

peace'mak'er, n.

- One who makes peace or reconciles parties at variance
- Allays agitation, calms

Easy Installation

- Remove manhole cover and clean rim
- Place PEACEMAKER insert on frame rim and add media
- Replace cover

Summary of Advantages

- Durable, no maintenance, no corrosion
- Constant venting of line pressure
- Superior malodor control
- Three-year guarantee
- Minutes to install
- Economic

Odour Control Systems Cover, Collect and Treat for Odour Control

Abstract

The aim of this paper is to introduce a new concept to odour control design strategies for Waste Water Treatment Works. This new concept involves intimately serving odour sources by application of a newly developed modular odour control system – the Peacemaker Filter-Scrubber.

Traditional designs have been dictated by the use of Biofiltration methods utilising one, maybe two centralised filters to serve diverse odour sources using long runs of extract ductwork. The modular Peacemaker combined with a full range of G.R.P. covers from a single manufacturer provides several other key benefits to designers and the client.

Introduction

Based upon increasing legislation, together with the ever-increasing awareness of the public to odour nuisance, there is a continuing review of odour abatement systems within the Waste Water Treatment Industry. The paper introduces a newly designed abatement system and an integrated approach to design thinking.

The OCS Cover, Collect and Treat System is designed, manufactured and installed entirely by a single Company and offers major benefits to the client.

- Single Source of Supply
- Fully Compatible Corrosion and Chemical Resistant Components
- U-V Resistant, Robust, Heavy Duty uPVC Ductwork
- Modular, High Performance Filter-Scrubber Units Operating Under Partial Vacuum

Odour Abatement Covers

Good odour control design starts with well sealed, close fitting covers to each source of smell, whether it is a tank, sump, well or channel etc. Additionally, it is essential that Odour Control Covers should also provide good, safe operator access.

OCS SAFECOVER™

- Flat Profile, Minimises Ventilation Rates Cost Saving
- Tight Sealing, Minimises Ventilation Rates Cost Saving
- Slip Resistant, Unhindered Operator Access Increased Safety
- Enhanced Appearance, Superior Finish At Superior Cost

The traditional design of odour abatement covers is a result of the non-structural nature of hand lay-up G.R.P. materials and the methods used. Unlike traditional G.R.P. domed, raised and ribbed covers OCS Safe Covers™ provide continuous slip-resistant flat surfaces maximising sealing (even around complicated structures and equipment) with safe operator access whilst at the same time minimising tank, sump, well or channel volumes for optimum ventilation efficiency.

The inherent mechanical strength of structural G.R.P. used in manufacturing OCS Safecovers™ is perfect for heavy-duty designs, for example 5kn/m² minimum loading (is our standard for OCS Cover, Collect and Treat Systems).

Finally, structural G.R.P., which uses isopthalic polyester and vinyl ester resins has far superior chemical and corrosion resistance when compared to traditional orthopthalic resins commonly used in hand lay-up moulded covers.

Why Structural G.R.P.?

- Strong as Steel
- Superior Corrosion Resistancy
- Minimum 30 Year Service Life

- Light Weight
- No Scrap/Theft Value
- Increased Safety

Odour Ventilation Ductwork

With the advent of commercially available U-V stabilised uPVC materials which can be formed into heavy duty, thick walled (4-6mm) ductwork, it is now no longer necessary to provide additional U-V protection and strengthening (by G.R.P. wrapping) to ensure that a ductwork system provides a service life of upto 30 years.

The selection of these materials, combined with the OCS Peacemaker[™] modular approach to odour abatement (which is discussed later) ensures labour and materials cost savings during installation.

Why Thick Walled Upvc Ducting?

U-V Resistant

•

30 Year Service Life

- No Additional Strengthening Required
- Capable of Longer Unsupported Spans
- 40% Cheaper than GRP Wrapped uPVC

Odour Abatement Systems - Water Industry Standards

Generally speaking, there are 4 standard types of odour abatement systems (excluding chemical dosing) currently employed throughout the Waste Water Treatment Industry.

