Use of Biotrickling Filter Technology to Solve Odour and Safety Concerns at Dubai Sports City Sewage Treatment Plant

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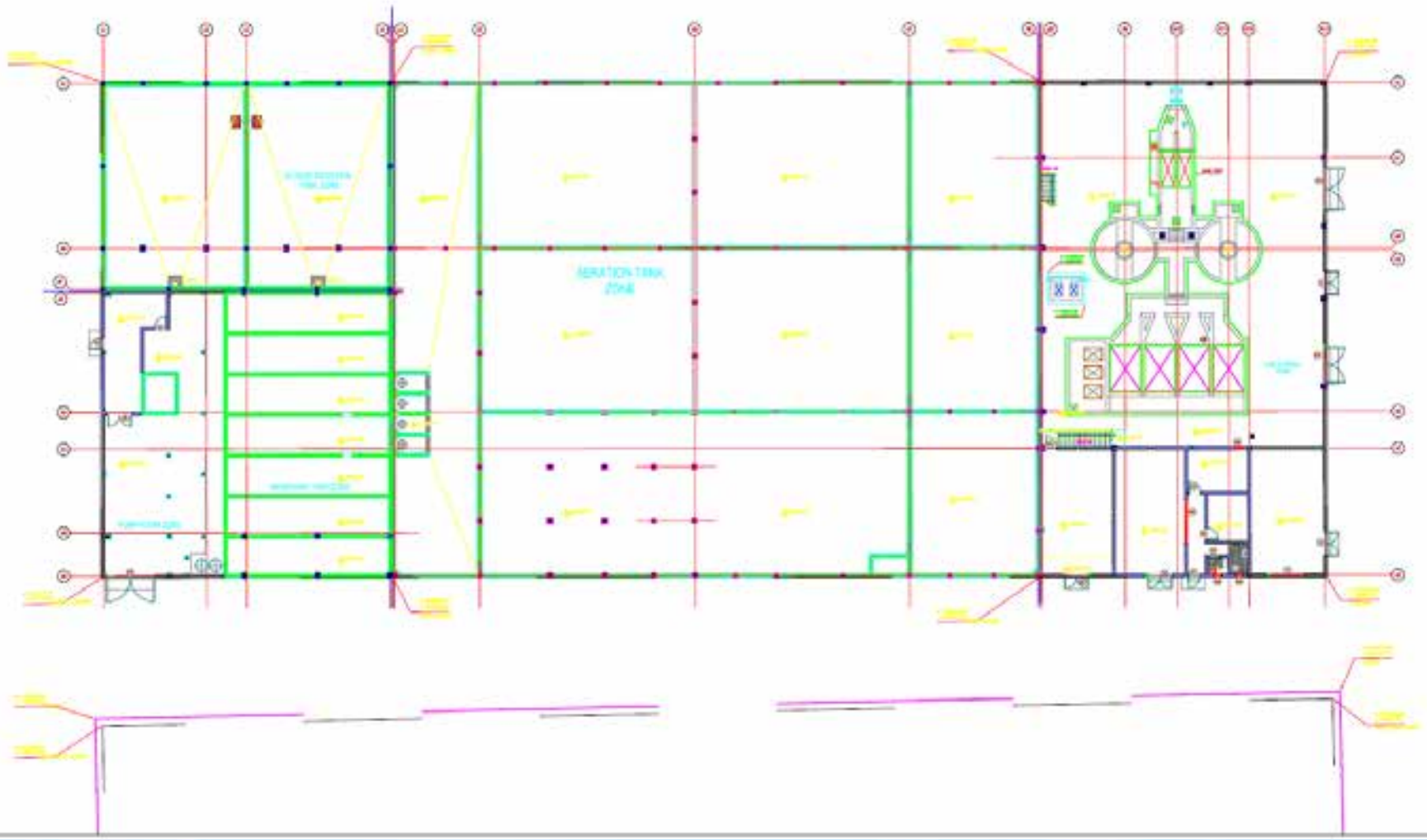
OUTLINE

- Background
- Odour Study
- Technology
- Installation
- Results


DUBAI SPORTS CITY

BACKGROUND

- **Collection system –**
  - Gravity sewer network
  - One pumping station
  - Total Flow = 2000 m^3/day
- **Tankers –**
  - Nearby developments
  - Total Flow = 11,000 m^3/day
- **STP –**
  - Total design capacity
    - Average Flow: 25,000 m^3/day
    - Peak Flow: 30,000 m^3/day
  - MBR treatment process


AERATION TANK
ZONE

PROBLEM

- **Odor Complaints**
  - Next to school
  - International Cricket Council
  - Nearby residents
- **Health & Safety Concerns**
  - Unsafe conditions inside the building
  - H_2S concentration > 50 ppmv in the room air

