Municipal Odour Control Systems

TRANSFORMING WATER. ENRICHING LIFE.

WHY DO WE NEED ODOUR CONTROL?

There are 3 Main Reasons:

- Odour is a nuisance
- In some cases odours may be a health hazard
- Odorous compounds can cause corrosion

NUISANCE vs. HAZARDOUS ODOURS

Most sewage odours are nuisance before they are hazardous

Compound	Typical Concentration in WWTF, ppm	Odour Threshold, ppm (smells bad)	OSHA PEL/IDLH, ppm (harmful)	LEL, ppm (explosive)
Hydrogen Sulphide	0.05 to 500	0.001	20/100	40,000
Ammonia	0 to 200	17	50/300	15,000
Methyl Mercaptan	0.001 to 1	0.001	10/150	39,000
Carbon Disulphide	0.01 to 10	0.03	20/500	13,000

PEL – Permissible Exposure Limit

IDLH – Immediately Dangerous to Life and Health

LEL – Lower Explosive Limit

TYPES OF ODOURS

Hydrogen Sulfide (H_2S)

- Typically 100x higher concentration than other odours
- Masks other odours, which then become noticeable after H_2S is removed
- Relatively easy to remove

Organic Sulfur Compounds

- Methyl Mercaptan (MM) – CH_4S
- Dimethyl Sulfide (DMS) – C_2H_6S
- Dimethyl Disulfide (DMDS) – $C_2H_6S_2$

Nitrogen Compounds: Ammonia and Amines

VOC's

- Aldehydes
- Ketones

AVAILABLE TECHNOLOGIES

- **Biological Odour Control**
  - Use bacteria to metabolize (oxidize) odorous sulfur compounds
- **Chemical Odour Control**
  - Use chemicals to absorb and react with volatile odorous compounds
- **Activated Carbon and Dry Chemical Odour Control Media**
  - Use activated carbon or chemically enhanced media to physically adsorb and chemically react with odorous compounds
- **Hybrid and Custom Designed Systems**

Evoqua Odour Control Installations

PRODUCT	TOTAL	USA	INTERNATIONAL
Chemical Scrubbers	728	596	132
Biological Odour Control Systems	742	579	163
Activated Carbon and Dry Chemical Systems	638	503	135
TOTAL ODOUR CONTROL	**2,108**	**1.678**	**430**
Emergency Chlorine Scrubbers	692	544	148
TOTAL SYSTEMS	**2,800**	**2,222**	**578**

Evoqua's RJ Environmental is one of the longest continuously operating odour control companies in the world with global installations in 45 countries.

BIOLOGICAL ODOUR CONTROL PRODUCTS

BIO-TRICKLING SCRUBBERS

Standard air flows up to 25,500 m3/hr in a 4.25 m dia. tower

H_2S concentrations to up to 1,000 ppm

PUF random synthetic media

> 99% H_2S destruction (8-10 seconds)

> 99.5% H_2S destruction (12-15 seconds)

> 95% organic odours destruction (15-20 seconds)

