FULL-SCALE IMPLEMENTATION OF A BIOTRICKLING FILTER FOR TREATING ZIMPRO ODORS FROM THE DRY CREEK WASTEWATER TREATMENT PLANT, FORT WRIGHT, KY

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Paper presented at the Water Professionals Conference, Nashville, TN, July 20-23, 2004

ADVANTAGES AND DISADVANTAGES OF SLUDGE HEAT TREATMENT

Advantages

- **Solids content ranges from 30% - 50% and no chemical conditioning required;**
- **Essentially complete oxidation of volatile solids is achieved, producing stabilized sludge with no pathogenic organisms and heating values of about 12,000 Btu/lb**

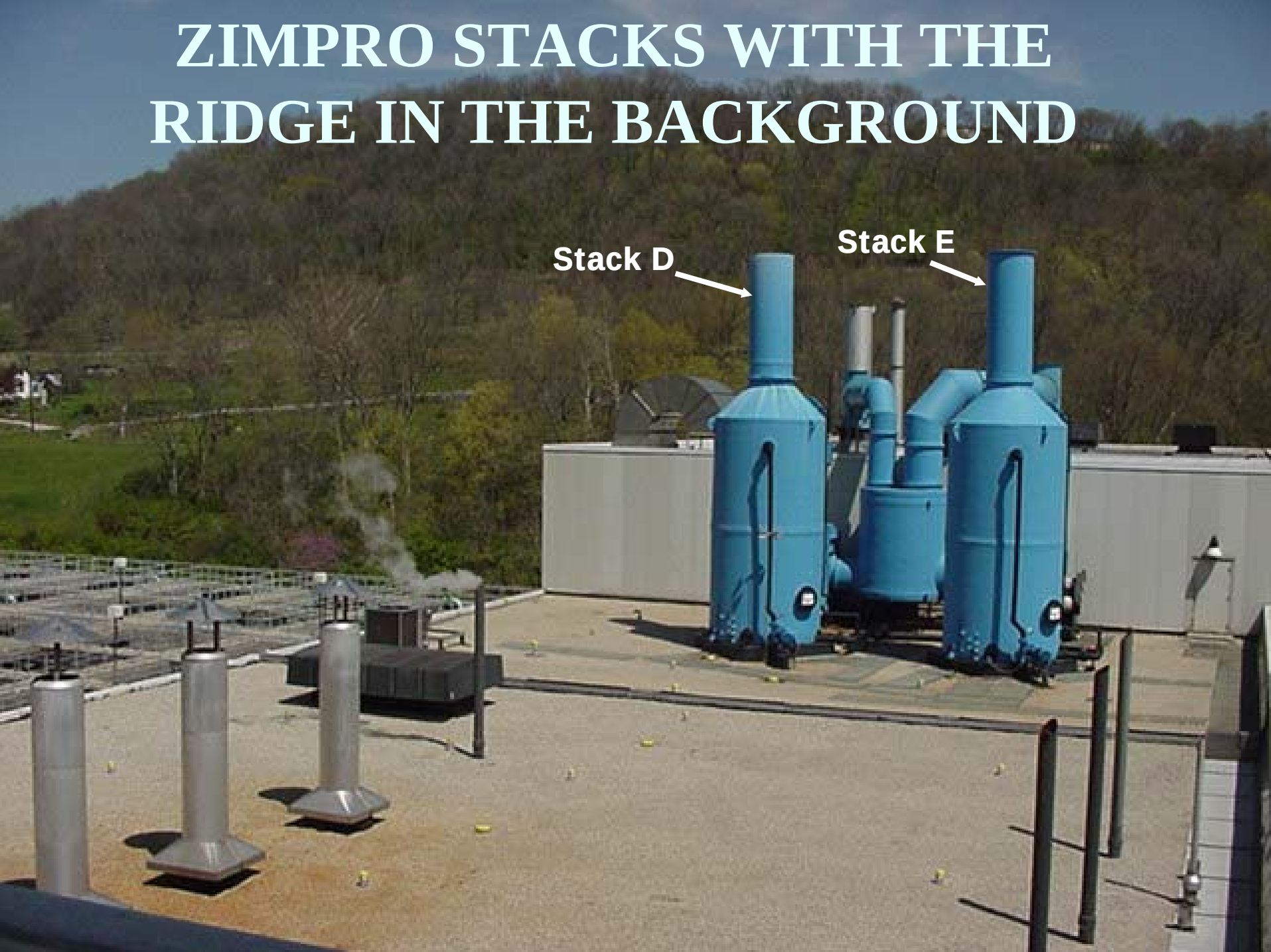
Disadvantages

- **High capital cost with strong preventive maintenance program required;**
- **Significant production of odorous gases and sidestreams with high BOD**