(1) Adsorption Filters (E.G. Carbon)

- Effective for Low Odour Concentrations only
- Moisture Intolerant and Adsorb Everything
- Require Regular Media Changeouts
- Electric Supply only
- Produce Hazardous Waste
- Small Footprint/Civils
- Low Capex, Very High Opex

(2) Wet Chemical Scrubbers

- Effective for Low and High Odour Concentrations
- Utilise Hazardous Chemicals
- Complex Operation and Controls
- High Maintenance
- Requires Electricity and Water Supplies
- Small Footprint/Civils
- V. High Capex, Medium Opex

(3) Biological Filters/Scrubbers

- Limited Applications Require Steady Odour Loadings
- Requires Electricity and Water Supplies
- V. Large Footprint/Civils
- Produce Hazardous Waste
- High Maintenance for Efficient Operation
- High Capex, Low Opex

(4) Dry Chemical Scrubbers (E.G. Permanganate)

- Limited against Complex Sulphides/Mercaptans
- Low Maintenance
- Small Footprint/Civils
- Simple Operation
- Low Capex, Medium Opex

Of these 4 types, it is fair to say for reasons of perceived cost effectiveness, that the Waste Water Treatment Industry over the past 10 years, has invested most heavily in Biological Filter systems.

The very nature of Biological Filters has dictated the thinking of Design Engineers in planning odour abatement systems for Waste Water Treatment Plants. The filters' requirements of long retention time, steady state odour loadings without peaks, need for water/final effluent supply (combined with the fact that the plant has a number of distant odour sources), have meant that the most effective design is usually that of a large centralised filter, catering for a multiple number of odour sources via extensive ductwork runs.

The result is the need for costly civils to provide a base for the filter, large capacity extract fans to provide for dilution air to ensure odour peaks from process sources do not go beyond the upper limits of the filters (i.e. 50ppm for peat and heather types and 100ppm for calcified seaweed types) and costly, inefficient and complex ductwork runs which can present access and safety problems and look unsightly above ground.

Due to the shortcomings of all the above systems, Odour Control Systems Ltd. has developed The Peacemaker Odour Filter-Scrubber together with a modular approach to odour control.

What is The Peacemaker?

Of the 4 standard types of system listed above, The Peacemaker system falls across the categories of Adsorption Filters and Dry Chemical Scrubbers, hence the term Peacemaker Filter-Scrubber.

It is a system of modular design, based upon dual chambered vessels (or modules) manufactured from corrosion resistant, heavy duty plastic and G.R.P. materials. It does not utilise a water supply.

Each dual chambered vessel (or module) comprises:

- (A) A Foul Air Inlet Chamber.
- (B) Lower Air Diffusion Plate.
- (C) Lower Odour Oxidising Media Chamber.
- (D) Middle Air Diffusion Plate
- (E) Upper Odour Polishing Media Chamber.
- (F) Clean Air Outlet Vent.

The system is completed by interconnecting ductwork, flow balancing valves and air extraction fans.

As with other fan assisted odour abatement systems, the extraction fan creates a partial vacuum via connecting ductwork to the covered odour source to avoid odour leakage. Foul air is pulled into the inlet chamber and diffused via the lower diffuser, which is designed to maximise its distribution across the surface areas of the medias. It is firstly drawn upwards through the oxidising chamber, which contains dry impregnated media granules.

The impregnate is chlorine dioxide, which is stabilised within the media. The impregnation and stabilisation process is patented. Chlorine Dioxide is a very powerful oxidising agent e.g. 2.5 times that of chlorine and 4 times that of potassium permanganate. The result is a media bed of high odour removal capacity.

Chlorine Dioxide rapidly oxidises the most odorous compounds found in off-gases from wastewater treatment processes.

e.g. Sulphides to Sulphates Mercaptans to Sulphonates and Sulphonic Acids Amines to Carboxylic Acids.

Products of reaction are odourless and environmentally sound (e.g. no chlorinated organics are formed)

From the lower oxidising chamber, air is then drawn into the upper odour polishing chamber, which contains adsorptive media to provide further removals of any remaining non oxidisable odorous compounds.

Several adsorptive medias are used depending upon the odour polishing requirements.

This Peacemaker oxidising/adsorption or filter-scrubbing process offers large odour removal capacities per module and provides excellent odour removals performance.

Odour Removals Performance

- (1) Independent testing has shown that the Peacemaker is capable of effectively removing 100% hydrogen sulphide and mercaptan compounds, even at very high peak loadings. (See table 1)
- (2) T.O.N. removals in the 95 –99% range by a single module. (See figures 2 + 3)
- (3) Ability to handle shock loadings of over 1000ppm H₂S without significant odour breakthrough. Whilst also maintaining media bed stability

Tables 1 + 2 summarise some of this work. (see overleaf)