Odour
Problem Solved

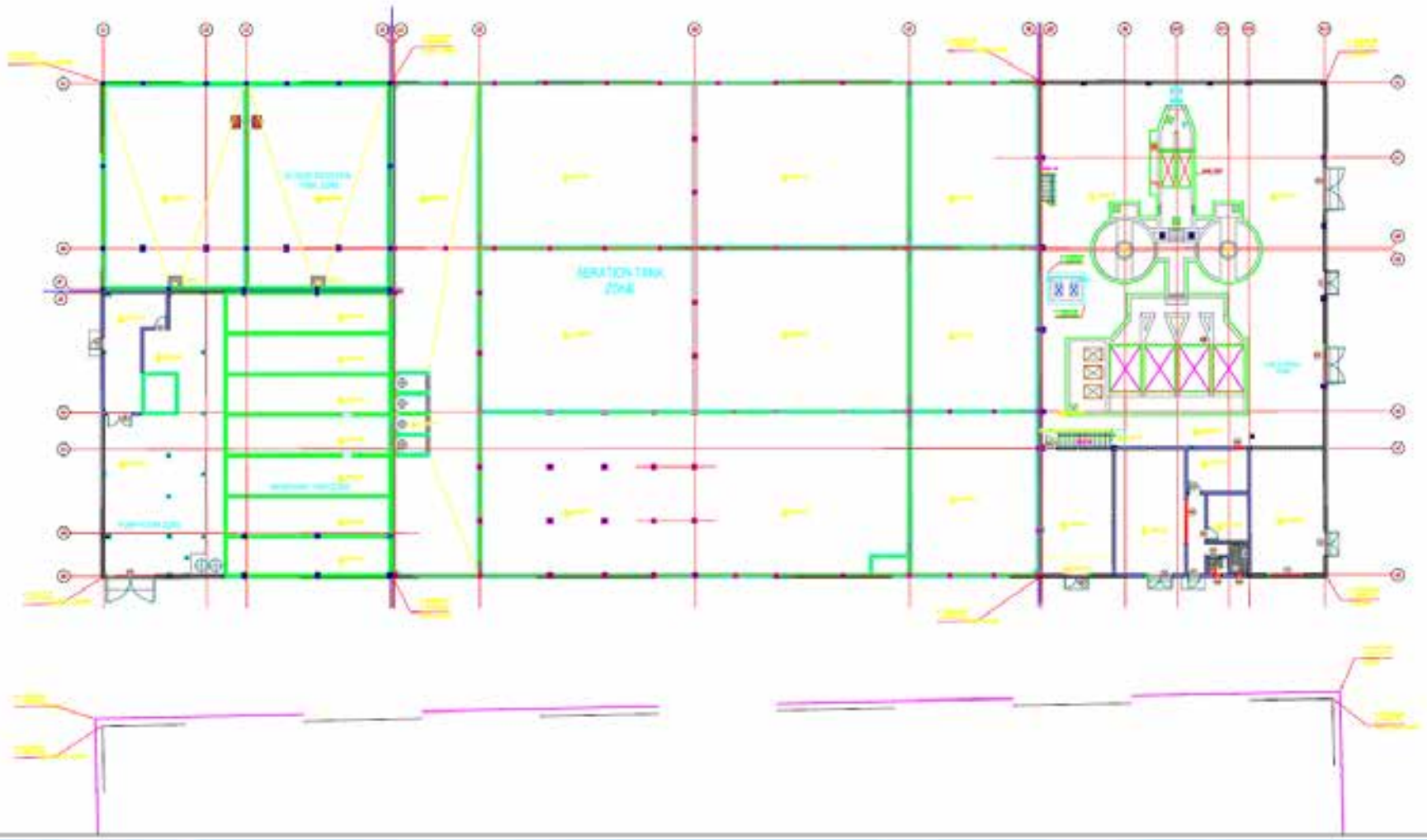
Odour Problem

Total Odor Control by bioair

Equipment
Supply

Odour
Assessment

Design
Basis


AERATION TANK
ZONE

Odour Sources

- Inlet Chamber
- Course Screens
- Grit Removal
- Fine Screens

Inorganic odours

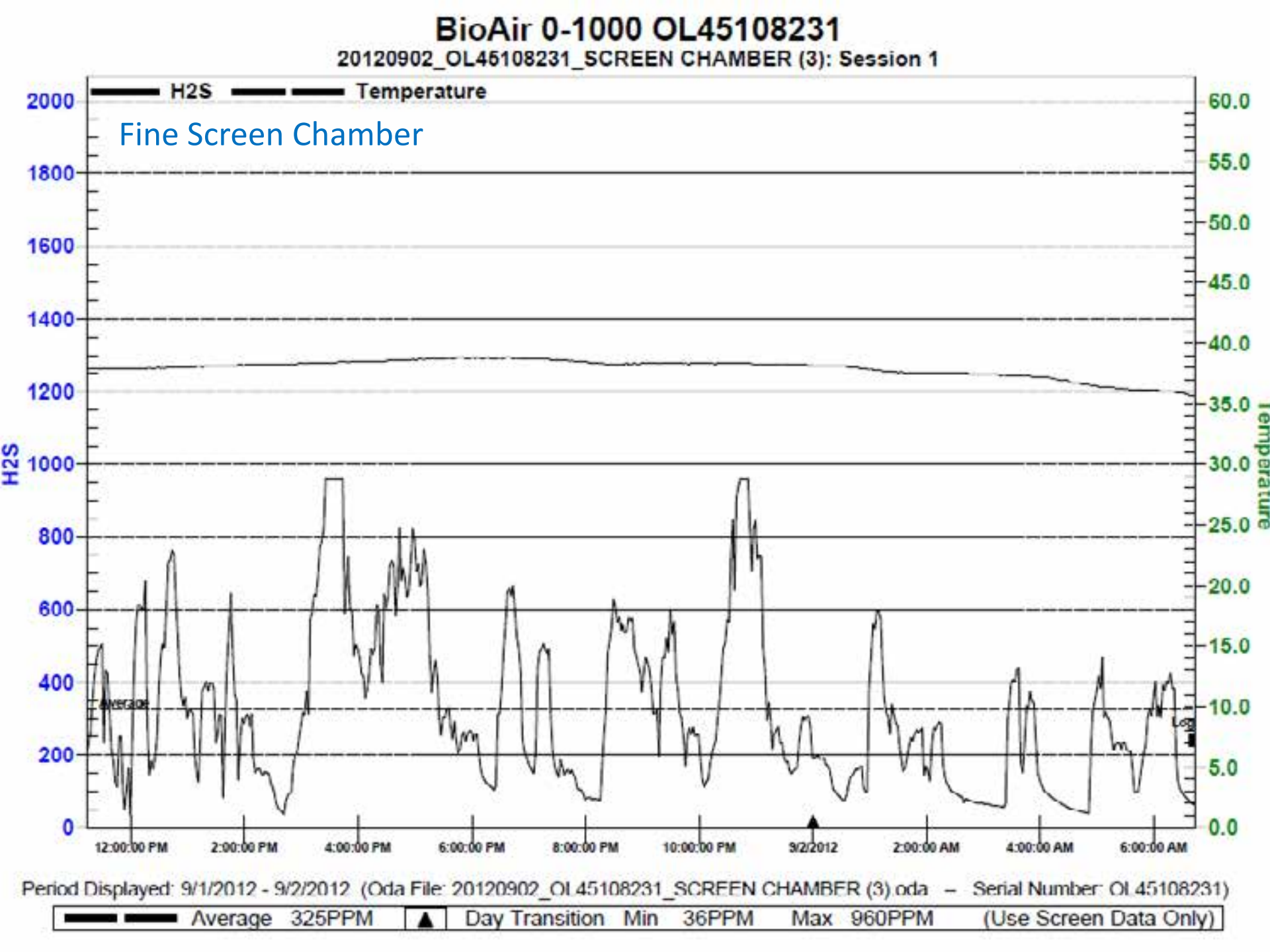
- H_2S Rotten egg
- NH_3 Urine

Organic odours

- CH_3SH (MM) Decayed cabbage
- $(CH_3)_2S$ (DMS) Decayed vegetables
- $(CH_3)_2S_2$ (DMDS) Rotten vegetables

ODOUR STUDY - ASSESSMENT

H_2S Measurement – use OdaLogs


BioAir 0-1000 OL45108231
20120902_OL45108231_SCREEN CHAMBER (3): Session 1
H2S
Temperature
Fine Screen Chamber
2000
1800
1600
1400
1200
1000
800
600
400
200
0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
12:00:00 PM
2:00:00 PM
4:00:00 PM
6:00:00 PM
8:00:00 PM
10:00:00 PM
9/2/2012
2:00:00 AM
4:00:00 AM
6:00:00 AM
Period Displayed: 9/1/2012 - 9/2/2012 (Oda File: 20120902_OL45108231_SCREEN CHAMBER (3).oda – Serial Number: OL45108231)
Average 325PPM
Day Transition Min 36PPM Max 960PPM (Use Screen Data Only)

