

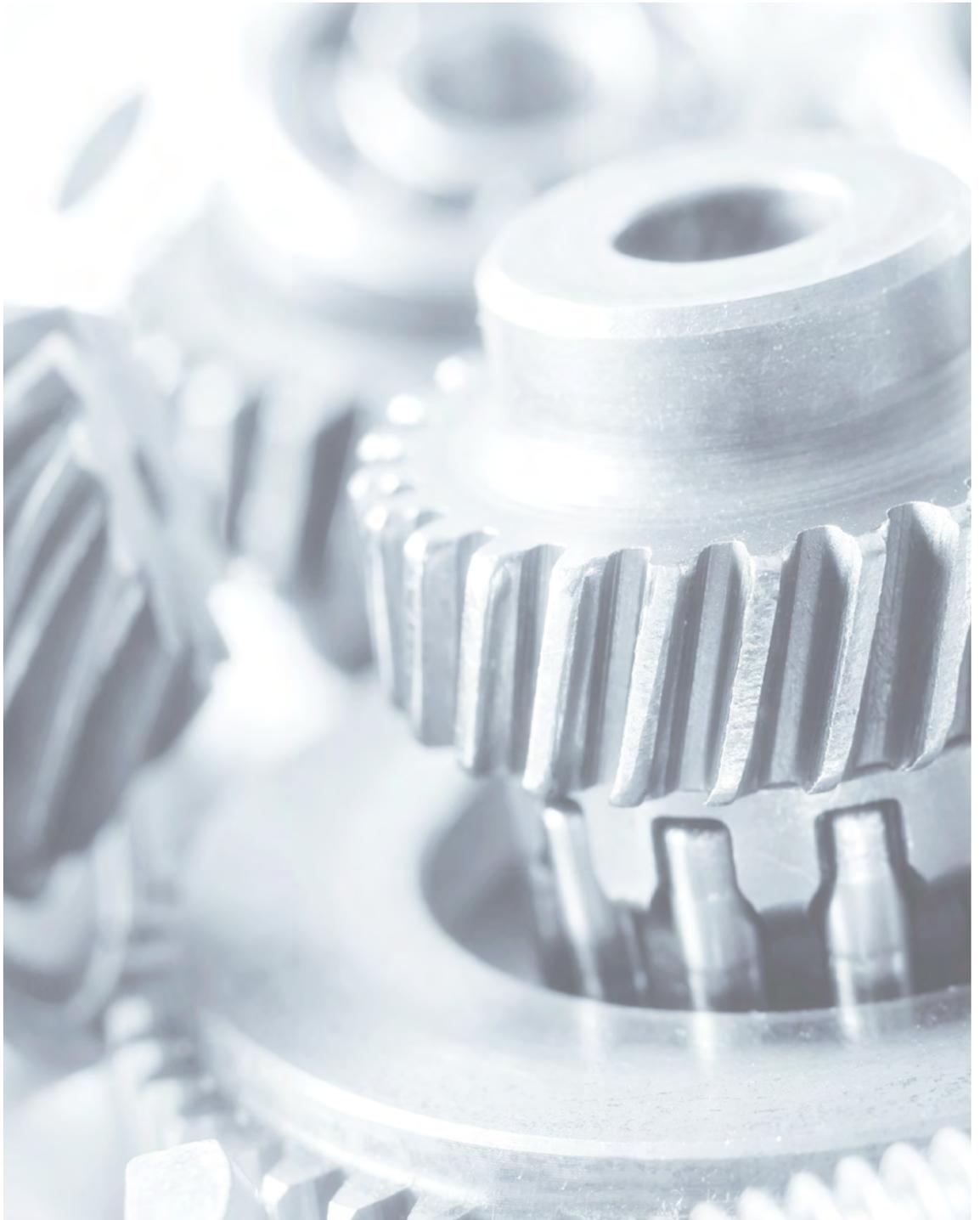


CASE STUDY

Preliminary Treatment Facility, USA

Industrial

Deodorisation by CAP AAlbuquerque Bernarillo County Water Utility Authority New Mexico, since January 2012



January 7, 2012

Measurements of PTF deodorization by CAP Clean Air Plants

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Acknowledgements

Thanks are extended to the staff of ABCWUA for their interest, motivation, and work. Thanks also for taking the CAP water samples and providing the test data.