High capital cost

Low operating cost

Long media life

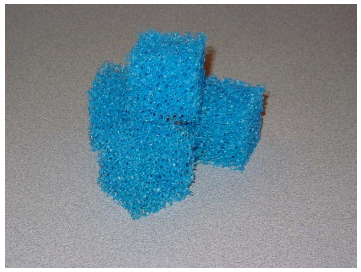
Grow autotrophic bacteria

- Adjusts to H_2S levels
- Acidophilic (loves low pH)
- Sulphide as food source

Generate a low pH waste stream

Ideal for Large Treatment Plants and high H_2S concentrations

OPTION: Custom design for air flows above 25,500 m3/hr



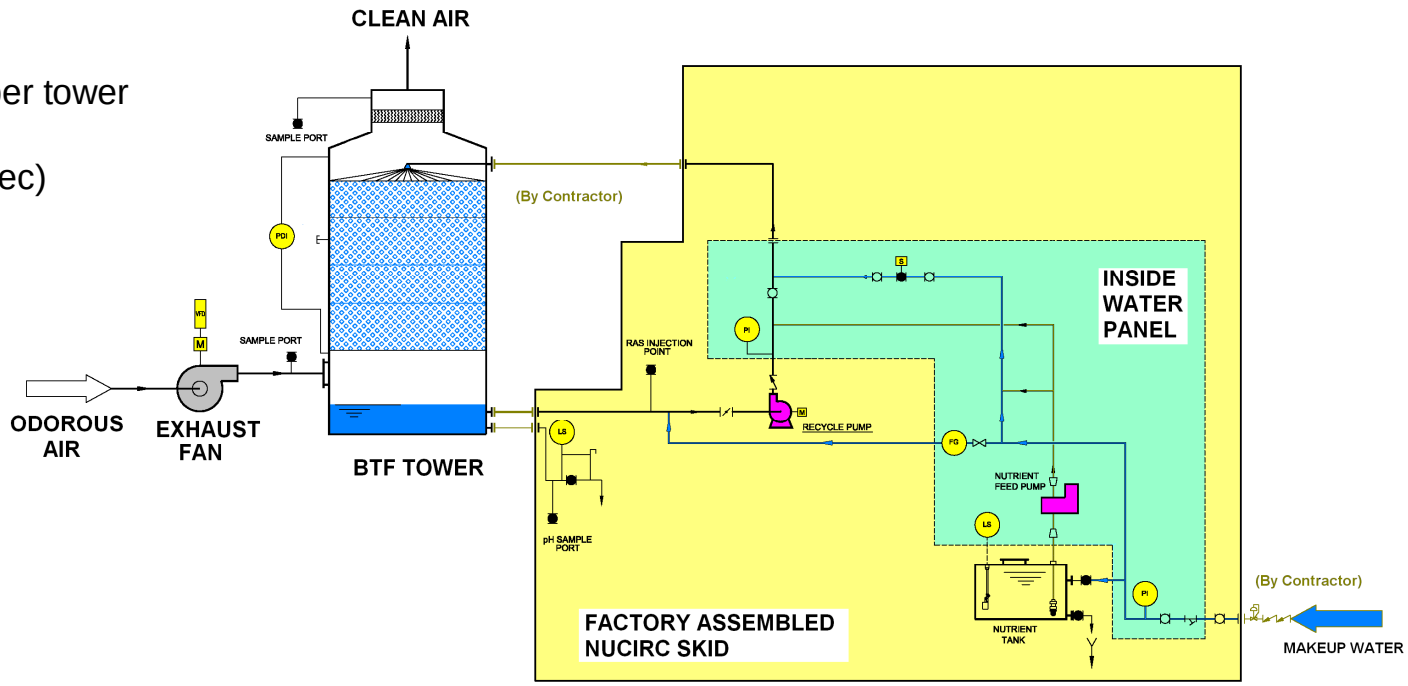
BIOSCRUBBER FEATURES

- **Uses autotrophic bacteria (*Thiobacillus*) to oxidize sulfur compounds to soluble sulfate**
- **Requires water, oxygen (air), CO2, and nutrients (N, P, K), temperature and time**
- **Over a period, biomass changes to accommodate H_2S fluctuations**
- **99% H_2S removal at 10 seconds contact time**
- **Generates low pH waste stream**