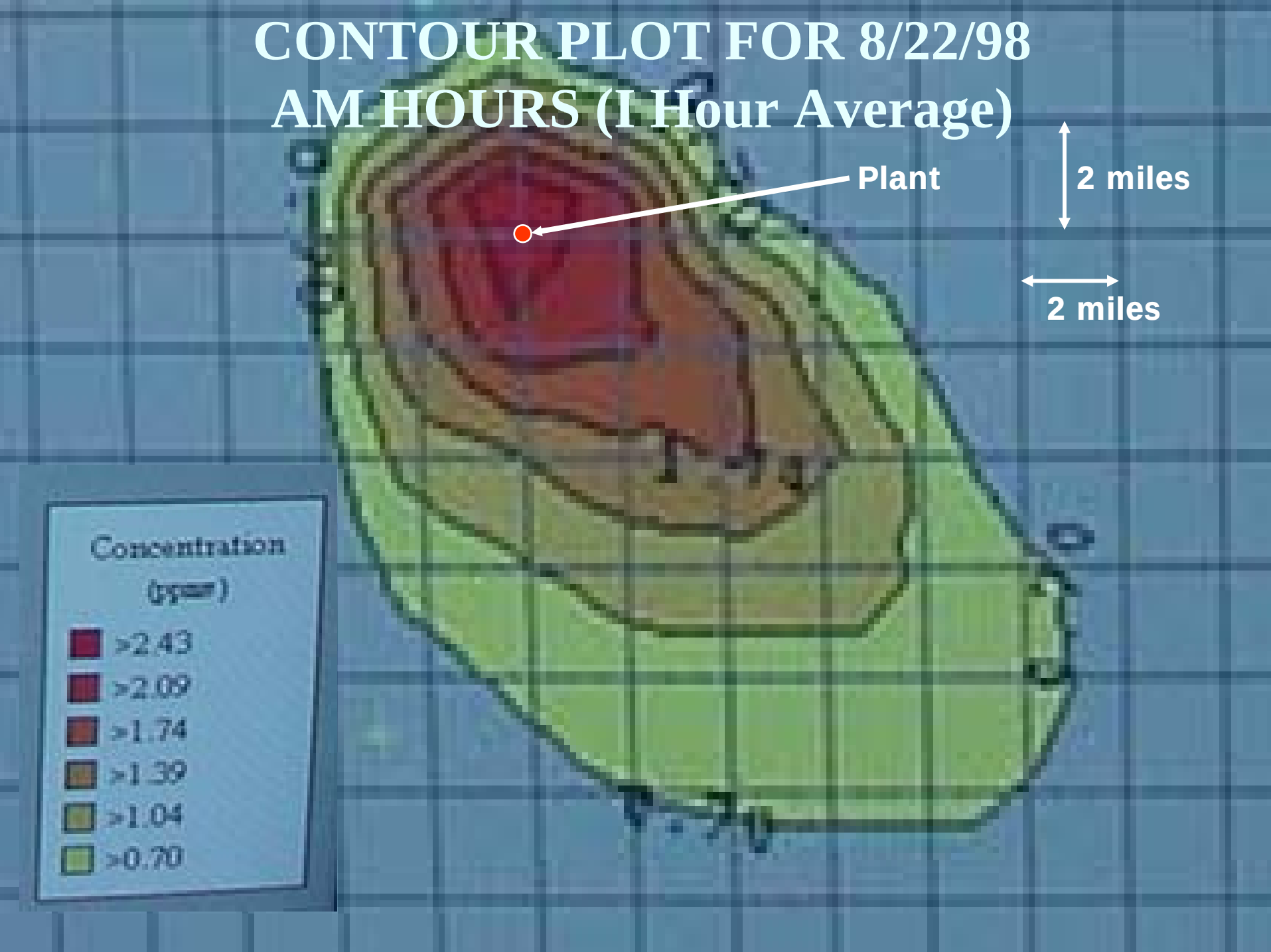
DRY CREEK TREATMENT PLANT

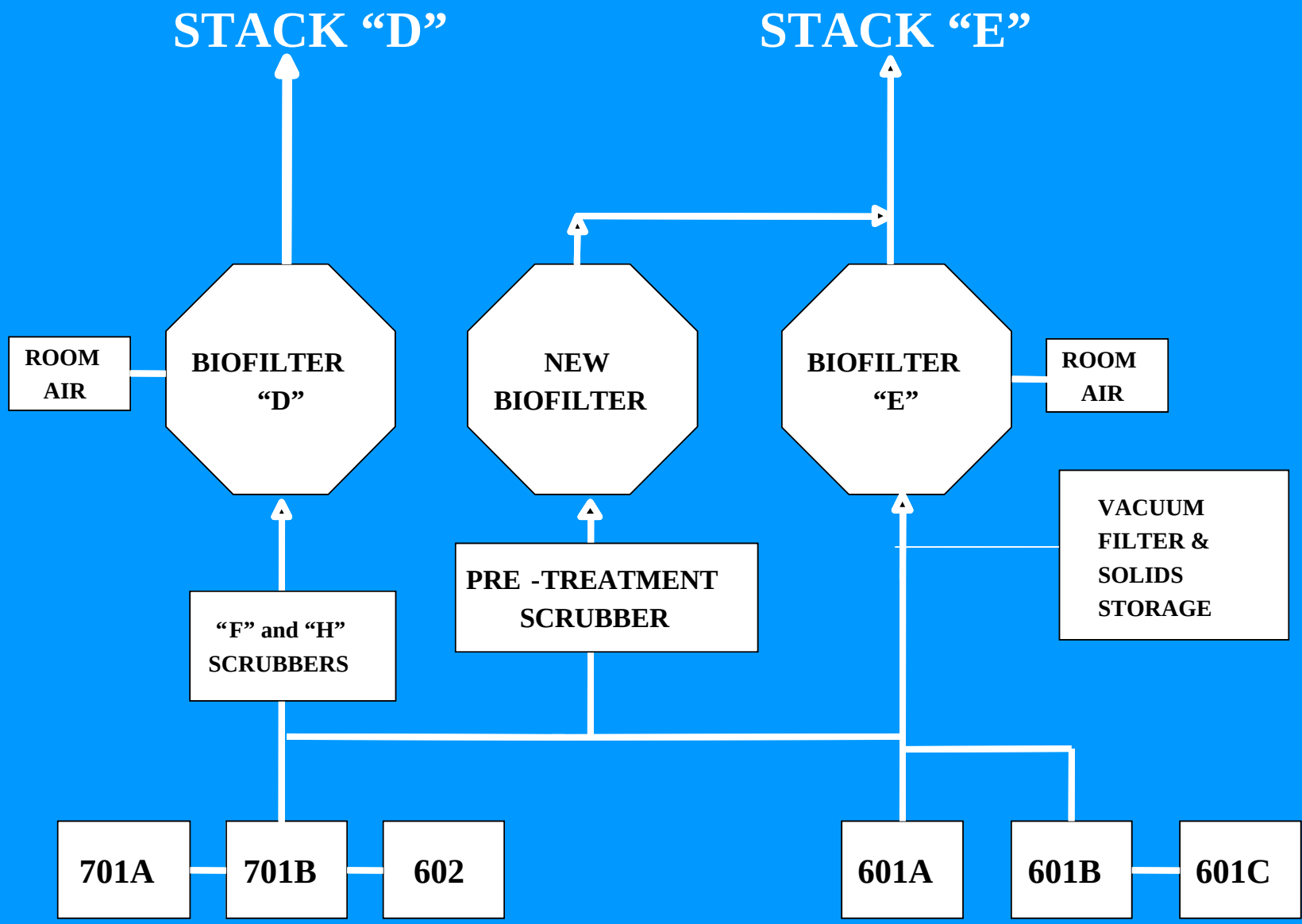
TERRAIN SURROUNDING THE DRY CREEK TREATMENT PLANT