Summary

A deodorization test was conducted at the ABCWUA Preliminary Treatment Facility (PTF) during 2010 and 2011. CAP bio-oxidation units were installed to capture and destroy hydrogen peroxide (H₂S), the key indicator of odor. The goal of the test was to prove that CAPs capture and destroy fugitive H₂S emissions.

1. CAPs formed an integral part of ABCWUA's successful efforts to control odor. Of 19 water samples taken from the CAP units, all 19 tested positive for elemental sulfur, proving that CAPs capture and destroy fugitive H₂S emissions, thus helping to deodorize the PTF.
2. 1,272,000 parts per billion (ppb) of H₂S was destroyed during the test period. This is millions of times higher than the odor threshold of 0.5 ppb, thus helping eliminate odor complaints from ABCWUA neighbors.
3. Odor was removed even though other odor control systems were in place, showing that CAPs are effective in sweeping up fugitive odors that other systems missed.
4. CAPs may also be used as a tool to measure how well the other odor control systems are working in real time---offering the opportunity to save money on chemicals by optimizing the odor control effort.
5. CAPs also are effective outdoors.

Recommendations

1. Include CAPs in any deodorization program to capture and control fugitive odor emissions.
2. Use portable CAPs outdoors: at known odor source locations, when doing maintenance, and in place of odor masking agents.
3. Use CAPs to measure and quantify odor control efforts.

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Project Description

This project was established as part of a general ongoing plant effort to control odors at ABCWUA. Odor at the plant is controlled by proper maintenance and operation, the use of a chemical scrubber, addition of hydrogen peroxide/iron in incoming sewage lines, and odor masking agents.

The purpose of this project is to prove that CAP Clean Air Plants (bio-oxidizers) placed at the Preliminary Treatment Facility (PTF) at the Albuquerque Sewage Treatment Plant sweep, capture, and destroy H₂S and other fugitive odoriferous compounds from PTF air.

Typical CAP Units

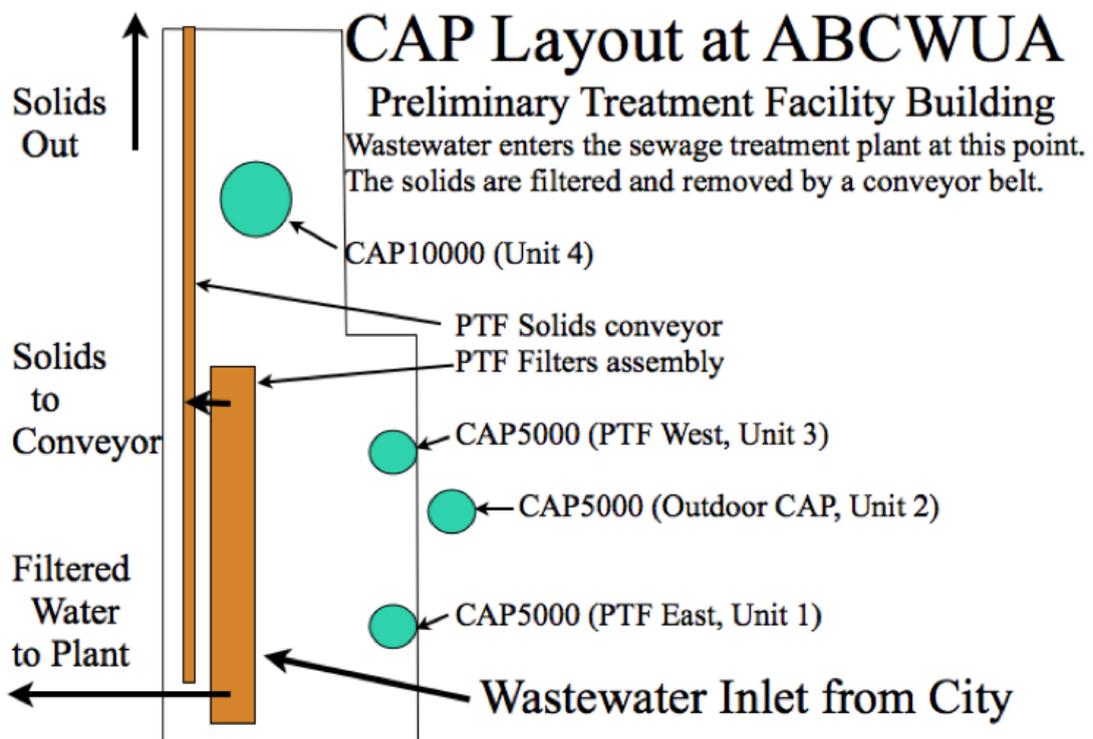
More information is available at www.u-earth.eu