ODOUR STUDY - ASSESSMENT

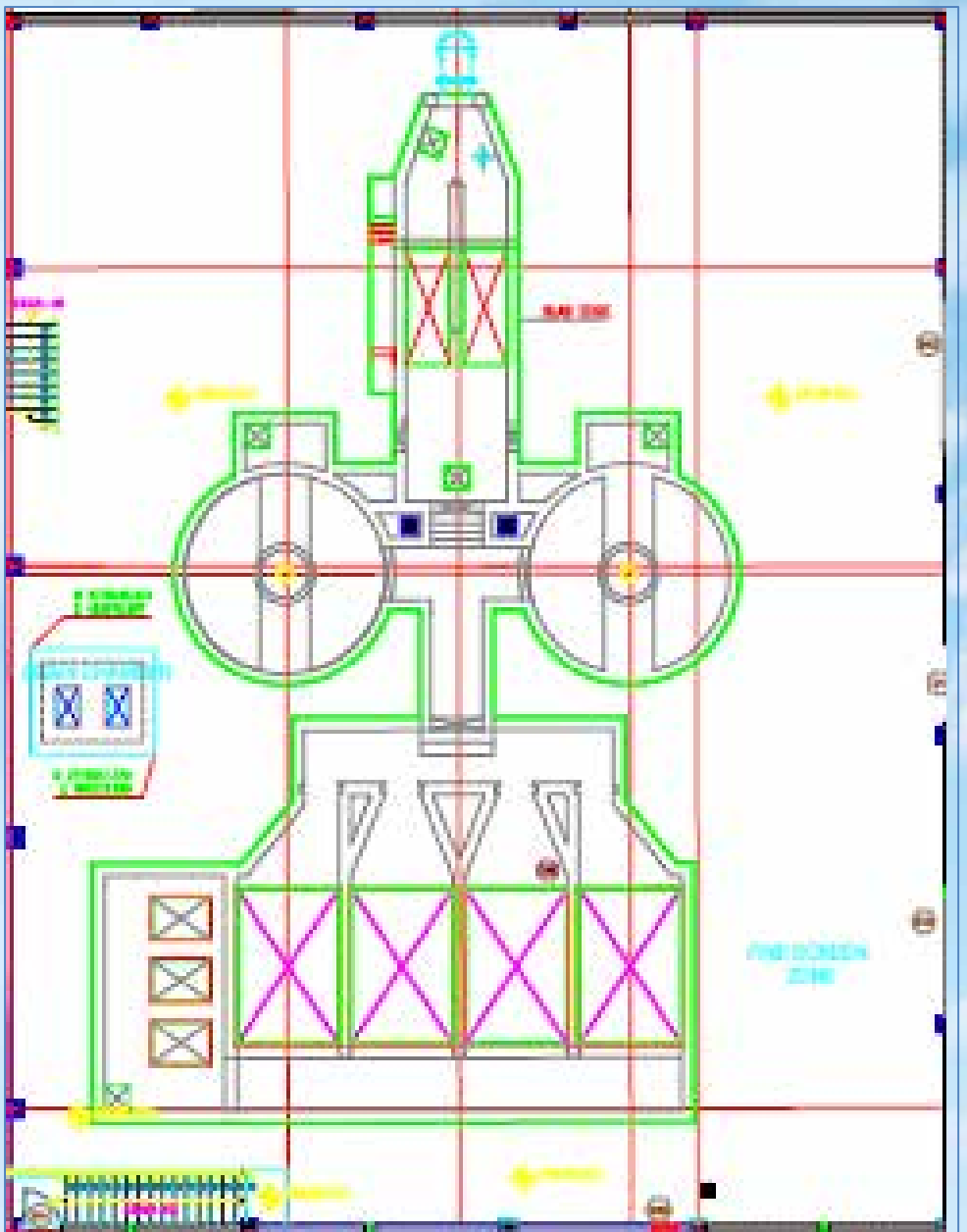
Organic odours – Draeger Tubes

- Methyl Mercaptan
- Dimethyl Sulfide
- Dimethyl Disulfide

SYSTEM DESIGN BASIS

- Location of Odour Control System
- System Design Requirements
  - Airflow
  - Odour Composition and Concentration
  - Treatment Objective
- Treatment Technology

SYSTEM LOCATION



SYSTEM DESIGN BASIS

Project Name: Dubai Sports City STP

Headworks:

	Velocity m/s	Duct Diam cm	Duct Area m2	Current Flow m3/hr				Ave. H2S ppmv	Airflow x H2S
Current	9	18	0.0254	823					
Design	12	18	0.0254	1097	use -->	1100	m3/hr	325	357500

Fine Screen:

	Volume ft3	acph	Airflow cfm	Airflow m3/hr					
	3600	6	360	612	use -->	600	m3/hr	224	134400

Pump Station:

	Volume ft3	acph	Airflow cfm	Airflow m3/hr					
	430	6	43	73.1	use -->	75	m3/hr	156	11700

