AL-KAWTHER INDUSTRIES LTD

Presentation
On

Recycle Of Industrial Wastewater With Media Filtration And Reverse Osmosis

By

Al- Kawther Industries Ltd.

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INTRODUCTION

EFFLUENT DISCHARGE STANDARDS

- MOI&E (MOWE)
- MEPA
- ROYAL COMMISSION… etc

MINISTRY OF INDUSTRY& ELECTRICITY(MOI&E) STANDARDS

Sl. No.	Parameters	Effluent
1	PH	5 to 11
2	EC	3200
3	SS mg/L	400
4	COD mg/L	810
5	TDS mg/L	2100
6	Chloride mg/L	600 to 1000
7	PO4 mg/lit	10
8	Oil & Grease	100

MEPA EMISSION Standards for Discharge of Effluent to a Surface Water Body

Parameter	Discharge Limit
Floatables	None
Total Suspended Solids	16mg/lit
Ph	6 to 9
Temperature	Determined case by case
Turbidity	75NTU
BOD	25mg/lit
COD	150mg/lit
TOC	50mg/lit
TKN	5mg/lit
Total Chlorinated Hydro Carbons	0.1mg/lit
Oil and Grease	8mg/lit
Phenols	0.1mg/lit
Ammonia(as nitrogen0	1mg/lit
Arsenic	0.1mg/lit
Cadmium	0.02mg/lit
Chlorine residual	0.5mg/lit
Chromium (total)	0.1mg/lit
Copper	0.2mg/lit
Cyanide(total)	0.05mg/lit
Lead	0.1mg/lit
Mercury	0.001mg/lit
Nickel	0.2mg/lit
Phosphate(total as Phosphorus)	1mg/lit
Zinc	1mg/lit
Total Coliform	1000MPN per 100ml

MEPA Standards

TABLE 3E
IRRIGATION WATER QUALITY STANDARDS
AT THE POINT OF DISCHARGE TO IRRIGATION SYSTEM

PARAMETER[1]	UNITS	Maximum Allowable	Monthly Average
PHYSICAL			
Floating Particles	mg/m^2	NIL	NIL
Temperature	$\Delta°C$	10	-
Total Suspended Solids	mg/l	15	10
Total Dissolved Solids	mg/l	2000	1750
Turbidity[2]	N.T.U.	5	2
CHEMICAL			
Aluminium	mg/l	25	15
Ammonia, Total as N	mg/l	40	15
Arsenic	mg/l	0.5	0.1
Barium	mg/l	2.0	1.0
BOD_5	mg/l	50	25
Boron	mg/l	2.5	0.75
Cadmium	mg/l	0.05	0.01
COD	mg/l	350	150
Chloride	mg/l	1000	500
Chlorine Residual[3]	mg/l	0.5 (min)	-
Chromium	mg/l	1.0	0.1
Cobalt	mg/l	2.0	0.1
Copper	mg/l	0.5	0.2
Cyanide	mg/l	0.1	0.05
Dissolved Oxygen[4]	mg/l	2.0 (min.)	-
Fluoride[5]	mg/l	15	5
Iron	mg/l	10	5
Lead	mg/l	0.5	0.1
Manganese	mg/l	1.0	0.02
Mercury	mg/l	0.005	0.001
Nickel	mg/l	0.5	0.2
Oil and Grease	mg/l	15	8
pH	pH units	6 - 9	6 - 9
Phenols	mg/l	1.0	0.10
Phosphorus, total as P	mg/l	30	20
Sodium	mg/l	1000	500
Sodium Adsorption Ratio (SAR)	SAR units	20	10
Sulphate	mg/l	800	300
Sulphide	mg/l	0.1	0.05
Total Kjeldahl Nitrogen	mg/l	60	35
Total Organic Carbon	mg/l	150	50
Zinc	mg/l	5.0	2.0

continued

TABLE 3E (cont.)
IRRIGATION WATER QUALITY STANDARDS
AT THE POINT OF DISCHARGE TO IRRIGATION SYSTEM

VARIABLE	UNITS	Maximum Allowable	Monthly Average
BACTERIOLOGICAL			
Total Coliforms[6]	MPN/100 ml	23[7]	2.2
PARASITOLOGICAL			
Nematodes	No./10 ml	1	-
Protozoan Cysts	No./10 ml	1	-
Platyhelminths (Worms)	No./10 ml	1	-

Notes:

1) For any parameters not identified, specific standards will be determined on a case-by-case basis
2) Maximum turbidity not to be exceeded more than 5% of the time in the 24-hour period.
3) Free chlorine residual after 30 minutes of contact
4) Dissolved oxygen level is a minimum concentration requirement
5) Fluoride levels assume well-drained sandy soil for irrigation which will not be used for forage
6) Reclaimed water shall at all times be adequately disinfected, oxidized, clarified and filtered.
7) The wastewater shall be considered disinfected if the median number of coliform organisms in the effluent does not exceed 2.2 total coliforms MPN per 100 ml, as determined from the results of the last seven days for which analyses have been completed, AND if the number of coliforms does no exceed 23 total coliforms per 100 ml in any sample.

Pollutants in Industrial Wastewater

- Organic Substances
- Inorganic Substances
- Acid and Alkali
- Toxic Substances
- Color Producing Substances
- Fat,Oil & Grease etc

Recycling Of Carpet Factory Wastewater

PILOT PLANT

INTRODUCTION

Unit Operations& Unit Process

- Physical
- Chemical
- Biological

Coagulation
&
Flocculation

METHODS OF TREATMENT OF WASTEWATER

- **Primary:**
  - Utilizes Physical separation Process.
  - Achieves a low degree of treatment.
  - Is normally used in combination with higher levels of treatment.
- **Secondary:**
  - Uses one or combination of chemical or biological.
  - Anaerobic- Aerobic and Aerobic Treatment.
  - Achieves a moderate degree of treatment.
  - Produces effluent that is normally suitable for reuse in non- potable application.
- **Tertiary:**
  - Achieves a high degree of treatment.
  - Produces effluent that is suitable for nearly all non-potable applications.