ZIMPRO STACKS WITH THE RIDGE IN THE BACKGROUND



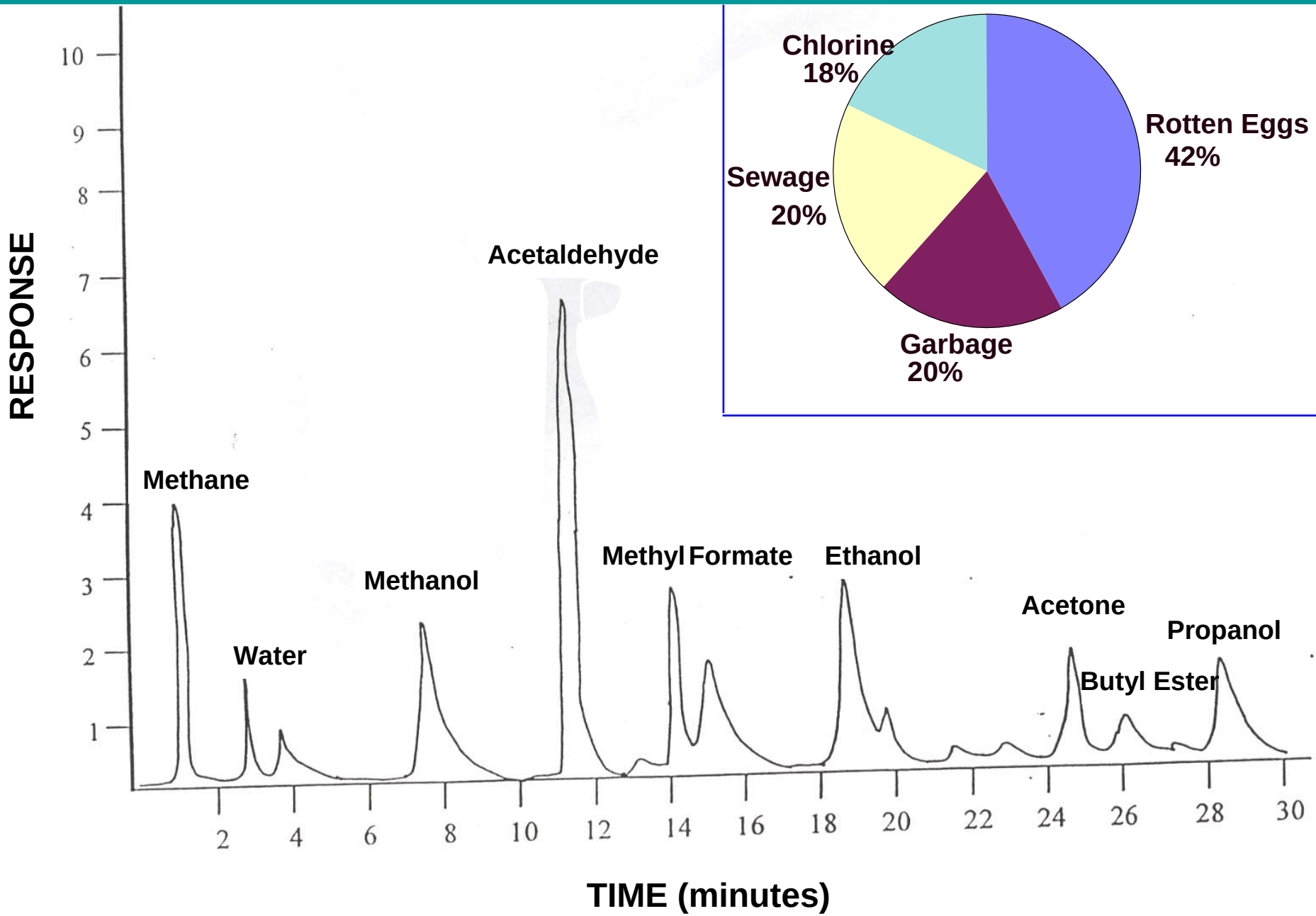
CONTOUR PLOT FOR 8/22/98
AM HOURS (1 Hour Average)



