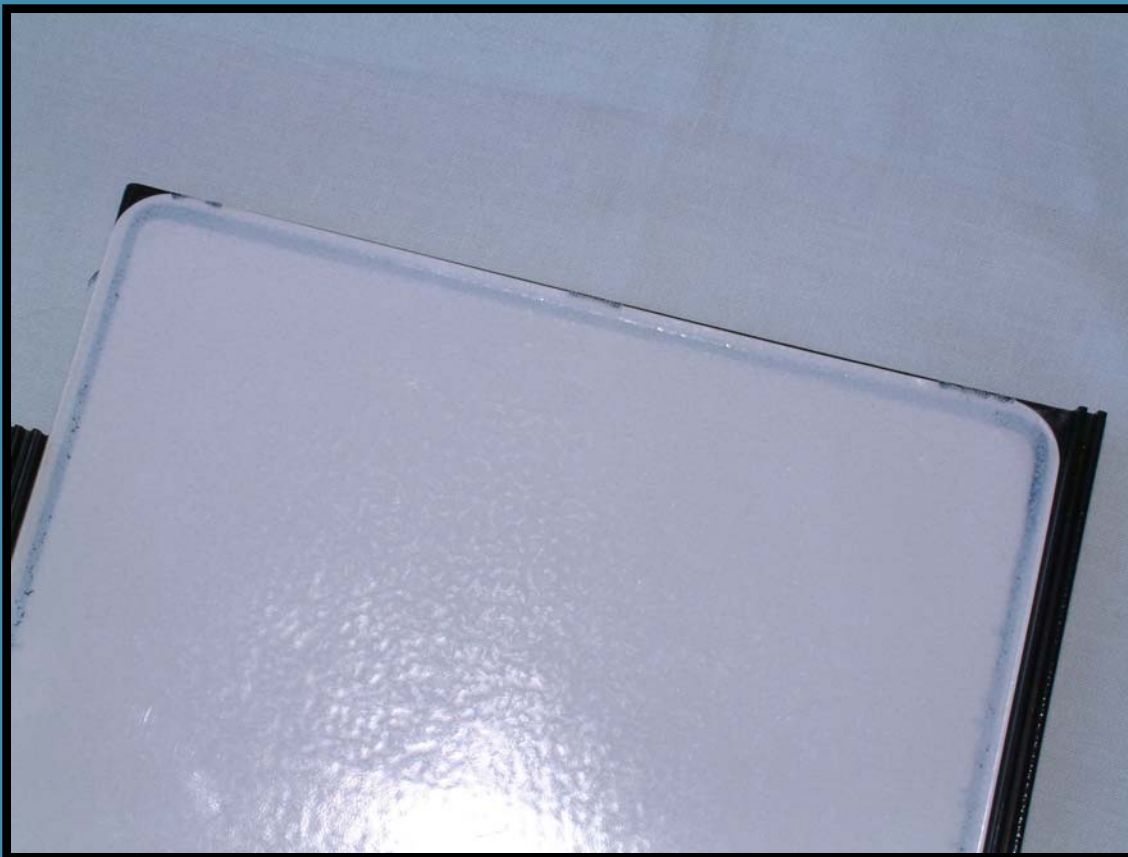
FII MicroClear™ Membrane Modules

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 m² membrane area

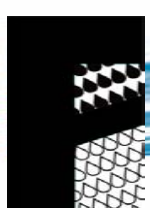


**FII MicroClear™ MCXL MODULE
FOR MBR**
7 m² membrane area





MicroClear™ MMERSED MEMBRANE AGGREGATES



FII MicroClear™ Immersed Membrane Aggregates¹

FII MicroClear™ MBR

**FII MicroClear™ MEMBRANE
AGGREGATE FOR MBR
315 m² membrane area**



**FII MicroClear™ MCXL MEMBRANE
AGGREGATE FOR MBR
525 m² membrane area**



¹Membrane aggregate: membrane modules complete with housing and air diffusers



FII MicroClear™ Immersed Membrane Aggregates¹

FII MicroClear™ MBR

**FII MicroClear™ MEMBRANE
AGGREGATE FOR MBR**
28 m² membrane area



**FII MicroClear™ MCXL MEMBRANE
AGGREGATE FOR MBR**
210 m² membrane area



¹Membrane aggregate: membrane modules complete with housing and air diffusers

FII MicroClear™ Immersed Membrane Aggregates¹

FII MicroClear™ MBR

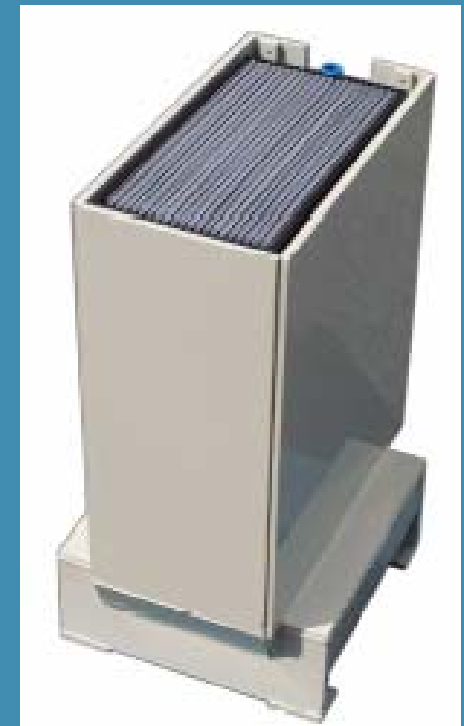
**FII MicroClear™ MC03
MEMBRANE AGGREGATE
FOR SEPTIC TANK INSERTION**
3.5 m² membrane area