PRETREATMENT

Wastewater Characteristics

Parameters	Equalization Tank	Primary Clarifier Outlet	Secondary Clarifier Outlet	Carbon Filter Outlet	RO Product water at 80% recovery
TDS mg/L	1600	1752	1780	1766	43.4
SS mg/lit	82	21	11	3	0
COD mg/L	1159	463	7	<1	0
Ph	4.7	9	7	8.2	5.5

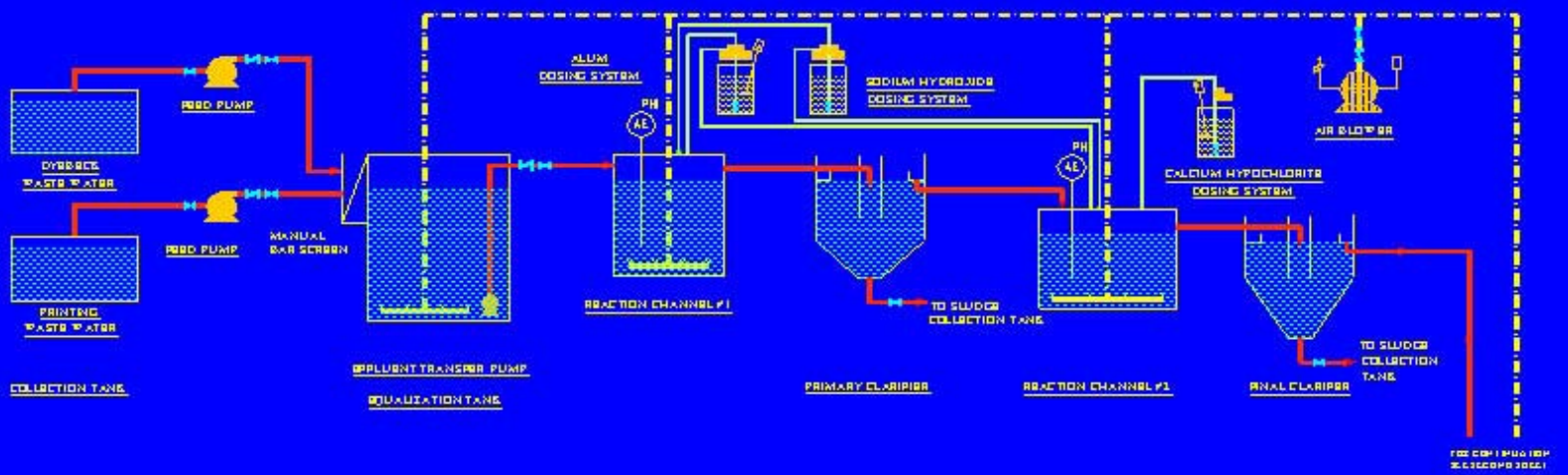
Water& Wastewater Quality

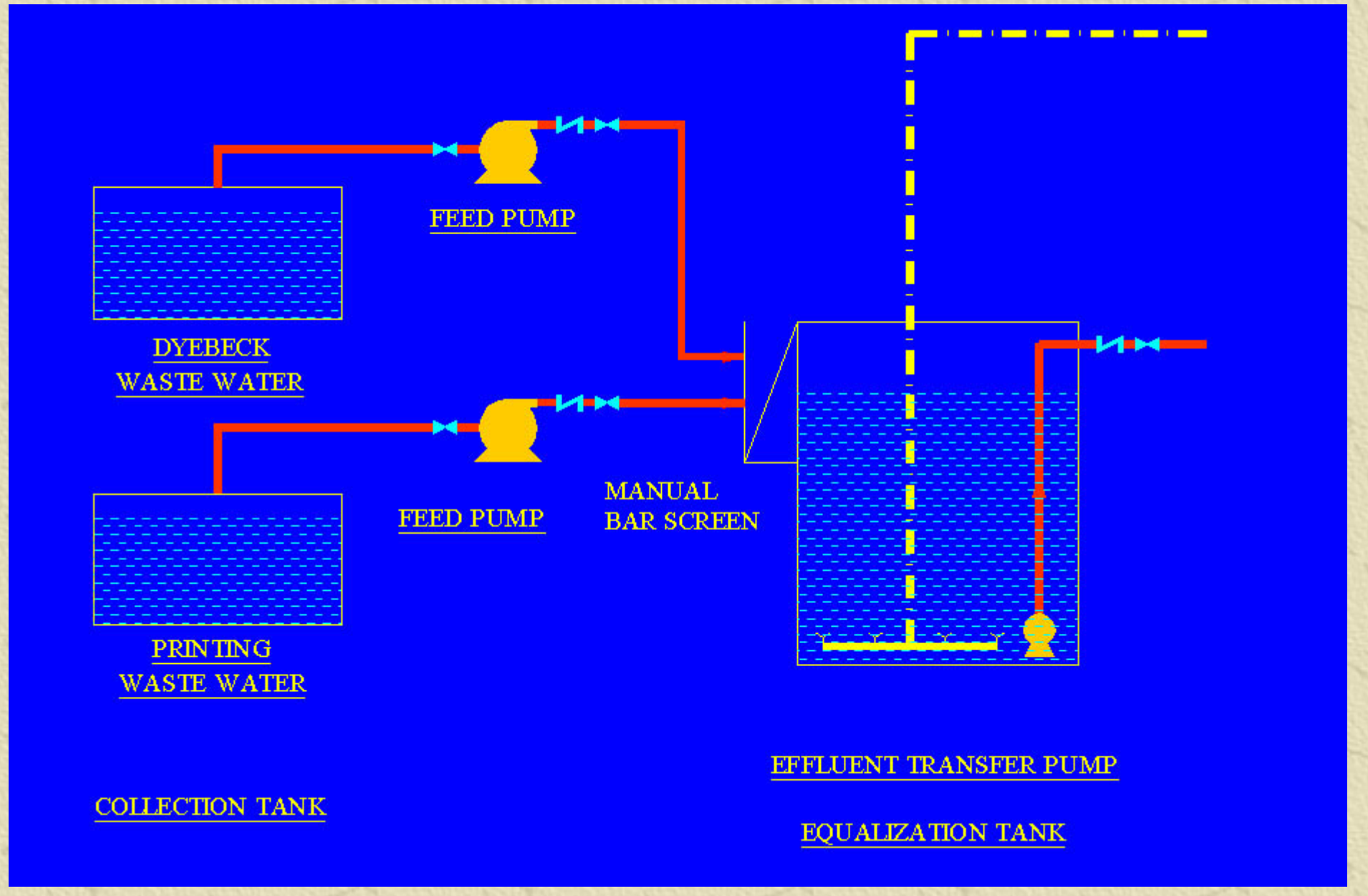
Sl. No.	Ion Concentration	Water quality Used for Carpet Process	Wastewater quality After Carpet Process	RO Permeate quality from Pilot Plant
1	Sodium mg/L	22.3	393.0	17.0
2	Potassium mg/L	2.4	4.3	0.1
3	Calcium mg/L	3.1	308.0	2.4
4	Magnesium mg/L	1.4	37.0	0.5
5	Chloride mg/L	42.0	412.0	8.5
6	Sulphate mg/L	1.5	200.0	2.0
7	Nitrate mg/L	1.5	31.0	8.0
8	Bicarbonate mg/L	2.1	112.0	4.2
9	Silica mg/L	0.3	6.2	0.7
10	TDS mg/L	76.0	1503.0	43.4
11	Ph	7.3	4.6	5.5