BIOSCRUBBER PROCESS FLOW: SINGLE STAGE

FEATURES

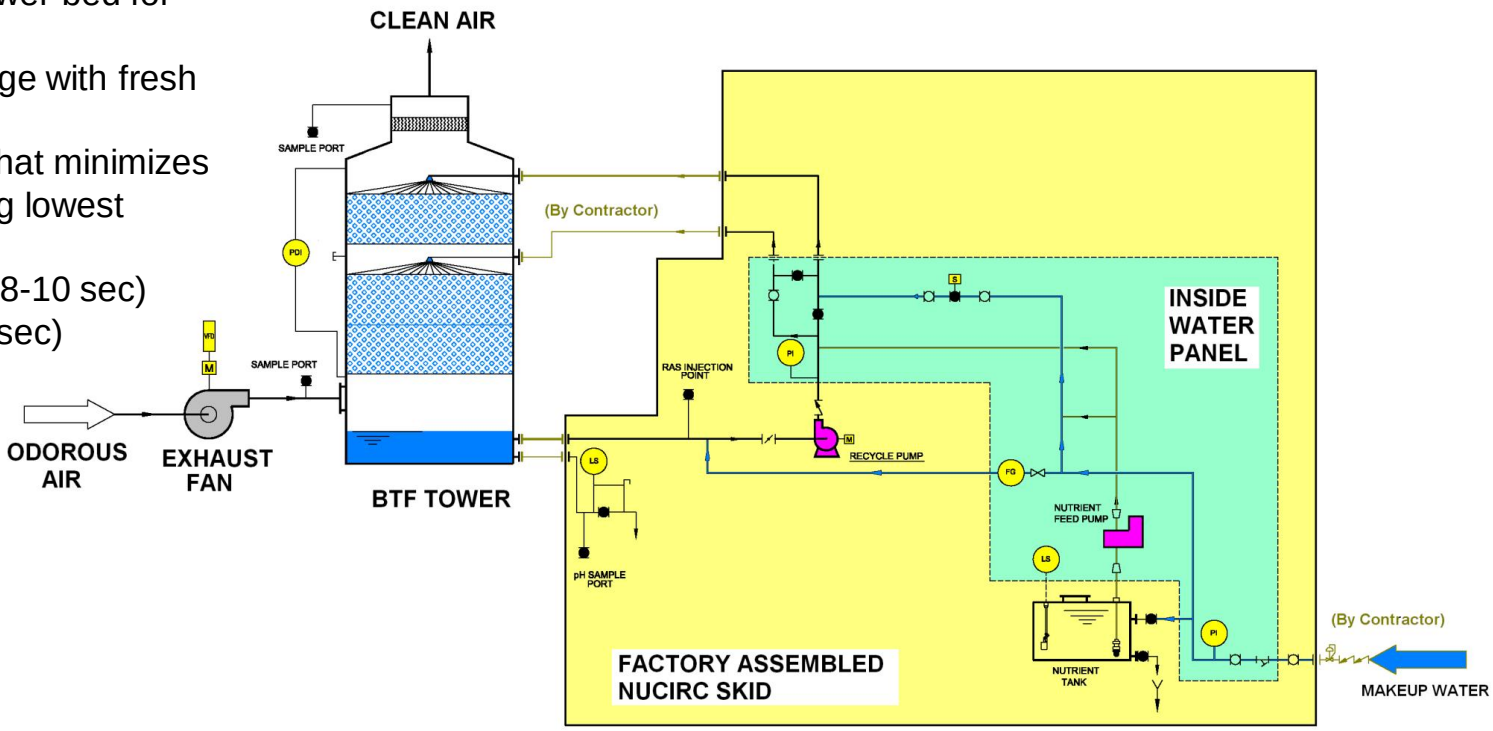
- High Air Flow 8,500-25,500 m3/her per tower
- 5-500+ ppm H_2S
- Good removal of H_2S (99% in 8-10 sec)
- Good organic removal (15-20 sec)
- Continuous Recirculation
- Full tower acclimation



BIOSCRUBBER/BTF PROCESS FLOW: DUAL STAGE

FEATURES

- Continuous Recirculation of lower bed for H_2S removal.
- Intermittent spray of upper stage with fresh water an nutrient.
- Patented dual stage process that minimizes water consumption while giving lowest possible odour emissions
- Good removal of H_2S (99% in 8-10 sec)
- Good organic removal (15-20 sec)