Table 1: Typical Peacemaker Odour Removals Performance						
		Peacemaker Inlet		Peacemaker Outlet		
Day No	Time	Mercaptans ppm	H ₂ S ppm	Mercaptans ppm	H ₂ S ppm	
1	10.55	60	30	0	0	
1	14.45	120	102	0	0	
1	23.00	120	31	0	0	
2	08.30	120	117	0	0	
2	22.35	15	6	0	0	
3	03.25	15	5	0	0	
3	12.00	15	28	0	0	
3	20.10	10	8	0	0	
4	08.45	6	3	0	0	
4	22.55	100	40	0	0	
4	22.55	100	52	0	0	
5	09.30	10	6	0	0	
5	20.00	100	52	0	0	
6	20.10	120	200	0	0	
7	15.10	120	45	0	0	
7	20.10	120	200	0	0	
8	08.15	135	71	0	0	
8	16.30		13		0	
8	20.25	50	200	0	0	
9	11.55	60	18	0	0	
10	09.25	8	10	0	0	
10	17.20	0.5		0	0	
11	01.20	2.5	36	0	0	
11	19.00	80	39	0	0	
12	02.40	60	68	0	0	
12	09.40	120	46	0	0	
12	17.25	65	15	0	0	
12	20.15	5	3	0	0	
13	09.50	120	72	0	0	
13	18.45	80	33	0	0	
13	20.05	120	99	0	0	
14	14.10	120	165	0	0	
14	20.30	240	115	0	0	
15	19.50	85	67	0	0	
16	09.25	120	41	0	0	
16	20.15	240	66	0	0	
16	22.50	00	38		0	
1/	09.00	20	14 88	0	0	
18	03.25	120	102	0	0	
19	17.40	4	1	0	0	
19	20.40	60	80	0	0	
20	08.05	120	28	0	0	
20	19.40	10	11	0	0	
21	04.30	60	80	0	0	
21	12.35	30	8	0	0	
21	19.50	20	21	0	0	
22	17.00	120	31	0	0	
22	19.30	55	10	0	0	
23	09.00	70	9	0	0	
23	19.40	23	11	0	0	
24	09.15	30	3	0	0	
24	21.15	120	34	0	0	
25	11.40	120	39	0	0	
20	20.10	120	04	0	0	
NOTE: Peacemaker System treating off gases from Sludge Reception Chamber at a North West Water Ltd. Site.						

Table 2: Typical Peacemaker Odour Removals Performance								
Odour Control Unit on the Imported Sludge Tank During Tankering in								
	HYDROGEN SULPHIDE		ТІМЕ	HYDROGEN SULPHIDE		TIME	TIME HYDROGEN SUL	
	INLET (ppm)	OUTLET ppm)		INLET (ppm)	OUTLET ppm)		INLET (ppm)	OUTLET ppm)
14.00	0	0	15.00	904	0	16.00	82	0
14.02	0	0	15.02	868	0	16.02	79	0
14.04	0	0	15.04	841	0	16.04	75	0
14.06	1	0	15.06	726	0	1606	71	0
14.08	3	0	15.08	725	0	16.08	61	0
14.10	13	0	15.10	633	0	16.10	61	0
14.12	14	0	15.12	506	0	16.12	55	0
14.14	14	0	15.14	492	0	16.14	55	0
14.16	15	0	15.16	492	0	16.16	55	0
14.18	15	0	15.18	361	0	16.18	55	0
14.20	26	0	15.20	357	0	16.20	53	0
14.22	26	0	15.22	339	0	16.22	36	0
14.24	27	0	15.24	333	0	16.24	21	0
14.26	27	0	15.26	328	0	16.26	18	0
14.28	27	0	15.28	304	0	16.28	12	0
14.30	27	0	15.30	296	0	16.30	12	0
14.32	36	0	15.32	288	0	16.32	9	0
14.34	36	0	15.34	279	0	16.34	9	0
14.36	35	0	15.36	274	0	16.36	6	0
14.38	44	0	15.38	261	0	16.38	3	0
14.40	44	0	15.40	256	0	16.40	1	0
14.42	43	0	15.42	214	0	16.42	1	0
14.44	43	0	15.44	187	0	1644	1	0
14.46	123	0	15.46	150	0	16.46	1	0
14.48	208	0	15.48	124	0	16.48	0	0
14.50	499	0	15.50	117	0	16.50	0	0
14.52	675	0	15.52	114	0	16.52	0	0
14.54	842	0	15.54	112	0	16.54	0	0
14.56	953	0	15.56	90	0	16.56	0	0
14.58	932	0	15.58	86	0	16.58	0	0

Blakeney W.W.T.W. - Odour Control Unit Performance

Performance monitoring of the odour control units at Blakeney W.W.T.W. was carried out on 07/09/00. The results of this monitoring exercise are presented below.