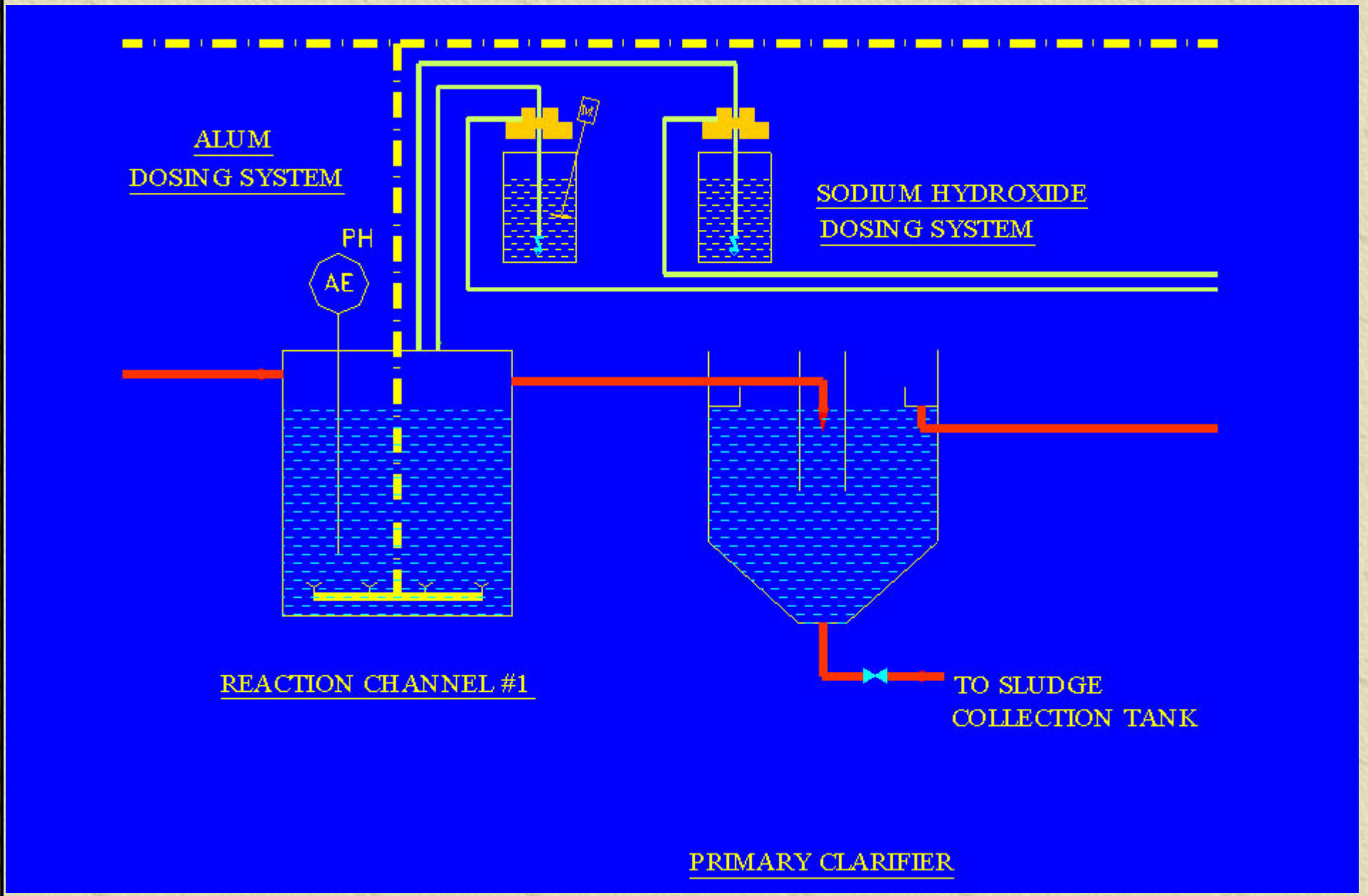
PROCESS DESCRIPTION

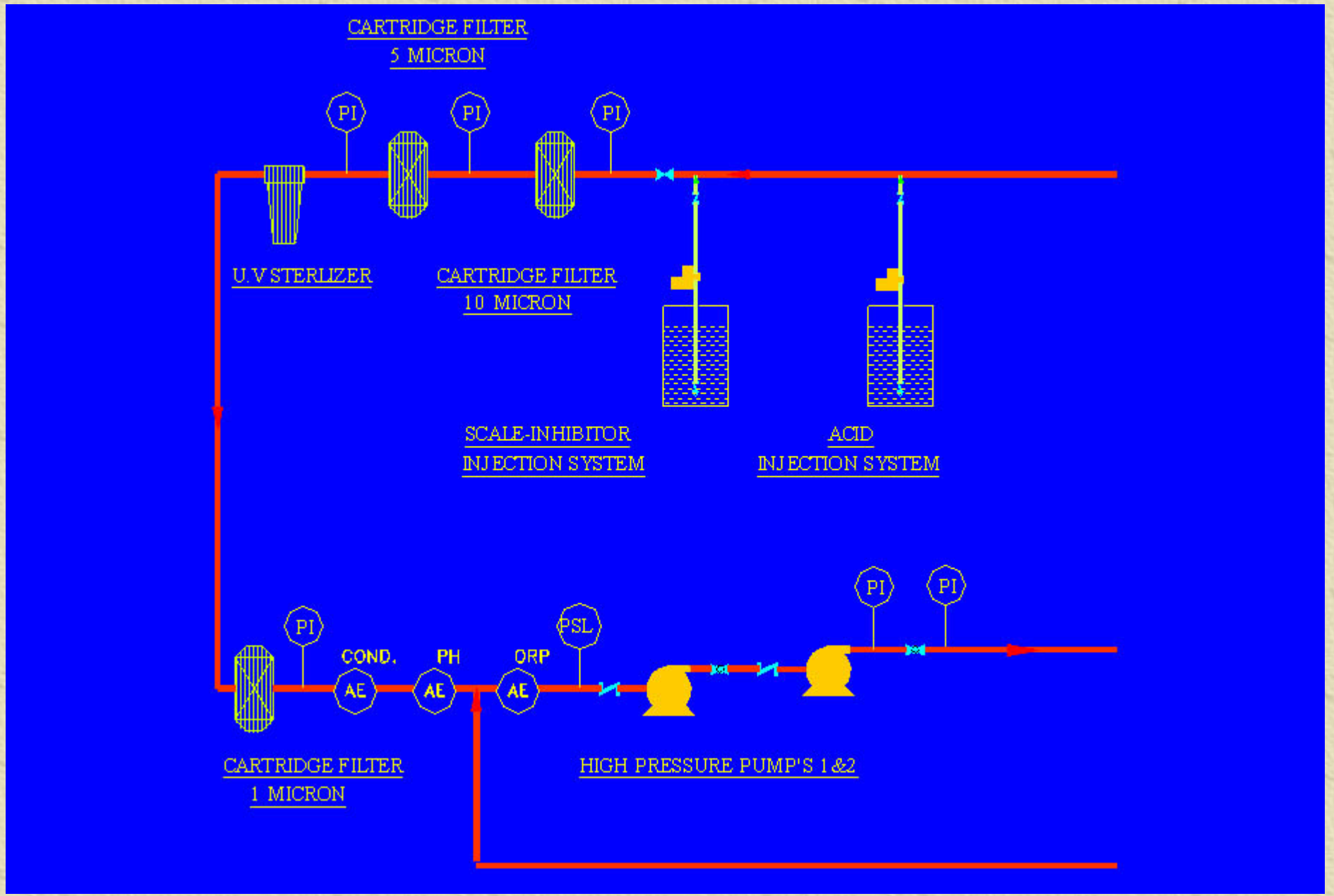
- Chemical Treatment
- Media Filtration
- Reverse Osmosis

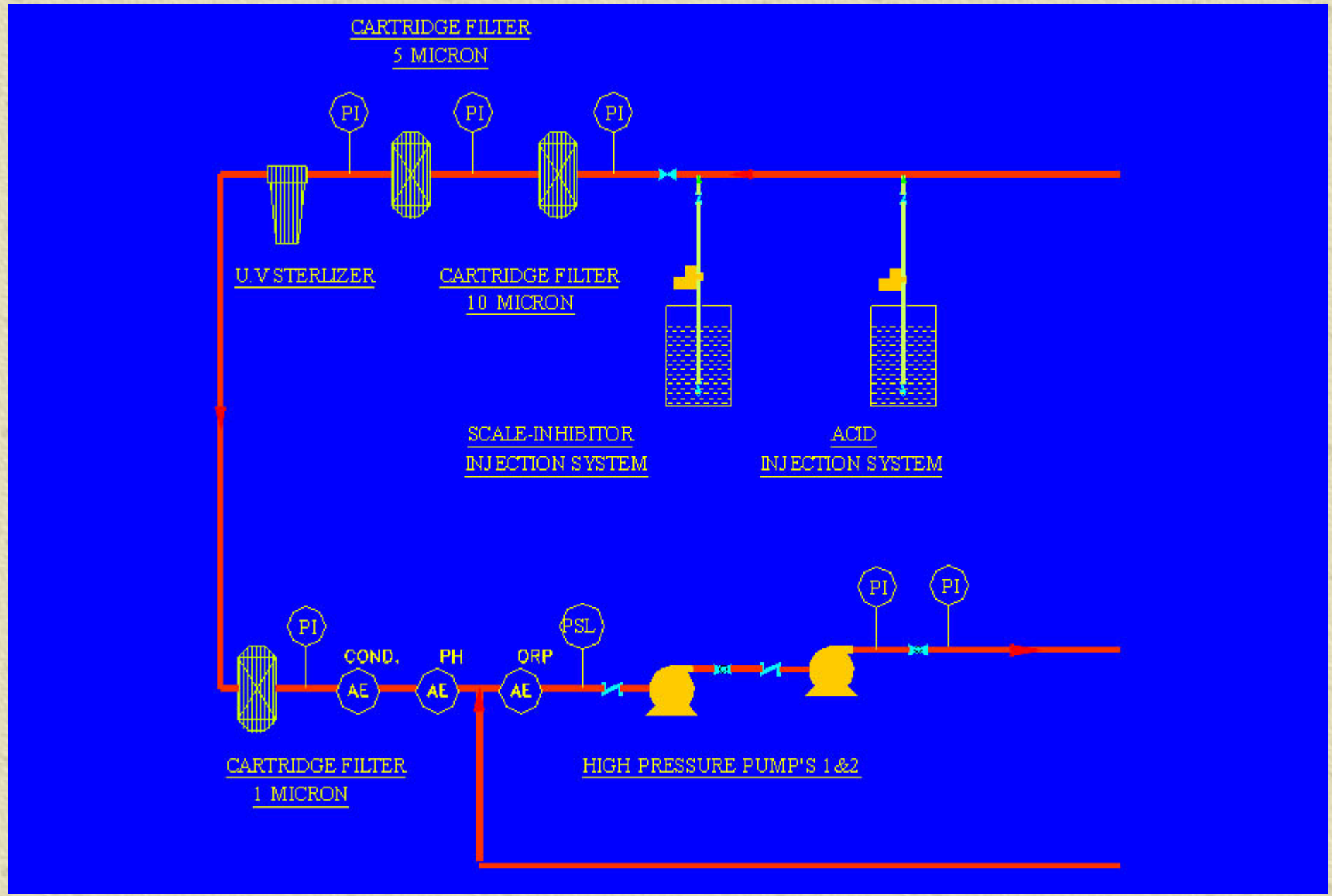
FLOW DIAGRAM 1ST SHEET




FEED PUMP
DYEBECK
WASTE WATER
FEED PUMP
MANUAL
BAR SCREEN
PRINTING
WASTE WATER
EFFLUENT TRANSFER PUMP
COLLECTION TANK
EQUALIZATION TANK