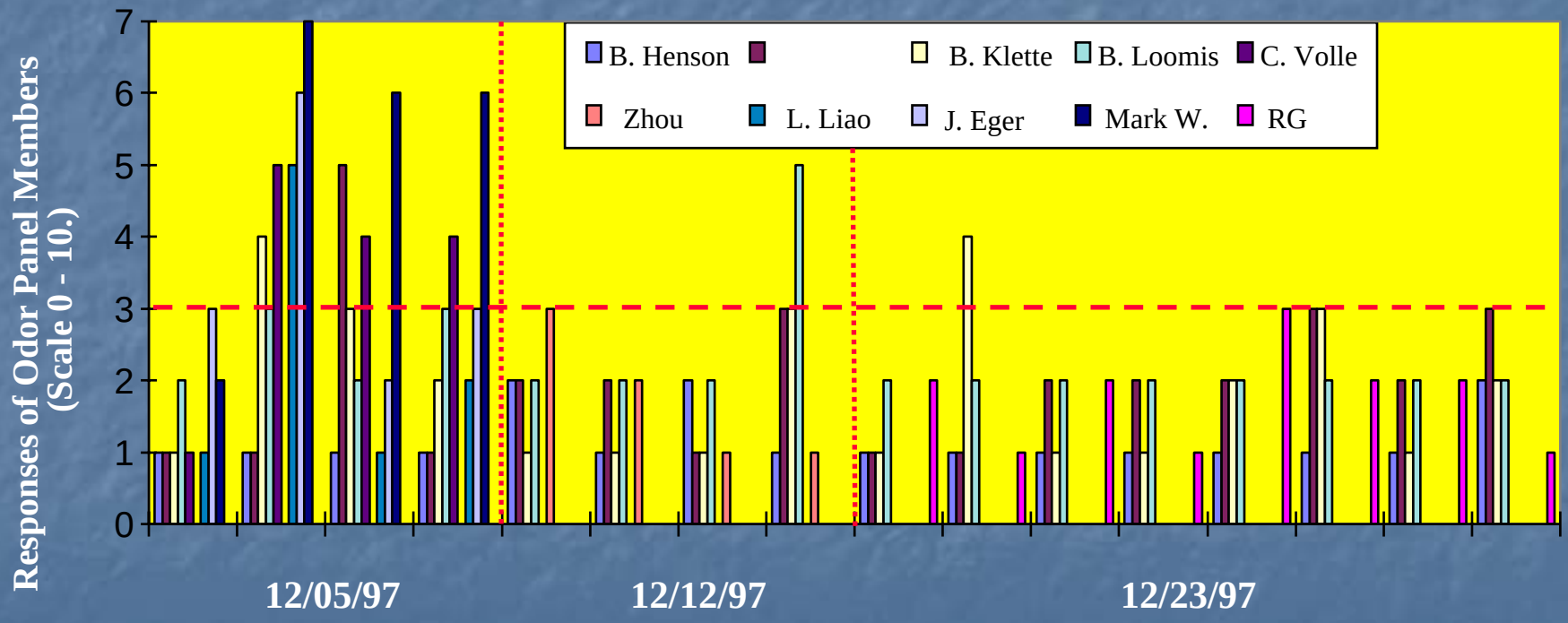


Tanks 701A, 701B, 602, 601A, 601B and 601C are raw and treated sludge storage tanks