Figure 1. Typical CAP10,000 models cleaned at a New York trash transfer facility.

CAP system set-up at PTF

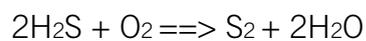
Four CAP units were placed at the PTF as shown below.



Background

Hydrogen Sulfide (H₂S) is a good indicator of odors, and has been selected as the target odoriferous compound for this project. CAPs destroy H₂S and related sulfur-containing odoriferous compounds biologically, leaving odor-less elemental sulfur as a residue in the CAP water.

Briefly, the H₂S is oxidized biologically as follows:



S₂, elemental sulfur, is non-toxic and non-odorous.

BioOx® biological media in CAPs supply the enzymes necessary for the biological destruction of odors.

Test proof of concept

The proof-of-concept for this test is that if elemental sulfur is found in the CAP units' water, then this proves that the CAP system is capable of de-odorizing the PTF by first capturing and subsequently destroying fugitive odors as represented by H₂S.

The odor detection levels for H₂S have been reported (www.nasalranger.com) as 0.0005 parts per million (ppm), or 0.5 parts per billion (ppb).

Therefore, capture and destruction of H₂S, as indicated by CAP water concentrations of elemental sulfur, proves that the CAP system is an effective de-odorizer at the PTF.

Summary of data

All of the data supplied by ABCWUA have been collected and are summarized in Table I below.

TABLE I. Summary of all PTF CAP samples. Elemental sulfur (S ₂) in CAP water, concentrations in mg/liter 19 out of 19 CAP water samples test positive for sulfur							
Dates	Unit 1 PTF East	Unit 2 Out- side	Unit 3 PTF West	Unit 4 CAP 10k	H ₂ S destruction from PTF air		
					per period ppm H ₂ S	cumulative ppm H ₂ S	per day ppm H ₂ S
Sept 8 - Dec 10, 2010 90 days	1,950		2,900		601.2	601.2	6.68
Dec 10 - Feb 7, 2011 60 days	280	270	270		101.7	702.9	1.695
Feb 7 - May 13, 2011 97 days	560 540	270 250	850 1,400		239.6	942.5	2.47
May 13 - Aug 4, 2011 83 days	950 930	200 200	1,000 1,200	200 200 (60 days)	329.8	1,272.3	4.22

Calculation Method and Project History

The purpose of this section is to demonstrate how to translate the elemental sulfur data from the CAP liquids, into equivalent air pollution data for the PTF.

Example calculation: An average reading of 1,900 mg/liter of elemental sulfur, S₂, is reported by a third party analytical lab measuring the test. The sample is an average reading for two CAP5000s, each containing 600 liters of water, and the units have been running for three months since the last cleaning.