					Calculated	1775	m3/hr	284	ppmv
					Design	1800	m3/hr	285	ppmv

TECHNOLOGY

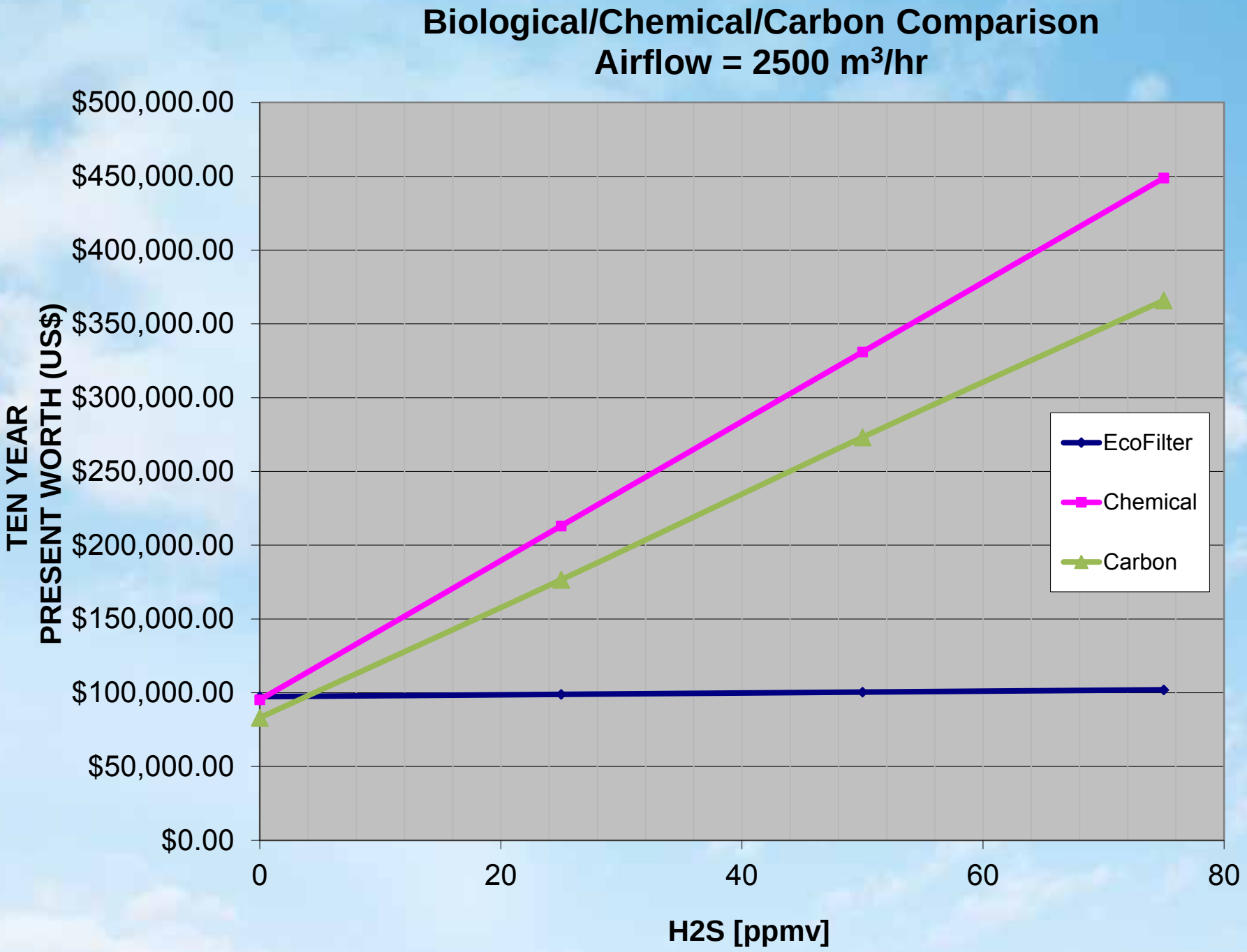
Requirements -

- Low Operating Cost
- Low O&M
- Consistent Performance
- Sustainable
- Environmentally Friendly