HYBRID BIOFILTER ODOUR CONTROL

ZABOCS®

2-stage odour control:
- Biological first stage
- Carbon Polishing stage

Standard air flow rate up to 8,500 m3/hr

> 99% H_2S destruction

Compact, low profile

Factory assembled for “plug & play” installation

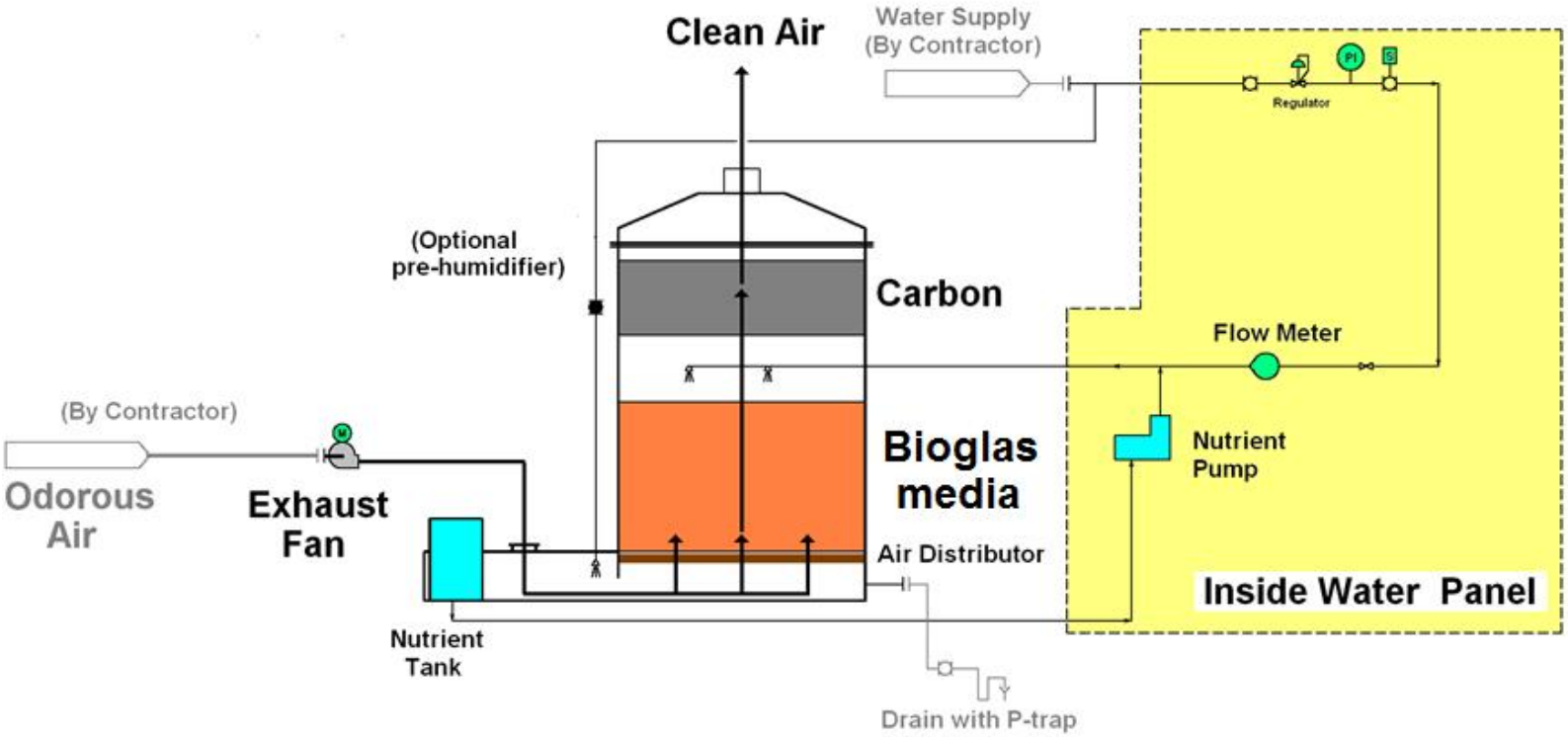
Low Profile - Ideal for residential area, P.S. or inside buildings

Long media life

Proprietary Bioglas media

OPTION: Custom design for air flows above 8,500 m3/hr

ZABOCS PROCESS FLOW



CHEMICAL ODOUR CONTROL PRODUCTS

LO/PRO ® Scrubber

Air flows up to 42,000 m3/hr
Polypropylene packing media
2 and 3 stage designs
> 99.5% H_2S & NH_3 destruction
50% lower chemical usage
Handles H_2S and organic odours
Ideal for dewatering and sludge drying odours
OPTION: Custom design for higher air flow up to 53,500 m3/hr