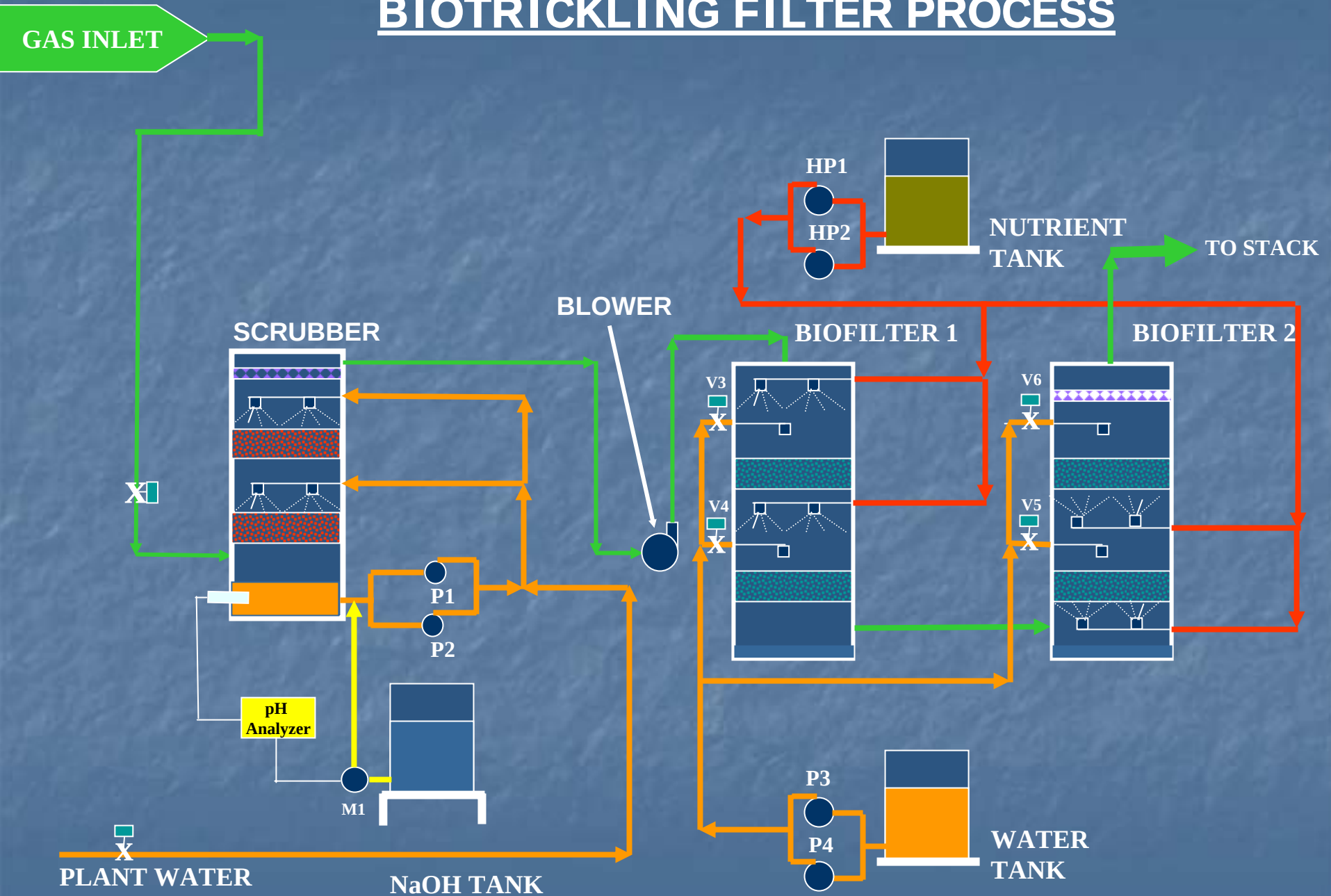
GC ANALYSIS OF ZIMPRO ODORS



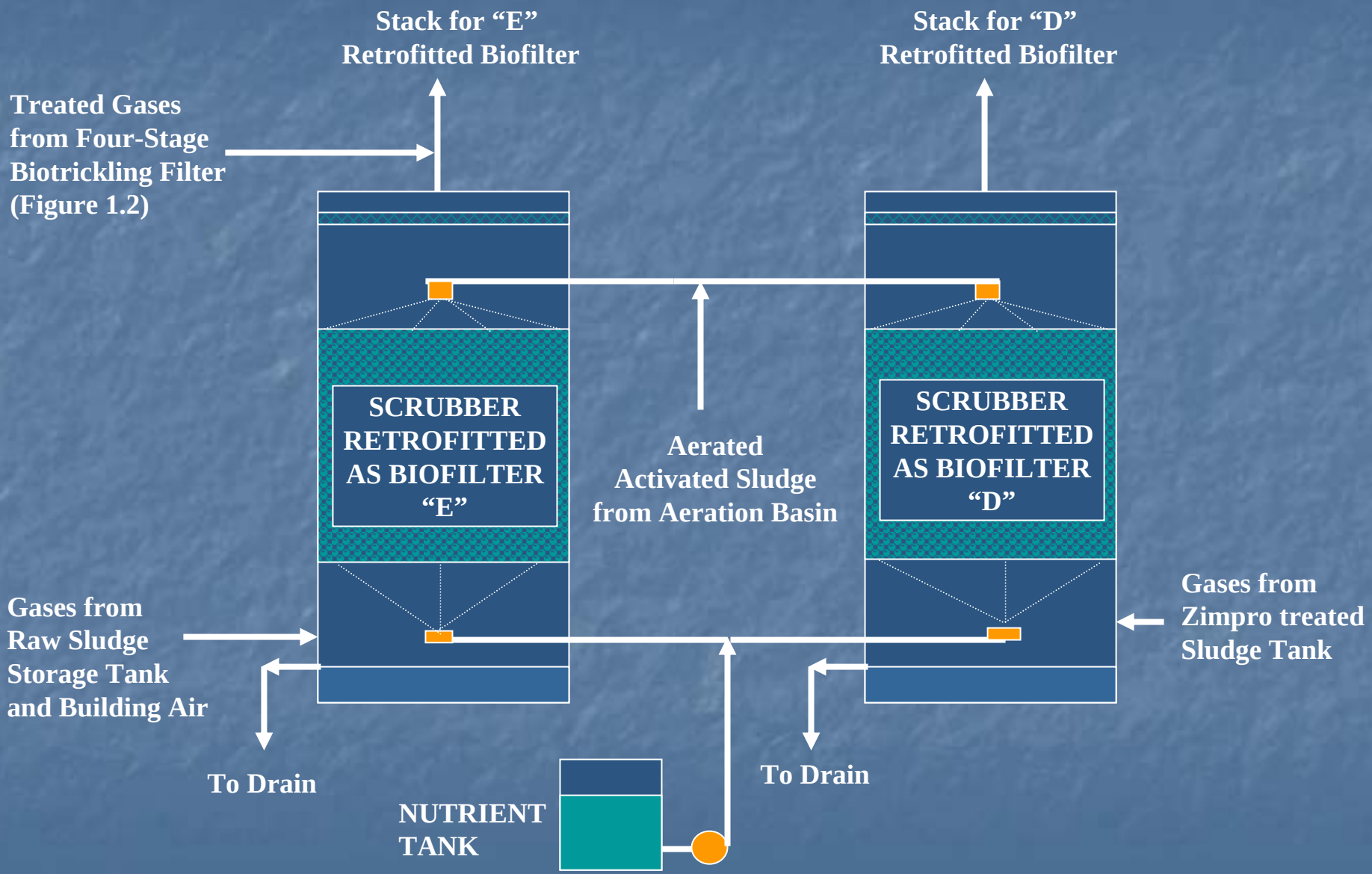
ANALYSIS OF CARBON-FILTERED AIR



BIOTRICKLING FILTER PROCESS



CHLORINE SCRUBBER RETROFITTED AS BIOFILTERS



Maximum Flow: 15,000 cfm
Actual gas flow: 9,000 cfm
Maximum inlet DT of odors 31,000
Maximum Inlet RT of odors 38,300