Contaminant Hydrogen Sulphide	Concentration (mg/l) Entering Unit	Concentration (mg/l) Leaving Unit
Sample 1	171.0	0.0
Sample 2	48.0	0.0
Sample 3	54.0	0.0
Sample 4	64.0	0.0

Notes

Hydrogen sulphide measurements were made with calibrated Anachem STX70 gas monitors and verified against the Drager analytical system.

Results of Olfactometric Analysis

The effectiveness of the odour control unit in reducing odour nuisance is measured in terms of a reduction in the threshold odour number (TON) of the airflow across the unit. The TON is the number of times that the air sample must be diluted until half a panel of eight trained "sniffers" can no longer detect any odour. Samples were analysed by AEA Technology, Culham, Oxon. Within 24 hours of sample collection. The results are summarised below. The odour control unit was tested four times for its performance.

Test 1	TON leaving unit (BL in 1)	TON leaving unit (BL out 1)	Percentage reduction in TON	
=	>1132790	1030	>99.91%	
Test 2	TON leaving unit (BL in 2)	TON leaving unit (BL out 2)	Percentage reduction in TON	
= 339575		1070	99.68%	
Test 3	TON leaving unit (BL in 3)	TON leaving unit (BL out 3)	Percentage reduction in TON	
= 344190		865	99.75%	
Test 4	TON leaving unit (BL in 4)	TON leaving unit (BL out 4)	Percentage reduction in TON	
= 398075		860	99.78%	

Odour Control Units Performance, T.O.N. Analysis at Tenbury Wells S.T.W.

FIGURE 3	Inlet OUE/m³	Outlet OUE/m³	Efficiency %
Best case (at 95% confidence interval extremes)	137274	28	99.98
Average (geomean of actual results) 86854		45	99.95
Worst case (at 95% confidence interval extremes)	54953	71	99.87

	Inlet OUE/m³	Outlet OUE/m³	Efficiency %
Best case (at 95% confidence interval extremes)	33096	29	99.91
Average (geomean of actual results)	20940	46	99.78
Worst case (at 95% confidence interval extremes)	13249	73	99.45

Modular Design Provides Flexibility

There are currently 6 basic Peacemaker modules, the 500, 1000, 3000, 4000, 9000 and 18000. Their characteristics are shown in Table 3.

Table 3. Characteristics of Peacemaker Modules						
Module	Typical Footprint m ²	Typical Gas Flow Capacity m³/Hr				
500	0.5	300	250			
1000	1.00	1000	1000			
3000	2.50	2080	2000			
4000	3.00	3000	3000			
9000	5.00	4500	5000			
18000	9.00	6200	10000			

These modules are the building blocks of the Peacemaker Filter-Scrubber System. They can be used singly or coupled in parallel or series for treatment of a very wide range of gas flows and odour loadings; indeed the design of any system and selection of module combination is dictated by required gas extract rate from the source (i.e. flow through the unit) and odour concentrations to be handled.

This modular approach provides great flexibility in system layout design and offers several key benefits to the client when compared to existing standard technologies being used.

These Include:

- (A) The small footprint requirements of systems make it possible to intimately serve odour sources
- (B) This greatly reduces civils requirements, both in terms of area required & also in terms of loadings per unit area

For example, typical civils loadings requirements for Peacemaker systems are in the 0.25 – 10 kn per square metre range

- (C) 'Intimately serving' odour sources eliminates costly and unsightly long ductwork runs from designs
- (D) Short ductwork runs improve gas removal efficiencies and increase reliability of the system's ventilation rate
- (E) As a 'dry' system, it requires only an electrical supply (no water or final effluent) which is usually readily available close to odour sources such as Sludge tanks, Desludge Chambers, Inlet Wells etc

Peacemaker Dry Filter-Scrubber

- Effective Across all Applications and Odour Challenges
- Simple Operation
- Minimal Maintenance
- Requires only Electric Supply
- Small Footprint/Civils
- Produces Non Hazardous Waste
- Felxible Designs
- Low Capex, Low Opex

A list of Peacemaker installations is given in Table 4 overleaf.