ALUM
DOSING SYSTEM
PH
AE
SODIUM HYDROXIDE
DOSING SYSTEM
REACTION CHANNEL #1
TO SLUDGE
COLLECTION TANK
PRIMARY CLARIFIER


CARTRIDGE FILTER
5 MICRON
PI
PI
PI
U.V STERLIZER
CARTRIDGE FILTER
10 MICRON
SCALE-INHIBITOR
INJECTION SYSTEM
ACID
INJECTION SYSTEM
PI
PI
PI
PSL
COND.
PH
ORP
AE
AE
AE
CARTRIDGE FILTER
1 MICRON
HIGH PRESSURE PUMP'S 1&2


CARTRIDGE FILTER
5 MICRON
PI
PI
PI
U.V STERLIZER
CARTRIDGE FILTER
10 MICRON
SCALE-INHIBITOR
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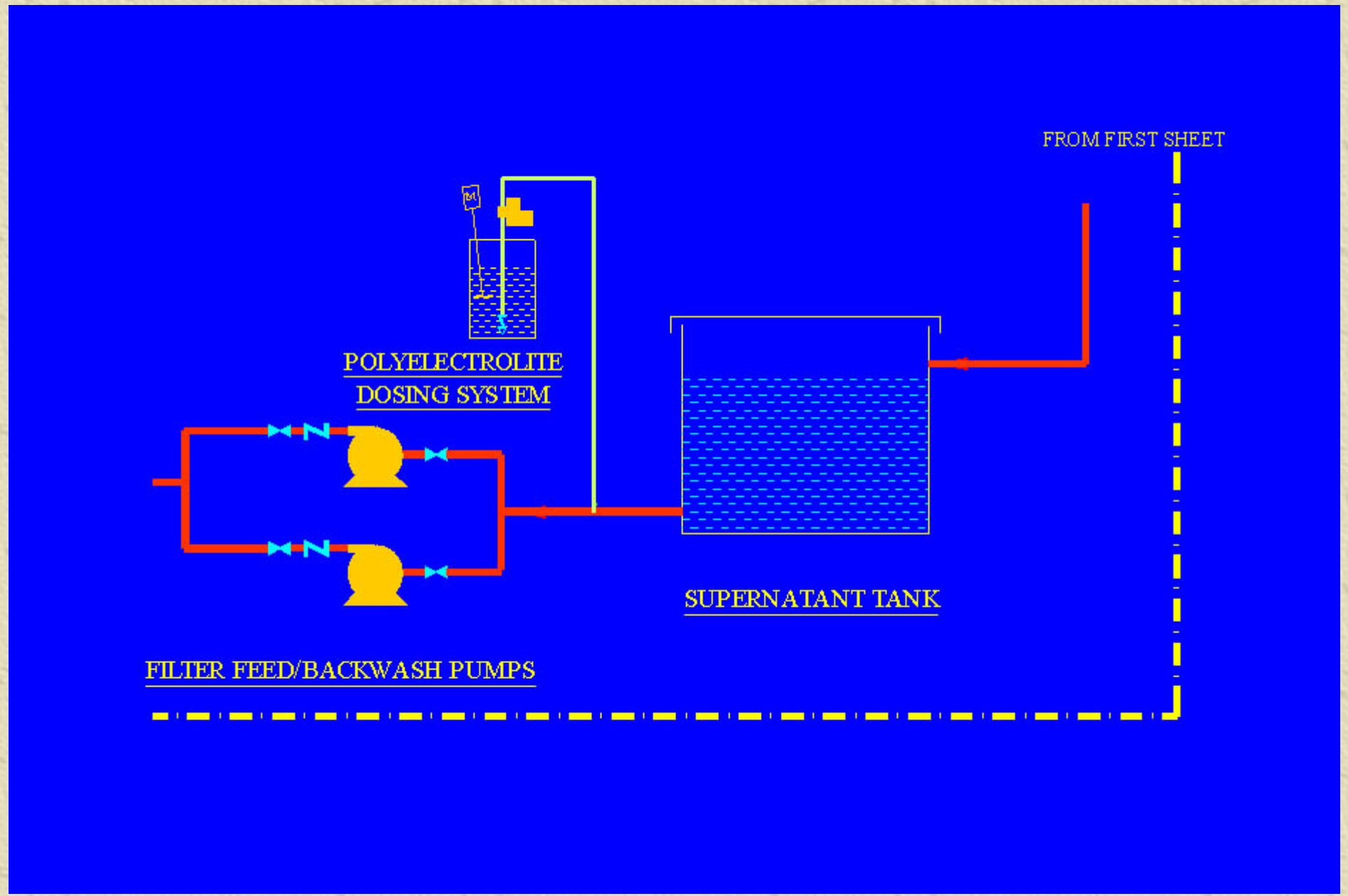