Total height of media in 4 beds: 12 ft
Diameter of each vessel: 6 ft

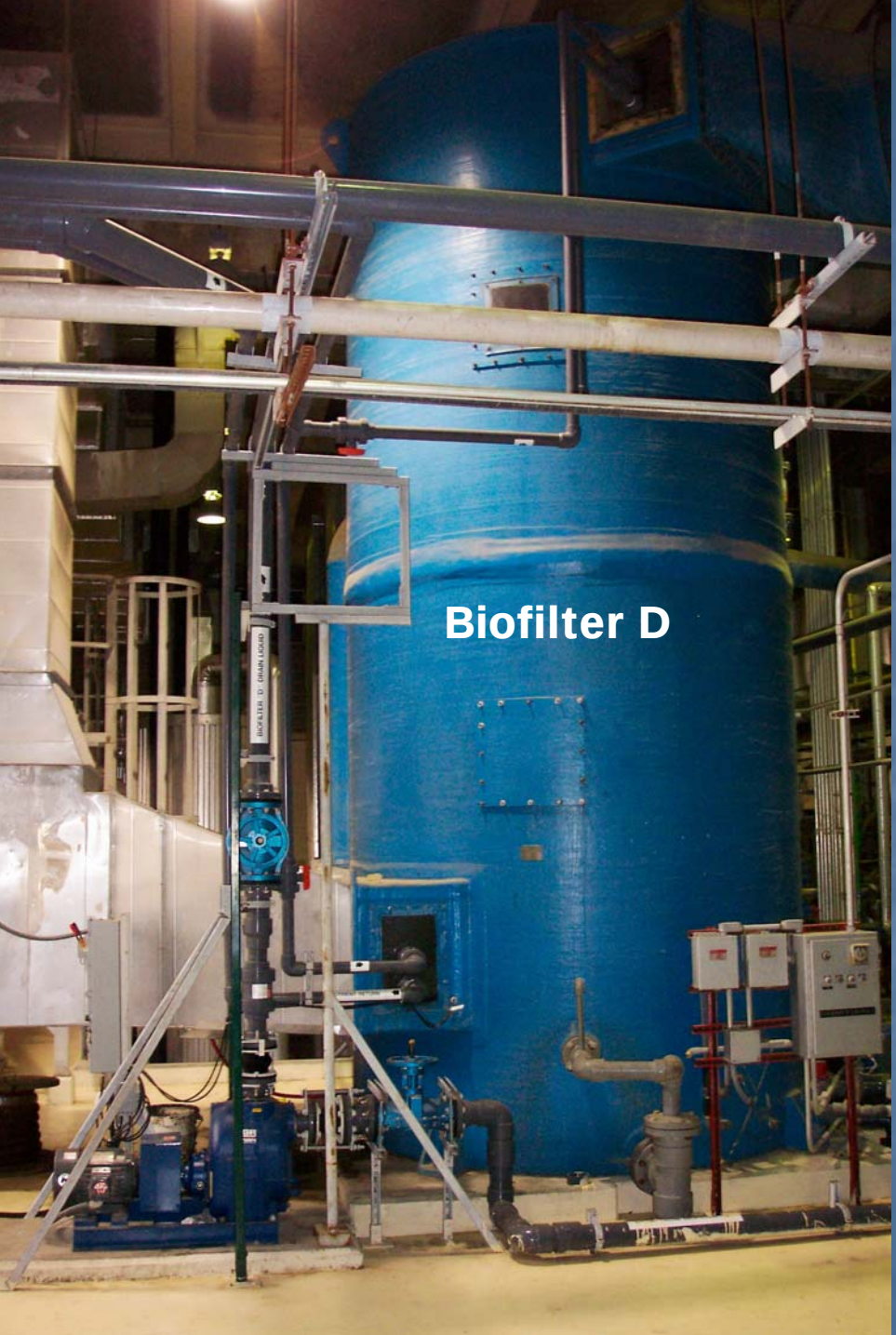
Total volume of media in 4 beds: 340 ft^3

Empty bed Residence Time: 2.3 seconds

% Odor Treatment Efficiency: 99.6% (DT)

% Odor Treatment Efficiency: 99.5% (RT)