LO/PRO PROCESS FLOW

- The LO/PRO® Process Can Be Configured in Several Ways:
- Two Stage
- Standard LO/PRO: for H_2S removal up to 100 ppm

  Stage 1 = NaOH,

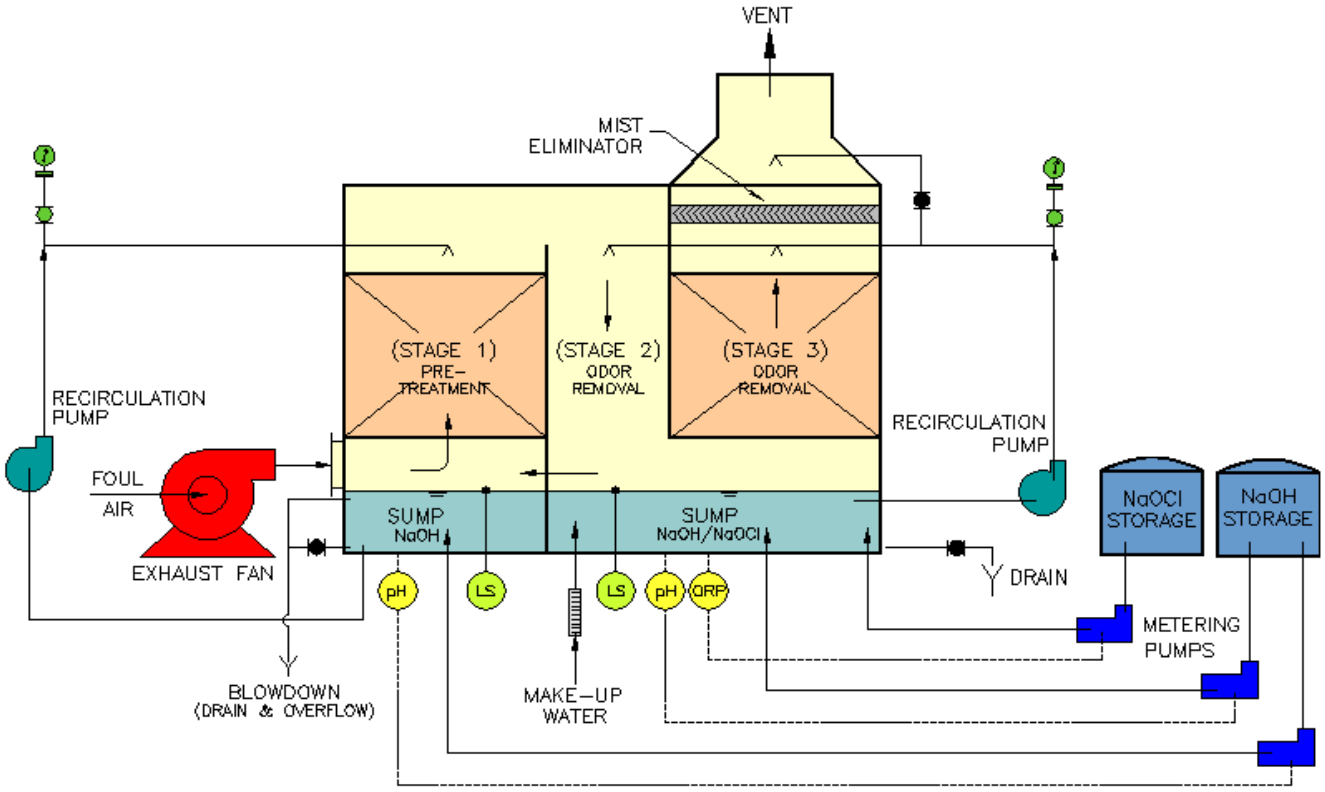
  Stage 2 = NaOCl + NaOH

- Three Stage
- NH_3/amines and H_2S/sulfides

  Stage 1 = H_2SO_4

  Stage 2 = NaOH

  Stage 3 = NaOCl + NaOH



LO/PRO BENEFITS

- **Multi-stage scrubbing process cuts chemical cost in half compared to conventional single stage scrubber**
- **Proven track record supported by years of operational experience and extensive performance testing**
- **Compact footprint and low profile**
- **Adaptable for indoor or outdoor installation in high ambient temperature up to 55 Deg. C**
- **Can treat NH_3 and H_2S odours in a single scrubber (dewatering, sludge drying sludge composting)**
- **Factory assembled packaged system. UNITARY construction requires minimum construction, installation and commissioning cost and time.**
- **Highest quality components**
- **No system downtime for routine calibration and maintenance**