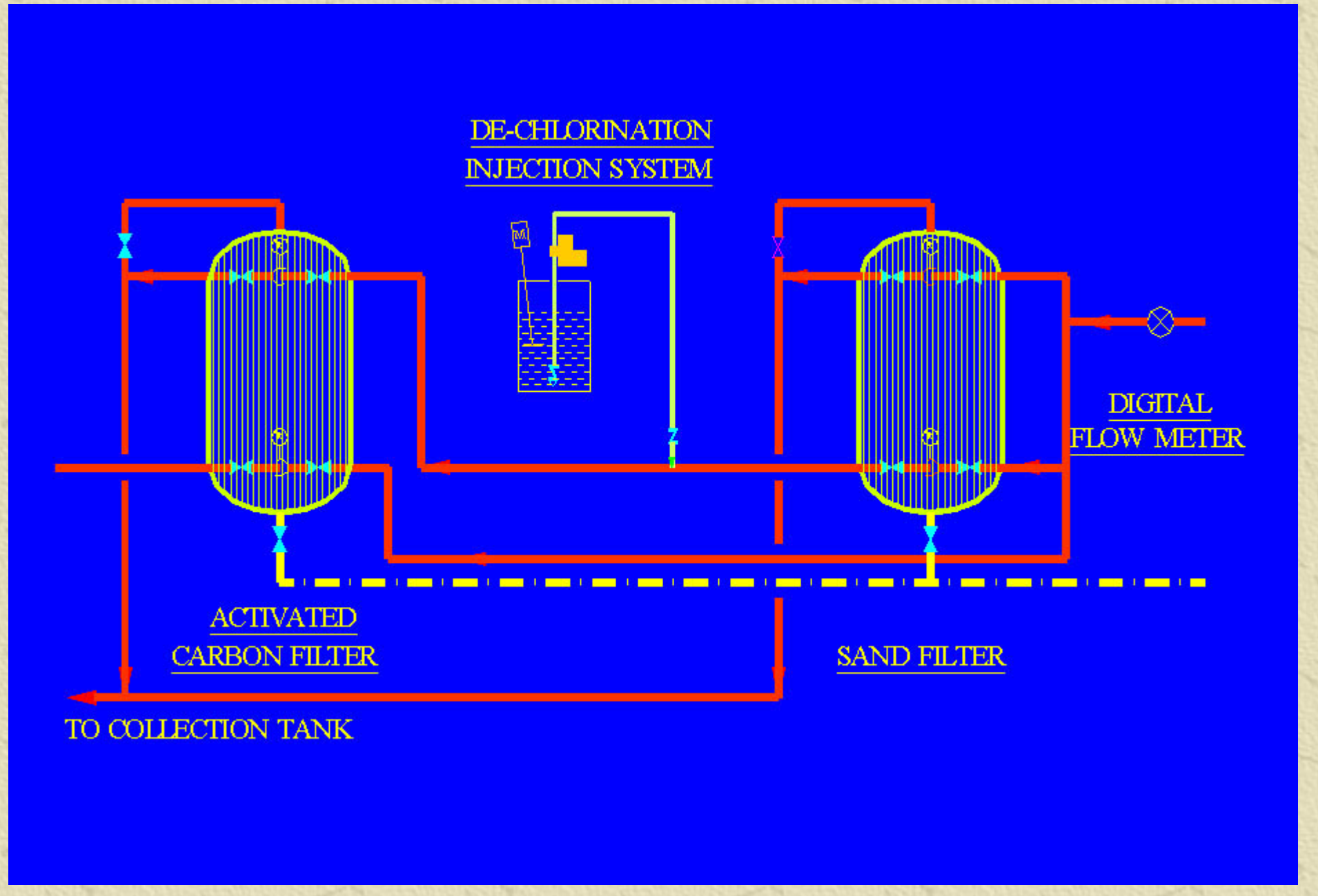
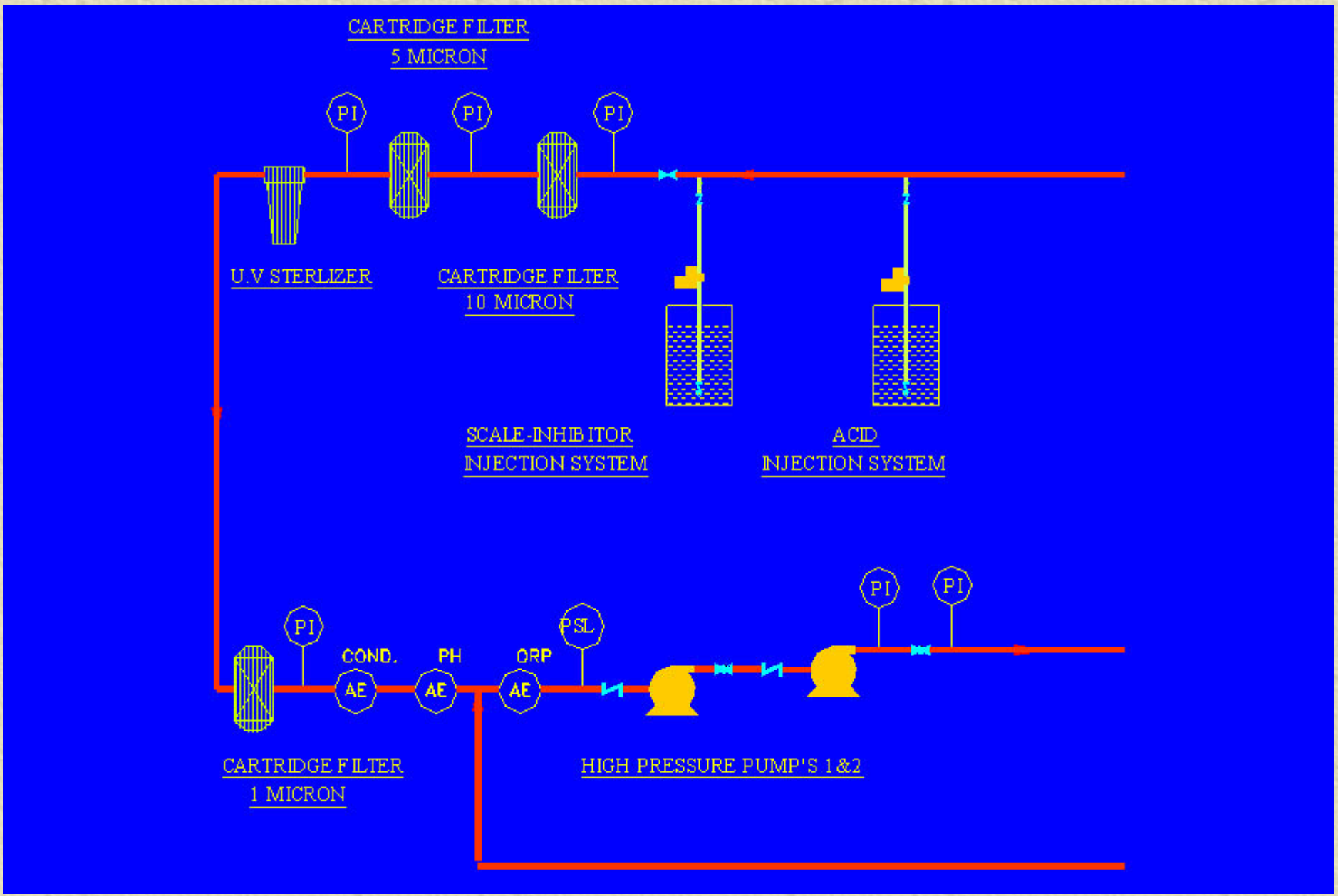
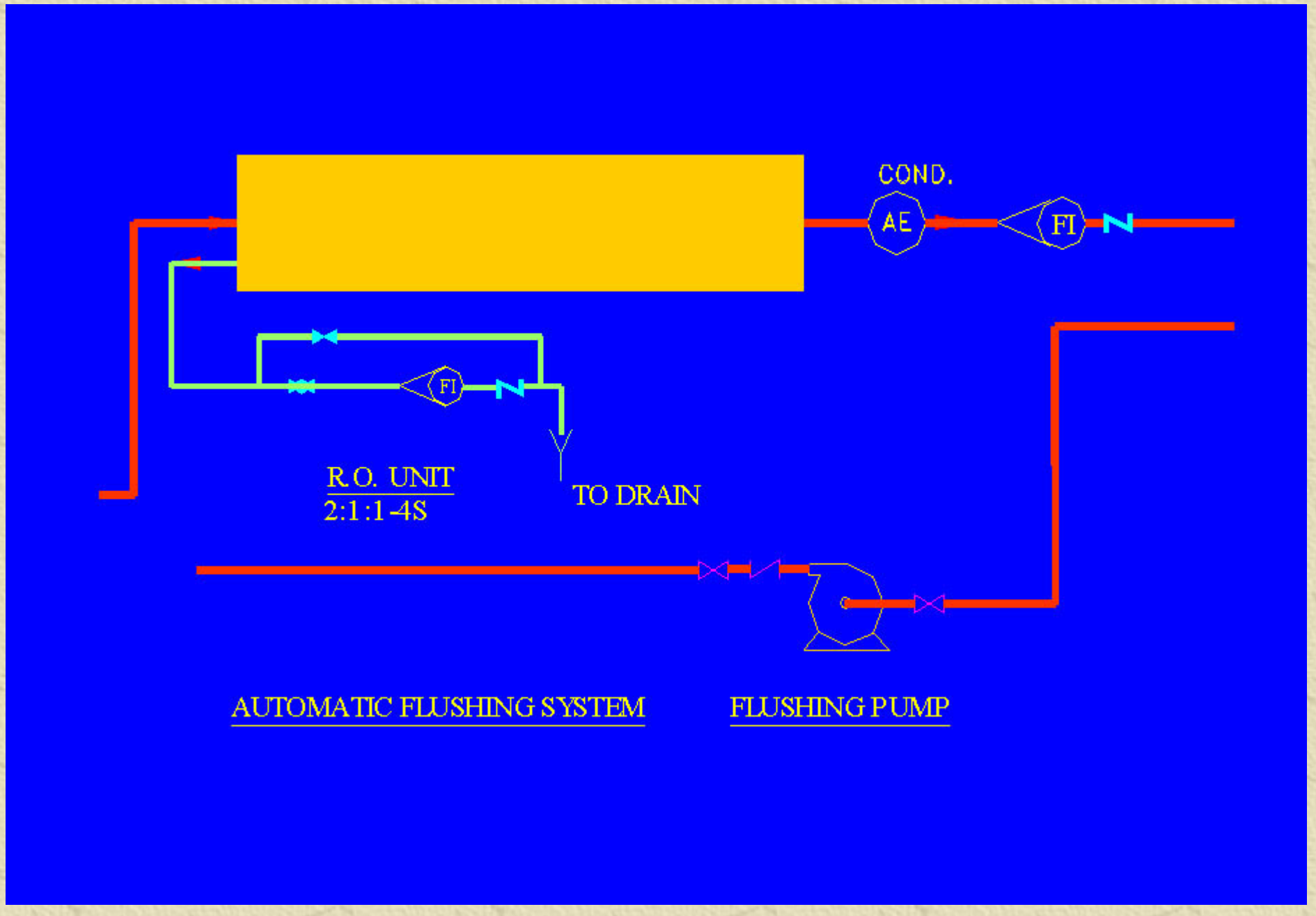
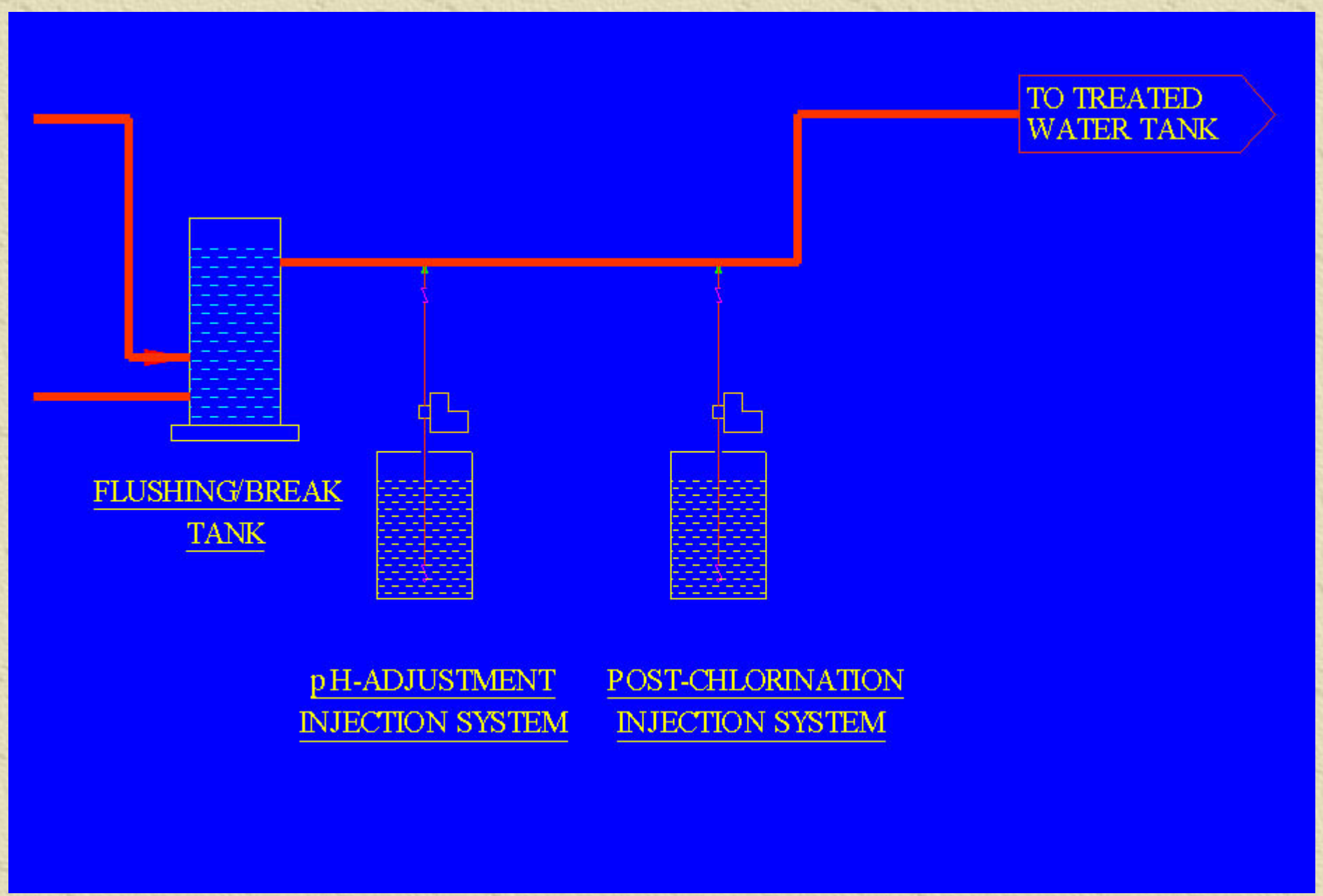
PH
ORP
AE
AE
AE
CARTRIDGE FILTER
1 MICRON
HIGH PRESSURE PUMP'S 1&2