**FII MicroClear™ MC03
MEMBRANE AGGREGATE
FOR SEPTIC TANK INSERTION**
7 m² membrane area



**FII MicroClear™ MCXL
MEMBRANE AGGREGATE
FOR SEPTIC TANK INSERTION**
7 m² membrane area



¹Membrane 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



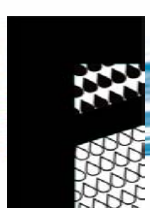
FII MicroClear™ MBR Containers for Equipment

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





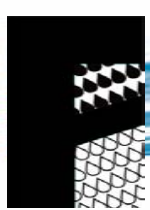
FII MicroClear™ MEMBRANE MAINTENANCE



FII MicroClear™ Membrane Maintenance

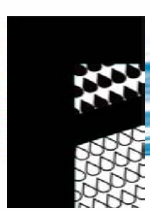
- Better resistance against clogging by fibrous substances - such as hair
- For small installations, individual modules can be lifted up by hand
- De-ragging & cleaning is easier as membrane modules can be opened up on one side to expose individual membrane plates to hose flushing





***FII MicroClear™ MBR
Monitoring***

FII MicroClear™ MBR TELEMETRY SYSTEM



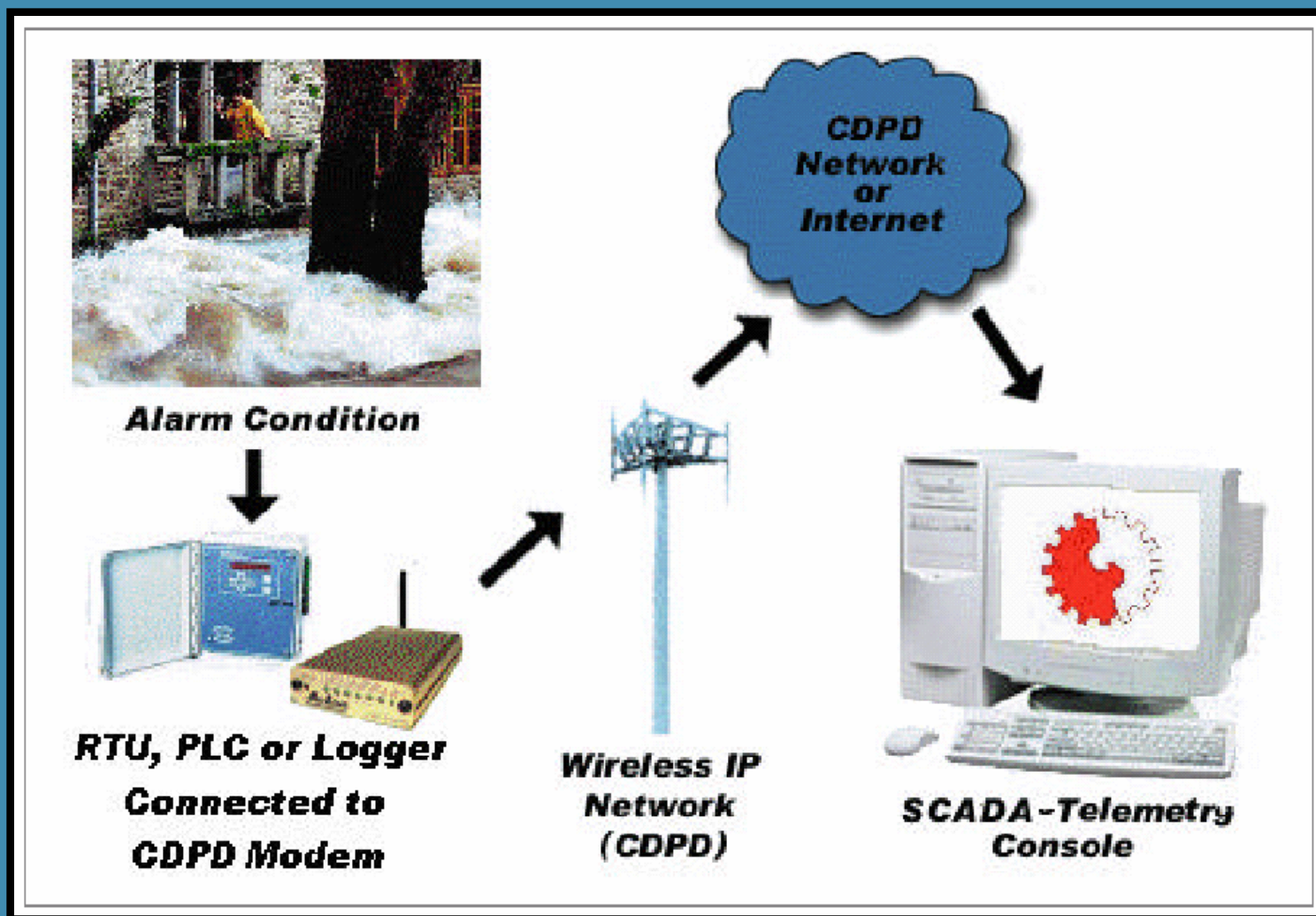
FII MicroClear™ MBR

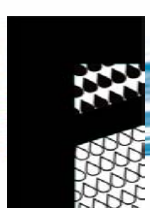
TELEMETRY SYSTEM ADVANTAGES

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

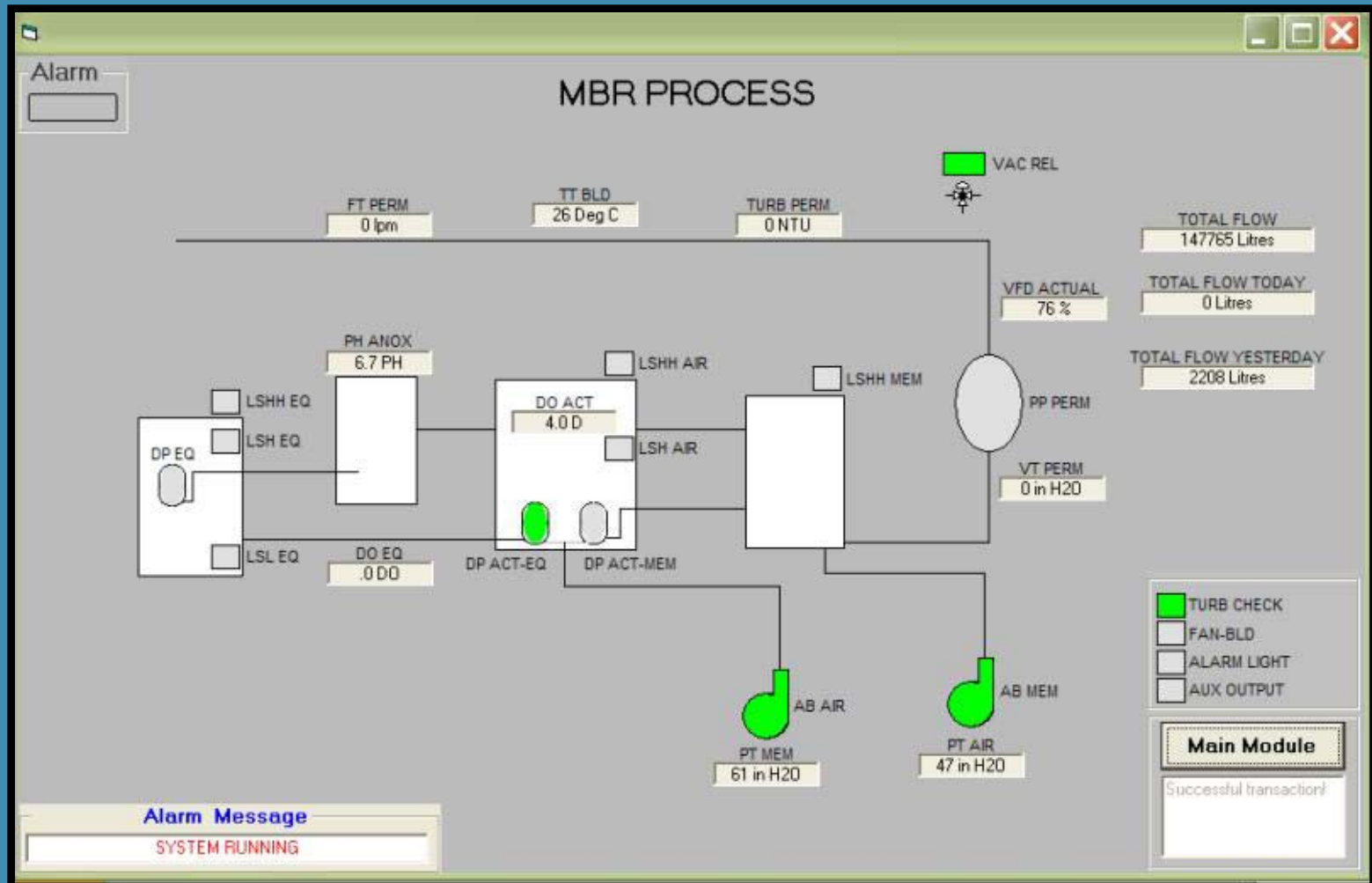




BASIC REMOTE TELEMETRY MODULE

- **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**

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