CHEMICAL ODOUR CONTROL PRODUCTS

PACKED TOWER

Air flows up to 96,000 m3/hr
Polypropylene packing media
1 or 2 or 3 scrubbing stage designs
> 99.5% H_2S destruction
Small footprint
Ideal for Large Treatment Plants and low concentrations
Can design for H_2S or NH_3
OPTION: Custom design for higher air flow up to 136,000 m3/hr

ACTIVATED CARBON ODOUR CONTROL PRODUCTS

EVOQUA CARBON MEDIA

For 1-year carbon life:

Virgin Activated Carbon, ~ 1 ppm
KOH Treated Carbon, ~ 10 ppm
MIDAS OCM, ~ 20 ppm

Pelletized Carbon - Low pressure drop

OTHER CARBON MEDIA

For 1-year carbon life:

Water Regen Carbon, ~ 12 ppm

Granular Carbon - High pressure drop
System Downtime for in-site regeneration
Generates a lot of acidic drain

COMBINING TECHNOLOGIES FOR OPTIMUM ODOUR CONTROL

- Bioscrubber with Carbon Polisher
- Bioscrubber with Chemical Scrubber Polisher
- Chemical Scrubber with Carbon Polisher
- Bioscrubber followed by Chemical Scrubber with Carbon Polisher

CONCLUSIONS:

Each odour control technology has its niche:

- **Chemical scrubbers are best suited for high air flow and low H_2S applications, complex odours and handling spikes.**
- **Biological systems are most attractive for treating high H_2S concentrations (> 10 ppm)**
- **Activated carbon systems are best for lower H_2S concentrations (< 10 ppm)**
- **Paying higher capital cost up front can end up costing less over time, but not always.**

Case Study: Brightwater WWTP, Seattle, WA

Challenges

- Total treated foul air flow rate of 884,000 m3/hr
- 13 Large custom sized 68,000 m3/hr each odour control systems
- Promise of “zero odour” from WWTP
- Combine Bioscrubber pre-treatment, chemical scrubbing, and carbon polishing
- H_2S removal efficiency 99.999% with < 0.001 ppm H_2S at stack

Evoqua Solution

- 8 BTF Bioscrubbers at 3 sec EBRT for pre-treatment (60% H_2S destruction)
- 13 custom packed tower chemical scrubbers using NaOH + NaOCl
- 13 custom designed Quad-Bed horizontal carbon adsorbers using virgin activated carbon for final odour polishing

Project Facts/Results

- In operation since November 2009
- Achieving “zero odours” (< 0.001 ppm)
- Award winning “park like” WWTP
- So beautifully landscaped & **odour free** that people hold weddings at the WWTP!

Case Study: Jebel Ali STP (Phase 1), Dubai, UAE

Challenges

- Large centralized odour control system, with total air flow rate of 159,000 m3/hr
- High H_2S concentrations from 330 to 600 ppm
- Includes exhaust from 17,400 m3/hr sludge dryer
- High H_2S removal with < 0.05 ppm H2S at stack

Evoqua Solution

- 12 BTF-1245 Bioscrubbers for pre-treatment (95% min)
- 4 PT-1200 Caustic scrubbers for polishing
- Venturi dust scrubber on dryer exhaust
- Associated controls and instrumentation

Project Facts/Results

- In operation since November 2009
- Bioscrubber achieving > 99.5% H_2S removal
- Mercaptans and organic sulphides < 0.8 ppm
- Chemical scrubbers kept in “reserve”
- Saving > $500,000 per year in chemical cost

EMERGENCY CHLORINE SCRUBBER SYSTEMS

1-TON Emergency Chlorine Scrubber, Qatar

90-TON Scrubber, Wiley, TX, USA

THANK YOU

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