Table 4. A Selection of Peacemaker Reference Installations						
Client	Location	Application	Gas Flows m3/Hr	Typical Odour Loadings H ₂ Sppm		
Severn Trent Water	Minworth S.T.W (W.Midlands)	Sludges (9 Systems)	300 – 1000	20 – 300		
Severn Trent Water	Monkmoor S.T.W. (Shrewsbury)	Sludges (6 Systems)	100 – 1400	20 – 200		
Wessex Water	Poole S.T.W. (Dorset)	Sludge Tanks (2 Systems)	16000 each	10 – 300		
Anglian Water	Colchester S.T.W. (Essex)	Sludges (5 Systems	200 – 500	25 – 750		
Anglian Water	Holland Haven & Jaywick S.T.W.'s (Essex)	Inlet Works (2 Systems)	700 – 1100	10 – 50		
Anglian Water	South Benfleet S.T.W. (Essex)	Desludge Wells	500	20 – 200		
Wessex Water	Weston-Super-Mare S.T.W. (Somerset)	S.B.C.	18000	0.5 – 5		
West of Scotland Water	Shieldhall S.T.W. (Glasgow)	Imported Sludges (2 Systems)	600 – 1400	50 – 500		
East of Scotland Water	Kelso S.T.W. (Kelso)	Inlet Works	300	2 – 10		
East of Scotland Water	Springfield S.T.W.	Inlet Works & Sludges (2 Systems)	200 – 1200	5 – 300		
East of Scotland Water	Galashiels	Sludge Drier	3500	0 – 20		
North of Scotland Water	Nairn	Sludges	320	0 – 100		
South West Water	Camelshead S.T.W. (Plymouth)	Sludges	1000	10 – 50		
South West Water	Sewage Scheme (4 Systems)	4 No. Pumping Stations	200 – 3000	2 – 50		
Severn Trent Water	Abermule S.T.W. (Powys)	R.B.C. Works	75	2 – 10		
Southern Water	Tunbridge Wells North S.T.W. (Tunbridge Wells)	Sludges	1100	20 – 300		
Southern Water	Benover Road P.S. (Yalding, Kent)	Vacuum Pumping Station	400	10 – 50		
Anglian Water	Brendon Walk P.S. (Spalding Lincs)	Vacuum Pumping Station	300 – 600	10 – 50		
Yorkshire Water	Aldwarke S.T.W. (Rotherham)	Sludges	750	20 – 300		
Yorkshire Water	Rawcliffe S.T.W. (York 3 Systems)	Works Inlet and Sludges	200 – 1700	10 – 300		
Yorkshire Water	Dronfield S.T.W. (S. Yorks)	Sludges	650	20 – 200		
North West Water	Preston S.T.W. (Lancs. 4 Systems)	Sludges & Liquors	200 – 450	20 – 250		
North West Water	Runcorn S.T.W. (Cheshire 2 Systems)	Sludges	200 – 300	20 – 500		
North West Water	Kendal S.T.W. (2 Systems)	Works Inlet & Sludges	900 – 1500	5 – 750		
Wessex Water	Bath CSO	Pumping Station & Storm Tank	1200	2 – 20		
Welsh Water	Cardiff S.T.W.	Inlet Works	44000	2. – 20		
Welsh Water	Aberaeron (2 Systems)	Sludges	500 – 1160	5 – 70		
Welsh Water	Llandudno Coastal Scheme (6 Systems)	6 No. Pumping Stations/Storm Tanks	200 – 1200	2 – 25		
West of Scotland Water	Dalmuir S.T.W.	Sludges	400	50 – 150		
Northumbrian Water	Amble P.S. (Amble Northumberland)	Pumping Station	200	5 – 10		

Since its launch into the U.K. Waste Water Treatment Sector in January 1996, well over 350 installations have been successfully completed.

The benefits of an integrated cover, collect and treat approach, including the modular Peacemaker with its excellent odour removal capabilities are fast becoming recognised as a new industry standard for odour control.

References

- (1) Odour Control and Prevention in the Water Industry IWEM Symposium, Bristol October 1994
- (2) Odour Nuisance in Waste Water Treatment Causes and Control Hobson J.A. and Toogood S.J., WRc Report UM 1025, 1989
- (3) Odour Control A concise guide Valentin F.H.H at A1 Warren Springs Laboratory, 1980
- (4) Odour Control for the 1990's Hit or Miss? Toogood S.J., IWEM 1990
- (5) Peacemaker A Modular Approach to Odour Control Naylor J, Beeston M, OCS Ltd, Mitchell J, Anglian Water Services Ltd

preserving the environment

Odour Control Systems Ltd 33a Castle Close, Manor Lane Hawarden Industrial Park Hawarden, Flintshire CH5 3QX Phone: +44 (0)1244 536700 Fax: +44 (0)1244 535184 E-mail: mail@odourcontrolsystems.ltd.uk Web: www.odourcontrolsystems.ltd.uk