Liquid flow rate: 3.5 gallons per minute



RETROFITTED SCRUBBERS

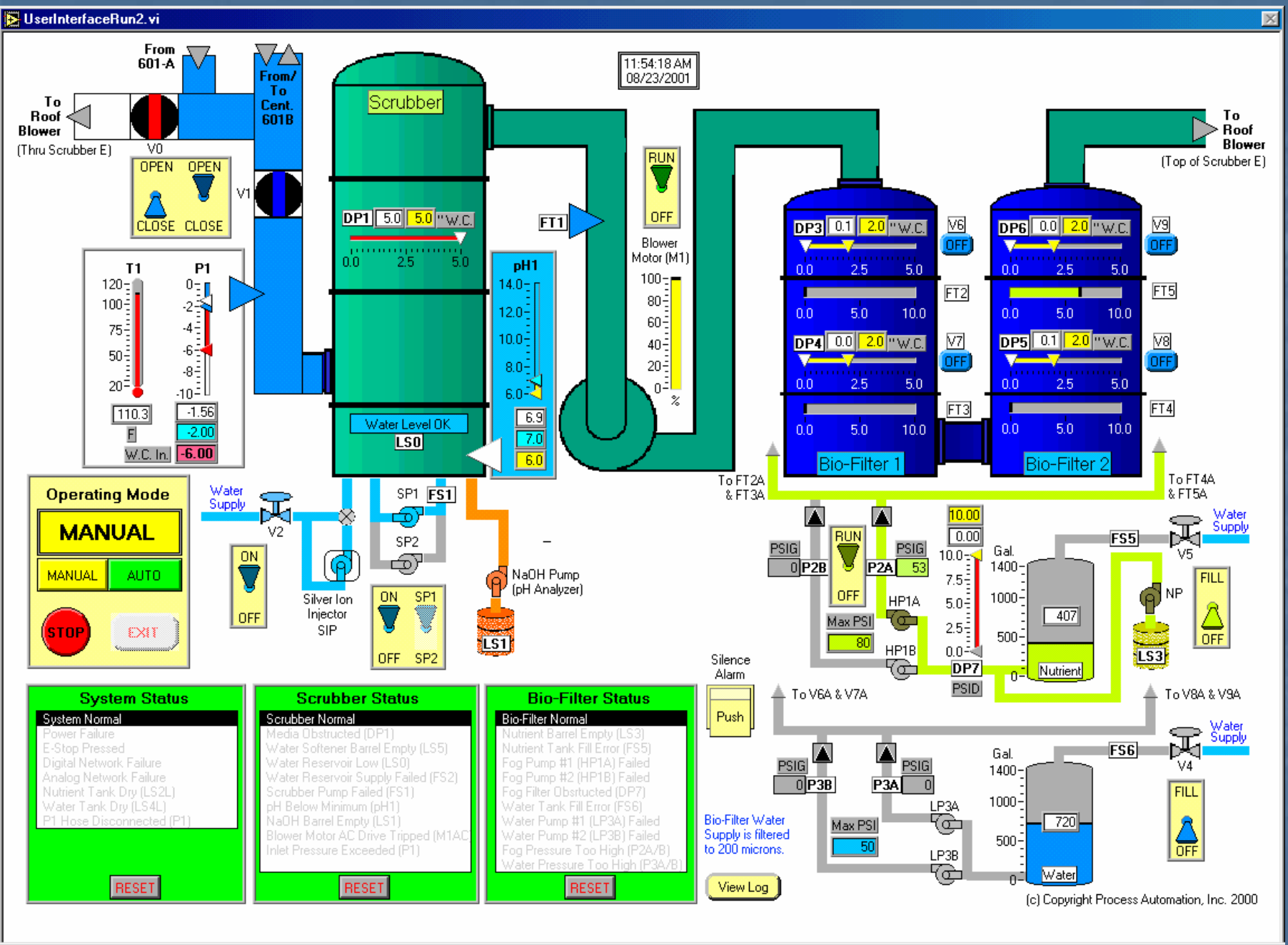
Scrubber D ➔ Biofilter D

Gas flow rate:	30,000 cfm
Diameter:	10 ft
Height of media:	6 ft
Volume of biomedia:	470 ft^3
Empty-Bed residence time:	1 second
Liquid flow rate:	2.4 gpm/ft^2
% Treatment:	99.9% (DT)
	99.8% (RT)