1,900 mg/liter = 1.9 gram/liter. Assuming 600 liters in one CAP, x 1.9 g/liter, this is 1.14 Kg captured sulfur per CAP.

90 days since the last cleaning: $1,140/90 = 12.7$ grams per day of sulfur were removed by each CAP.

Assuming a building volume of 120,000 ft³, divided by 360 ft³/lbmole = 333.3 lbmole air in PTF building (1 gram mol = 22.4 liters).

Molecular weight adjustments: Molecular wt. of H₂S = 34, mw S = 32. $12.7 \text{ g S} \times 34/32 = 13.5 \text{ g H}_2\text{S}$, / 454 g/ lb = 0.0297 lb, / 34 = 0.000874 lbmole H₂S, / 333.3 , x 1,000,000 = 2.62 ppm H₂S removed every day by each CAP.

Result: Over the 90 day period, 236 ppm H₂S were removed by each CAP.

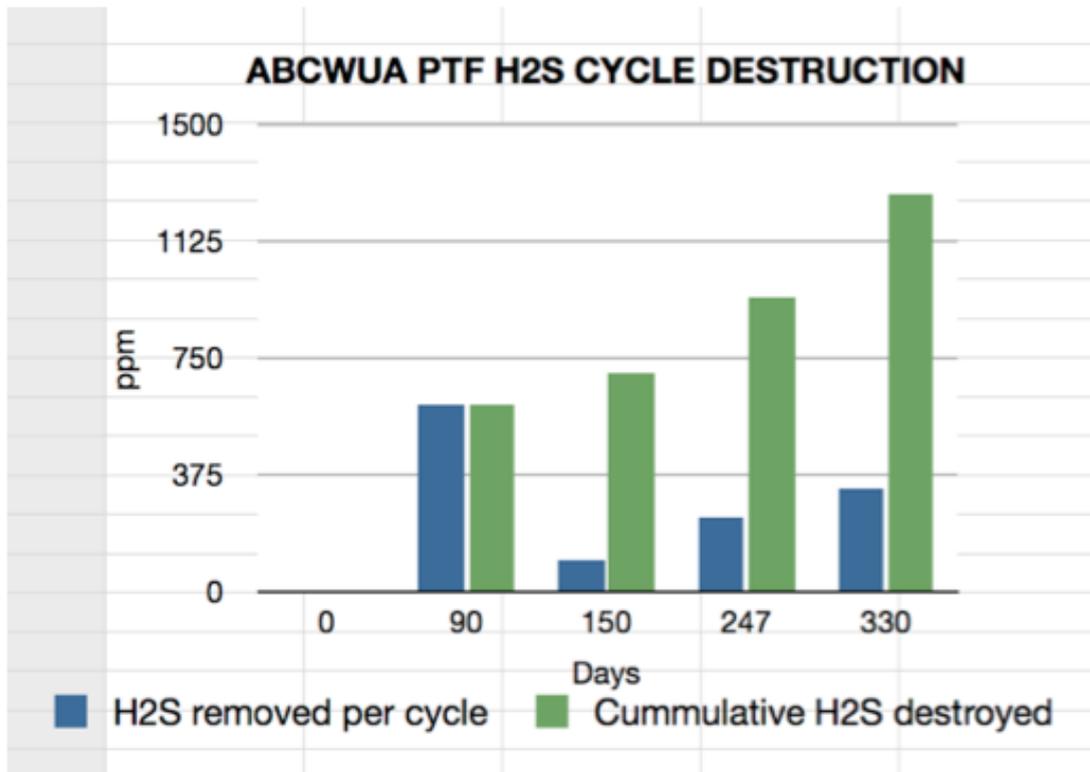
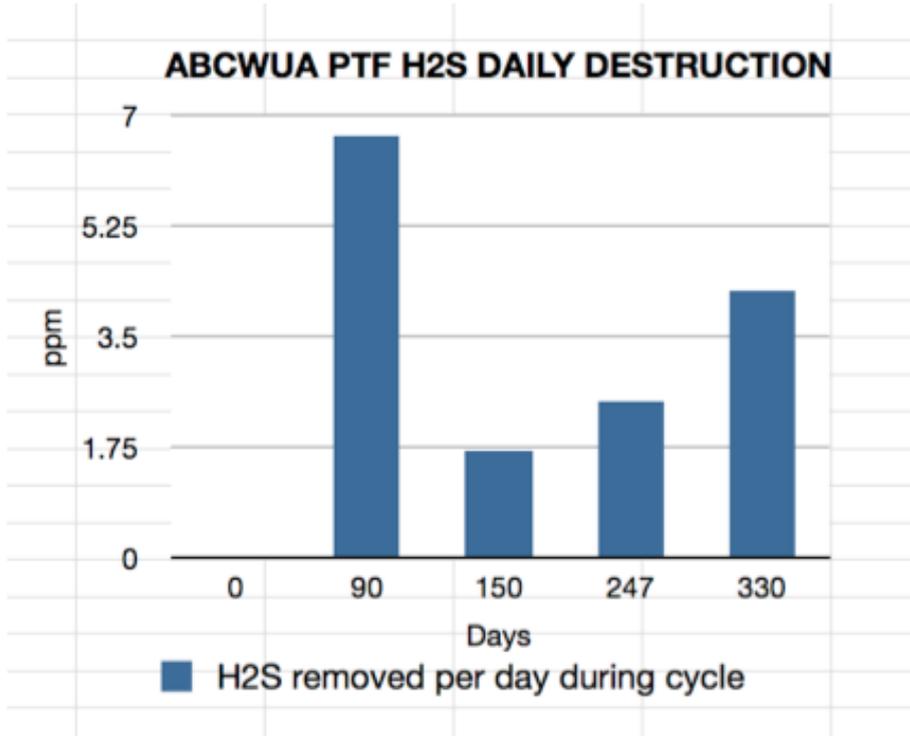
The two CAPS removed 472 ppm H₂S from the building during the test period.