TECHNOLOGY

Carbon Adsorbers

Biological Systems

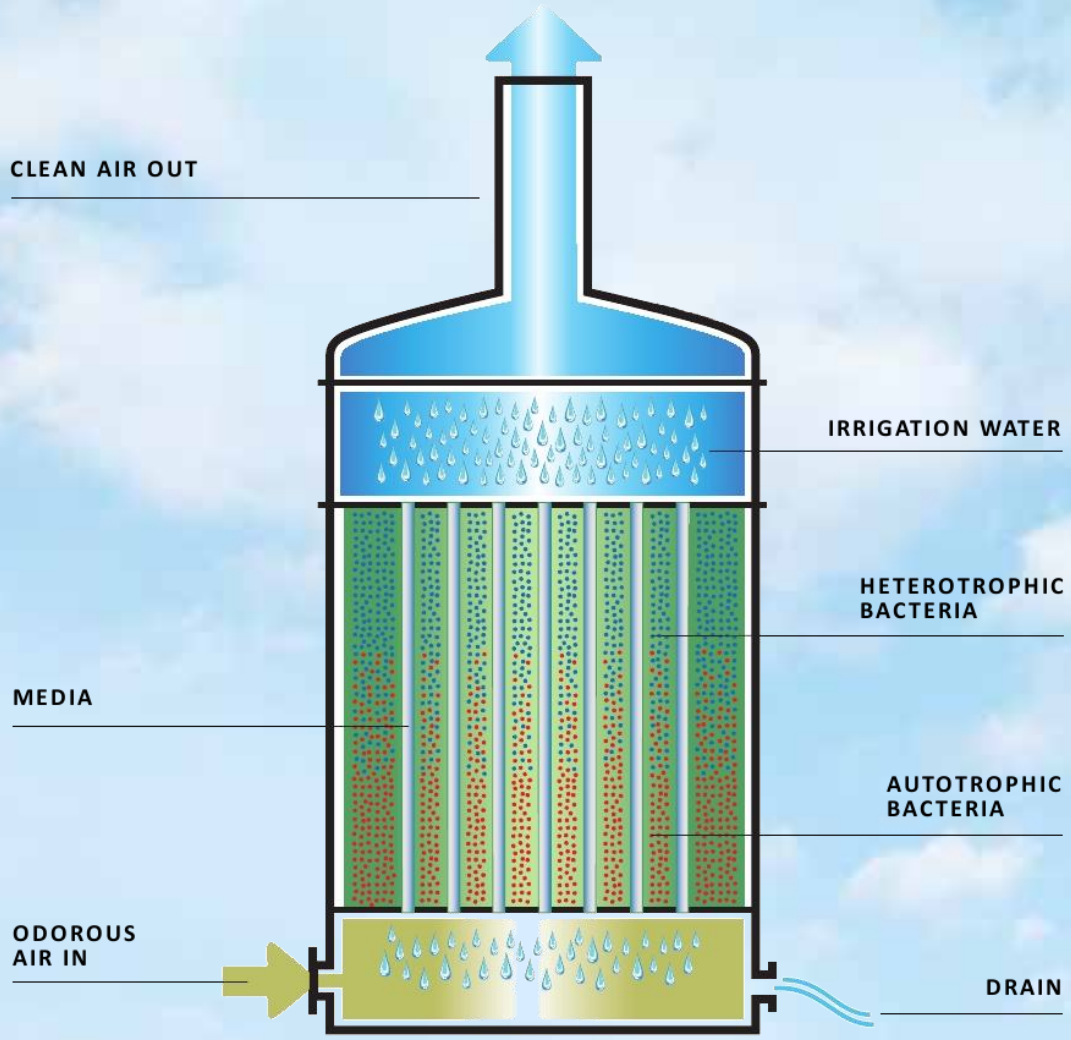

Biological/Chemical/Carbon Comparison
Airflow = 2500 m3/hr
$500,000.00
$450,000.00
$400,000.00
$350,000.00
$300,000.00
$250,000.00
$200,000.00
$150,000.00
$100,000.00
$50,000.00
$0.00
TEN YEAR PRESENT WORTH (US$)
0
20
40
60
80
H2S [ppmv]
EcoFilter
Chemical
Carbon

TECHNOLOGY

Selected Biotrickling Filter Technology -

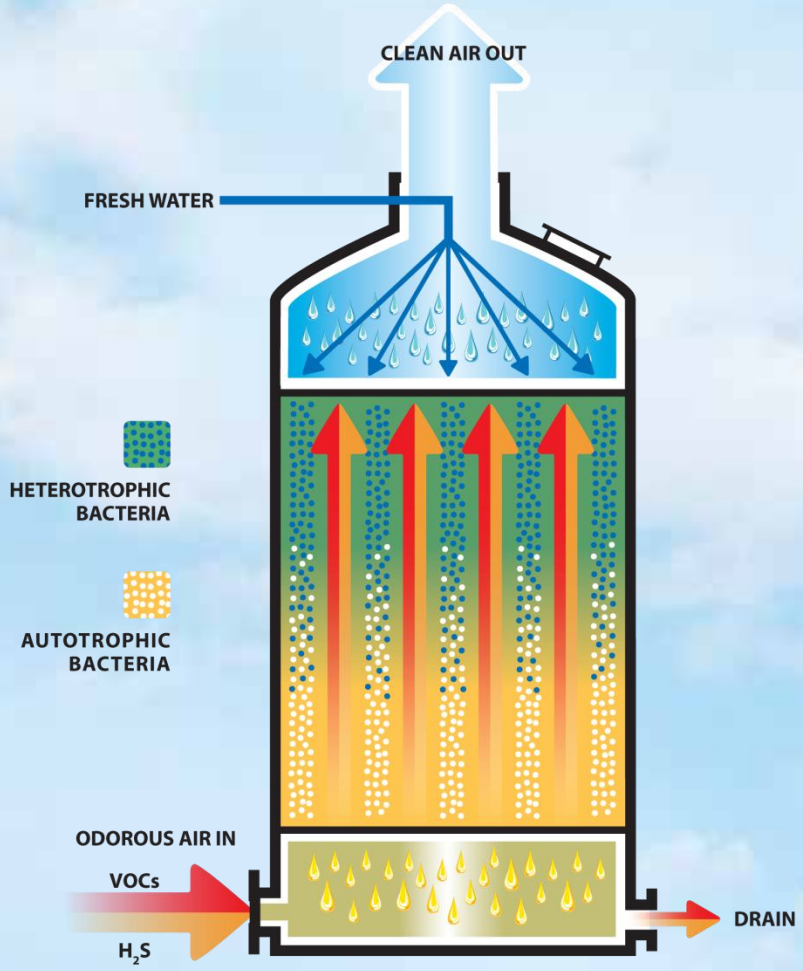
- Low Operating Cost
- Low O&M
- Remove H_2S and Organic Odours
- “Green” Technology