FROM FIRST SHEET
POLYELECTROLITE
DOSING SYSTEM
SUPERNATANT TANK
FILTER FEED/BACKWASH PUMPS


DE-CHLORINATION
INJECTION SYSTEM
DIGITAL
FLOW METER
ACTIVATED
CARBON FILTER
SAND FILTER
TO COLLECTION TANK


CARTRIDGE FILTER
5 MICRON
PI
PI
PI
U.V STERLIZER
CARTRIDGE FILTER
10 MICRON
SCALE-INHIBITOR
INJECTION SYSTEM
ACID
INJECTION SYSTEM
PI
PI
PI
PSL
COND.
PH
ORP
AE
AE
AE
CARTRIDGE FILTER
1 MICRON
HIGH PRESSURE PUMP'S 1&2


COND.
AE
FI
FI
R.O. UNIT
2:1:1-4S
TO DRAIN
AUTOMATIC FLUSHING SYSTEM
FLUSHING PUMP


TO TREATED
WATER TANK
FLUSHING/BREAK
TANK
pH-ADJUSTMENT
INJECTION SYSTEM
POST-CHLORINATION
INJECTION SYSTEM

Instrumentation

- Pressure Gauges
- Flow meters
- pH meter
- Conductivity meter
- ORP meter

Plant Performance

- The plant was operated more than eight months continuously providing water for carpet process without any major problem.
- Coagulant acts better at pH 9 in first stage chemical treatment and pH 7 in second stage chemical treatment.
- Water of SDI <3 was obtained by dosing cationic polymer 0.6mg/lit at pH 7.4
- SDI 2.5 - 3 after Cartridge Filter outlet
- RO System recovery has found to be well within limit and always meeting the designed figure.

Plant Performance…continued

- Pilot Plant is working satisfactorily with 20% routine variations in the characteristics of the carpet factory wastewater.
- Product water TDS is less than the designed value, 100 mg/l
- RO System recovery optimum at 80%
- The Antiscalant suggested is performing efficiently. So the frequency of cleaning the membrane considerably decreased.
- Treated water quality complying with the parameters stipulated by(MOI&E) standards, MEPA& Royal commission standards.

Benefits

- Save Fresh Water Feed about 70% (SR 7/m^3).
- Save Cost Of Disposal Of Wastewater (SR 2.17/m^3) with Corresponding Benefit to the Environment.

Treated Effluent Reuse

- Carpet Process
- Gardening
- Toilet Flushing
- Machine Cleaning
- Floor washing

Daily Power Consumption

Sl. NO	Item	Connected Load Kw	Duty Kw	Working Hours	Kwhr
1	Dyebeck Effluent Transfer Pump	1 x 0.75	1 x 0.75	20	15
2	Printing Effluent Transfer Pumps	1 x 0.75	1 x 0.75	20	15
3	Air blower	1 x 1.5	1 x 1.5	24	36
4	Alum dosing system	1x 0.25	1x 0.25	20	5
5	Sodium Hydroxide dosing system	1x 0.25	1x 0.25	20	5
6	Poly Eloctrolite dosing system	1 x 0.007	1 x 0.007	20	0.14
7	Calcium Hypo chlorite dosing system	1 x 0.007	1 x 0.007	20	0.14
8	Filter Feed Pumps	2 x 0.75	1 x 0.75	20	15
9	Filter Backwash Pumps	2 x 0.75	2 x 0.75	1	1.5
10	De- Chlorination Inj System	1 x 0.007	1 x 0.007	20	0.14
11	Acid Injection System	1 x 0.007	1 x 0.007	20	0.14
12	Anti Scalant Injection System	1 x 0.007	1 x 0.007	20	0.14
13	High Pressure Pump	1 x 13.2	1 x 13.2	20	264
14	PH Adjustment system	1 x 0.007	1 x 0.007	20	0.14
15	Post Chlorination System	1 x 0.007	1 x 0.007	20	0.14
16	Mixers in all chemical tanks	10 x 0.175	10 x 0.175	20	35
	TOTAL Kwhr				**392.48**

Monthly Chemical Consumption

Sl.No	Item	Consumption
1	Alum	556 Kg
2	Sodium Hydroxide 49% soln.	269 lit
3	Poly Electrolyte	6.95 lit
4	Calcium Hypo Chlorite	11.2 Kg
5	Sodium Meta Bi Sulfite	33 Kg
6	Sulfuric Acid 98% soln	38.5 lit
7	Antiscalant	6.25 Kg
8	Sodium Hypo Chlorite	14.6 Lit
9	Cartridge Filters 10”, 5”, 1”	3 each

WATER COST

- Equipment Amortization
- Energy Usage
- Salaries and Wages
- Spare Parts
- Consumption of Chemicals
- Membrane Replacement
- Fuel, Oil and Lubricant
- Cost of Operation and Maintenance

Cost Comparison

- **WWTP Capacity : 40m3/day (20 hour operation in a day)**

1)Cost of fresh water for process(appxr)

= {(50m3 x SR 7/m3) +40m3 x SR 1.03/m3}

= SR 391.20/- (SR9.78/m3)

2)Waste Water Recycling Pant Operating cost/ day

{Chemicals(SR 56.36)+Electricity (appxr. 392.48Kwhr x SR 0.12/m3)+ Sludge& brine disposal (15.6m3/day x SR2.17/m3)}

= SR 137.30/- (SR3.43/m3)

Cost Comparison (Continued)

3) Cost of total wastewater disposal by tanker (without treatment)

55.6m3/day x SR 2.17/m3 = SR 120.65/day

= SR 3016.25/month

= **SR 36195/year**

SAMPLES FROM DIFFERENT TREATMENT STAGES

SAMPLE FROM EQUALIZATION TANK

SAMPLE FROM REACTION TANK - 1

SAMPLE FROM REACTION TANK-2

FROM ACT. CARBON. FILTER OUTLET

SAMPLE FROM RO UNIT OUTLET

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DISCUSSION