These calculations were applied for all the data periods, and are presented in Table II below.

Table II. Project History, ABCWUA PTF Desulfurization			
Day	ppm H2S removed	H2S destroyed, ppm/day	Total H2S destruction, ppm
0	0	0	0
90	601.2	6.68	601.2
150	101.7	1.70	702.9
247	239.6	2.47	942.5
330	329.8	4.22	1272.3

Agreement of Data: ABCWUA and AWSI

The data below are taken from the ABCWUA report. There is general agreement between ABCWUA findings and the findings of Air and Water Solutions, Inc.



Results

ABCWUA staff took 19 samples of CAP unit water, and sent them out for 3rd party analysis.

Nineteen out of nineteen samples tested positive for sulfur, indicating positive deodorization of fugitive odors at the PTF.

Over 1,200 ppm of H₂S were captured and destroyed by the CAP Clean Air Plants during the test period, even though the PTF scrubber, and the Fe/peroxide system were operating.

This is over two million times the odor threshold.

Conclusions and Recommendations

1. CAPs capture and destroy H₂S from PTF indoor air.
2. A CAP system is recommended for control of fugitive odors at the PTF.
3. CAPs capture and destroy H₂S from plant outdoor air. The CAP5000 placed outside the PTF also captures odors.
4. A portable CAP5000 is recommended for outdoor odor control, during repairs and for normal operations.
5. CAP systems may be used as a tool to measure the amount of fugitive H₂S.
6. By quantifying the amount of odors generated, other systems using chemicals, such as scrubbers, iron/peroxide additions, and masking agents may be minimized. This will lead to savings in chemical costs and power consumption.

This means the CAPs were instrumental in sweeping fugitive odors, and helping you achieve your perfect record of 'no odor complaints' this summer.