BIOTRICKLING FILTER TECHNOLOGY

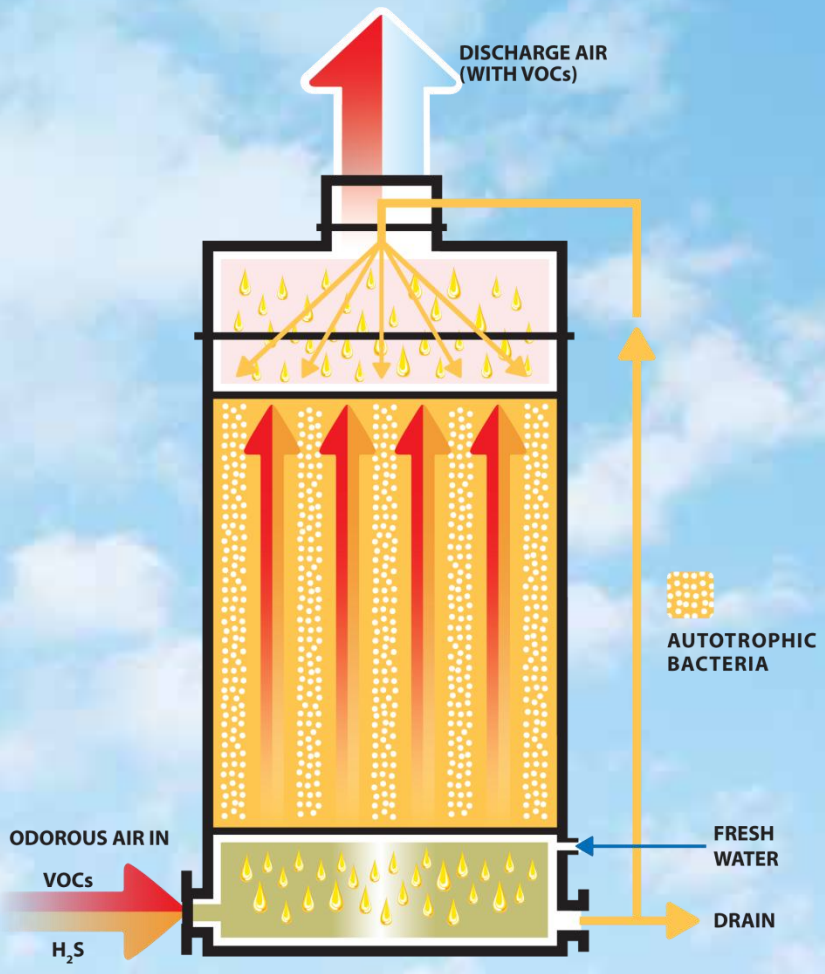


- Engineered flow channels – eliminate plugging and provide consistent performance
- High microbial density – treat high loadings
- Heterotrophic Bacteria – Organic Odours
- Autotrophic Bacteria – Inorganic Odours
- Media Life Expectancy (15 - 20 years)