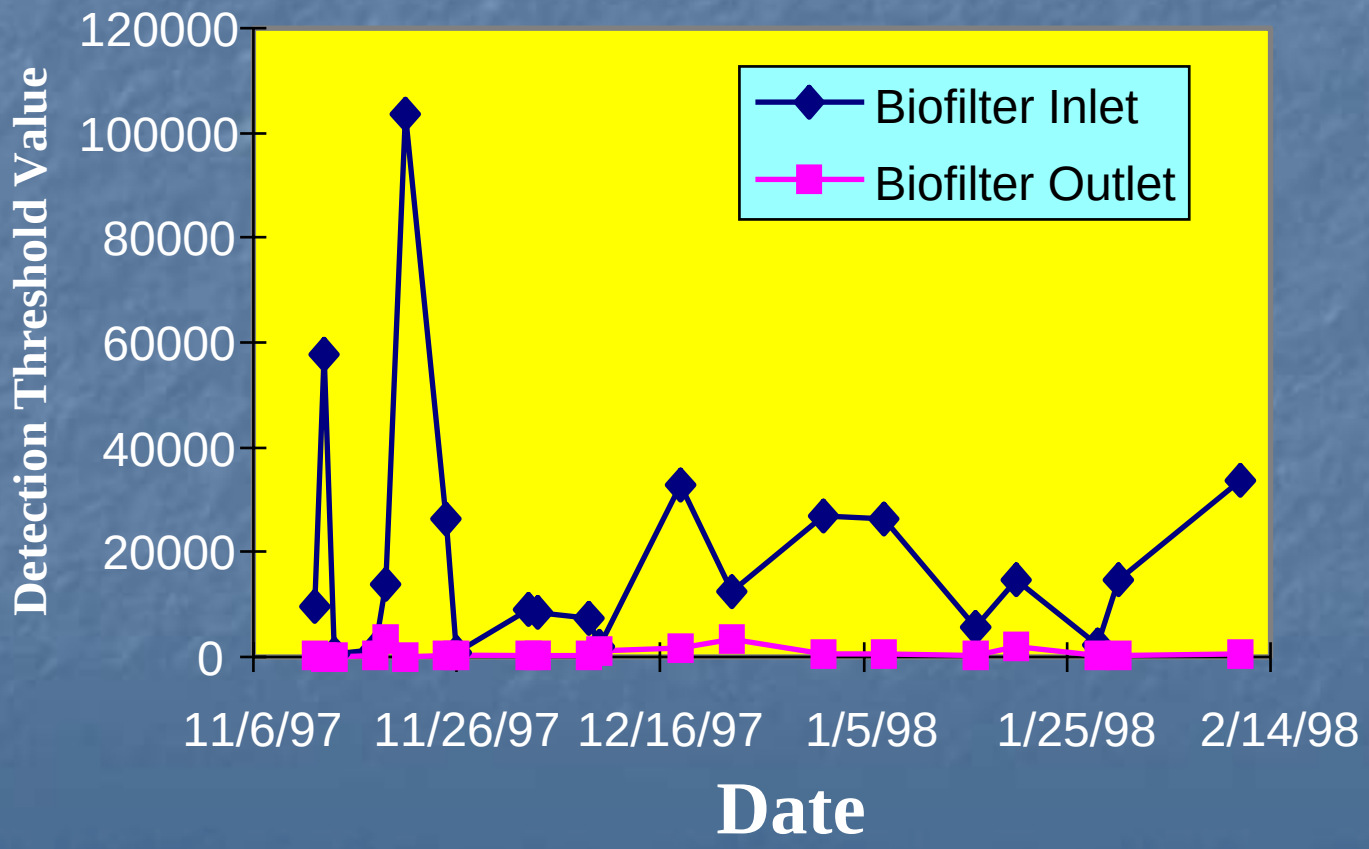
Scrubber E ➔ Biofilter E

Gas flow rate:	30,000 cfm
Diameter:	12 ft
Height of media:	5 ft
Volume of Biomedia:	566 ft^3
Empty-bed residence time:	1.13 sec.
% Treatment:	99.7% (DT)
	99.6% (RT)

COMPUTER CONTROL SYSTEM


UserInterfaceRun2.vi
From 601-A
From/ To Cent. 601B
To Roof Blower
(Thru Scrubber E)
V0
V1
OPEN
OPEN
CLOSE
CLOSE
Scrubber
11:54:18 AM
08/23/2001
DP1
5.0
5.0
"W.C.
FT1
RUN
OFF
Blower Motor (M1)
To Roof Blower
(Top of Scrubber E)
T1
P1
110.3
F
W.C. In.
-1.56
-2.00
-6.00
pH1
6.9
7.0
6.0
Water Level OK
LS0
DP3
DP6
DP4
DP5
V6
V7
V8
V9
FT2
FT3
FT4
FT5
Bio-Filter 1
Bio-Filter 2
To FT2A & FT3A
To FT4A & FT5A
Operating Mode
MANUAL
MANUAL
AUTO
STOP
EXIT
Water Supply
V2
ON
OFF
Silver Ion Injector SIP
SP1
FS1
SP2
ON
SP1
OFF
SP2
NaOH Pump (pH Analyzer)
LS1
PSIG
P2B
RUN
OFF
P2A
53
Max PSI
80
HP1A
HP1B
10.00
0.00
DP7
PSID
Gal.
1400
1000
500
0
407
Nutrient
FS5
V5
NP
LS3
FILL
OFF
Silence Alarm
Push
To V6A & V7A
To V8A & V9A
PSIG
P3B
P3A
0
Max PSI
50
LP3A
LP3B
720
Water
FS6
V4
Bio-Filter Water Supply is filtered to 200 microns.
View Log
System Status
System Normal
Power Failure
E-Stop Pressed
Digital Network Failure
Analog Network Failure
Nutrient Tank Dry (LS2L)
Water Tank Dry (LS4L)
P1 Hose Disconnected (P1)
RESET
Scrubber Status
Scrubber Normal
Media Obstructed (DP1)
Water Softener Barrel Empty (LS5)
Water Reservoir Low (LS0)
Water Reservoir Supply Failed (FS2)
Scrubber Pump Failed (FS1)
pH Below Minimum (pH1)
NaOH Barrel Empty (LS1)
Blower Motor AC Drive Tripped (M1AC)
Inlet Pressure Exceeded (P1)
RESET
Bio-Filter Status
Bio-Filter Normal
Nutrient Barrel Empty (LS3)
Nutrient Tank Fill Error (FS5)
Fog Pump #1 (HP1A) Failed
Fog Pump #2 (HP1B) Failed
Fog Filter Obsrtucted (DP7)
Water Tank Fill Error (FS6)
Water Pump #1 (LP3A) Failed
Water Pump #2 (LP3B) Failed
Fog Pressure Too High (P2A/B)
Water Pressure Too High (P3A/B)
RESET
(c) Copyright Process Automation, Inc. 2000
Start
NKSD2RUN
11:54 AM

INLET AND OUTLET DETECTION THRESHOLD VALUES



ADVANTAGES OF BIOFILTRATION

- Ambient temperature and pressure technology
- Produces no toxic by-products
  Chlorine (aqueous) scrubbing → Halocarbons
  Hypochlorite and NaOH → Chlorine & Halocarbons
  Thermal oxidation → combustion by-products
- Substantial cost savings
  Chemical treatment → Chemical Costs
  Thermal oxidation → Natural gas cost
  Short payback time
- Existing chemical scrubbers can be retrofitted
  No emission of by-products (halocarbons are carcinogenic)
  Saves chemical costs

CONCLUSIONS

- Biotrickling Filters (new and retrofitted) were able to treat over 99.5% of the incoming odor levels
- Complaints, which were being received daily before, became non-existent after installation
- Substantial savings in chlorine costs and associated corrosion impacts
- No emission of toxic by-products
- Easy to operate system; Minimal operator need
- Consumes $6,000 per year of nutrients to treat about 69,000 cfm of odorous gases