Biotrickling Filter vs Bioscrubber



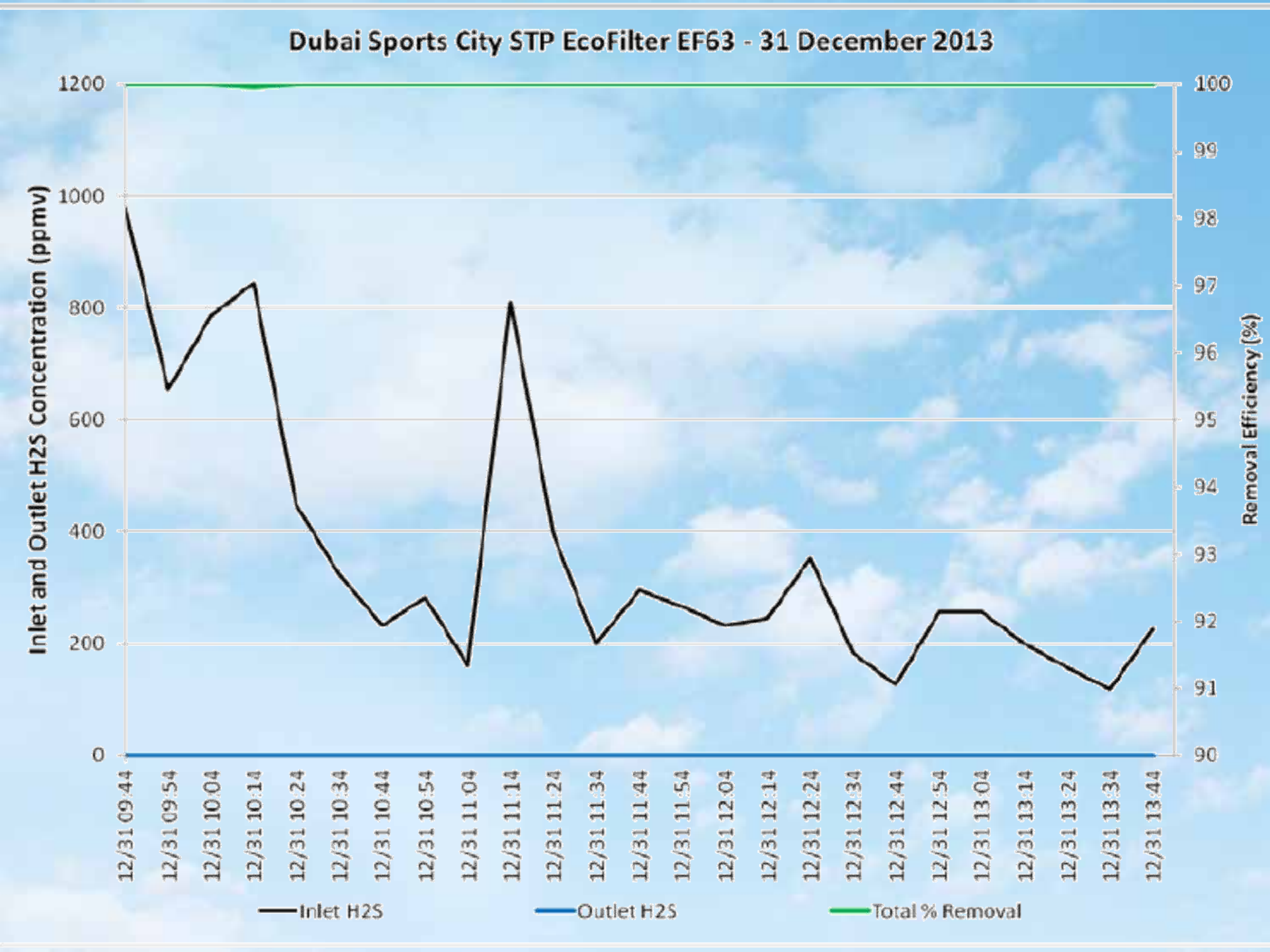
Biotrickling Filter



Bioscrubber

DUBAI SPORTS CITY

Unit	EcoFilter EF63
Location	Headworks Building
Application	Inlet Chamber, Screens and Grit Removal
Airflow Rate	1800 m^3/hr
H_2S (average/peak)	285 / 960 ppmv
System Performance	> 99.99% H_2S removal < 0.01 ppmv


Dubai Sports City STP EcoFilter EF63 - 31 December 2013
Inlet and Outlet H2S Concentration (ppmv)
Removal Efficiency (%)
1200
1000
800
600
400
200
0
100
99
98
97
96
95
94
93
92
91
90
12/31 09:44
12/31 09:54
12/31 10:04
12/31 10:14
12/31 10:24
12/31 10:34
12/31 10:44
12/31 10:54
12/31 11:04
12/31 11:14
12/31 11:24
12/31 11:34
12/31 11:44
12/31 11:54
12/31 12:04
12/31 12:14
12/31 12:24
12/31 12:34
12/31 12:44
12/31 12:54
12/31 13:04
12/31 13:14
12/31 13:24
12/31 13:34
12/31 13:44
Inlet H2S
Outlet H2S
Total % Removal

CONCLUSIONS

- H_2S in the Headworks room < 0.5 ppmv
  - Safe working environment for the Operators
- H_2S in the Biotrickling Filter discharge < 0.1 ppmv
  - Odour complaints are a thing of the past!
- Corrosion rate reduced
  - Maintenance cost reduced

CONTACT INFORMATION

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