SOMERSET ENVIRONMENTAL SOLUTIONS

www.somersetenvironmental.com

Introducing the Maelstrom Oxidizer®

a revolution in AMD treatment

April 2017

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What is a Maelstrom Oxidizer®

A Black Box!

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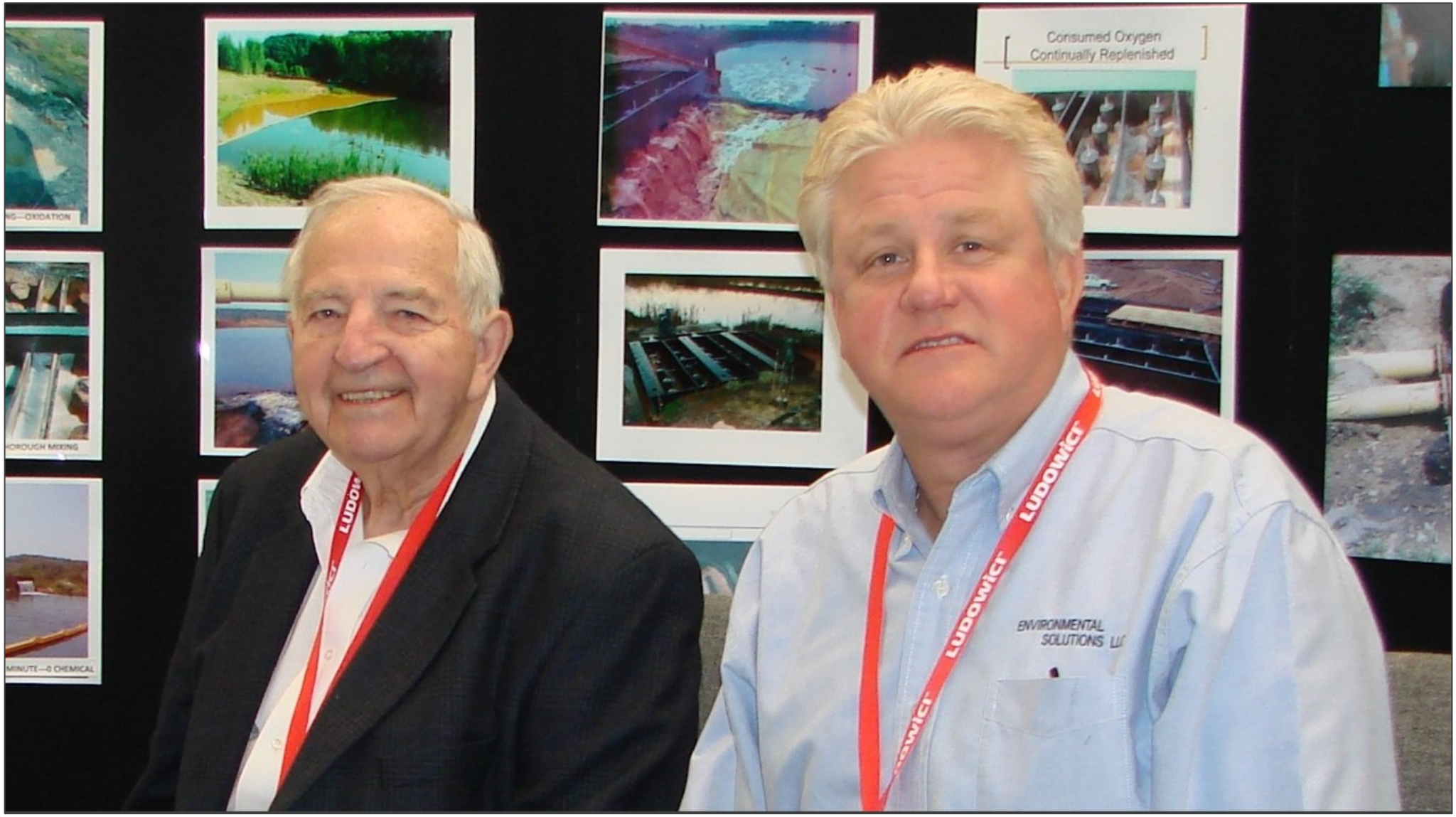
Somerset Environmental Solutions, Inc.

a little history . . .

- **Presentation by Jeff Hayden - President of SES**
  by Jim Oliver - VP of Operations
  by David Lloyd - Technical Sales Rep
  by Glenn Hazuka – Technical Sales Rep
- **The Maelstrom Oxidizer® was invented in years ago by Don Budeit**
- **Has not been significantly marketed and utilized until recently**
- **October of 2015, Somerset Coal International purchased the patent and rights from Environmental Solutions and formed Somerset Environmental Solutions (SES)**


Consumed Oxygen
Continually Replenished
LUDOWICI
ENVIRONMENTAL
SOLUTIONS LLC

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What is a Maelstrom Oxidizer®

- A patented Black Box!
- An Oxidizer - Fe
- A Degasser – CO_2
- A pH Raiser
- A Chemical Reducer

. . . An amazing device that allows you to consistently meet state and federal water quality standards

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The old company has quite a few systems installed:

Basic steel tank

½” or ¾” wall warping

The first units were very basic - (5’ X 10’ by 5’) steel, then went to HDPE plastic. Even though they worked very well as seen here treating water with 1800 ppm of iron and 450 + ppm of Mn, improvements were needed.

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Major Improvements in design, efficiency and strength!

Can build from 4’ x 4’ x 4’ to 10’ x 20’ x 6’

. . . or from 100 gpm to 10,000 gpm.

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So what does a Maelstrom Oxidizer® do?

The Maelstrom Oxidizer® is an apparatus and method for single pass mass transfer of oxygen into a liquid while off gassing CO2. The MO is comprised of individual aeration chambers aligned in sequence to allow continuous gravity flow of water to be permeated with oxygen repetitively until O2 saturation is achieved.


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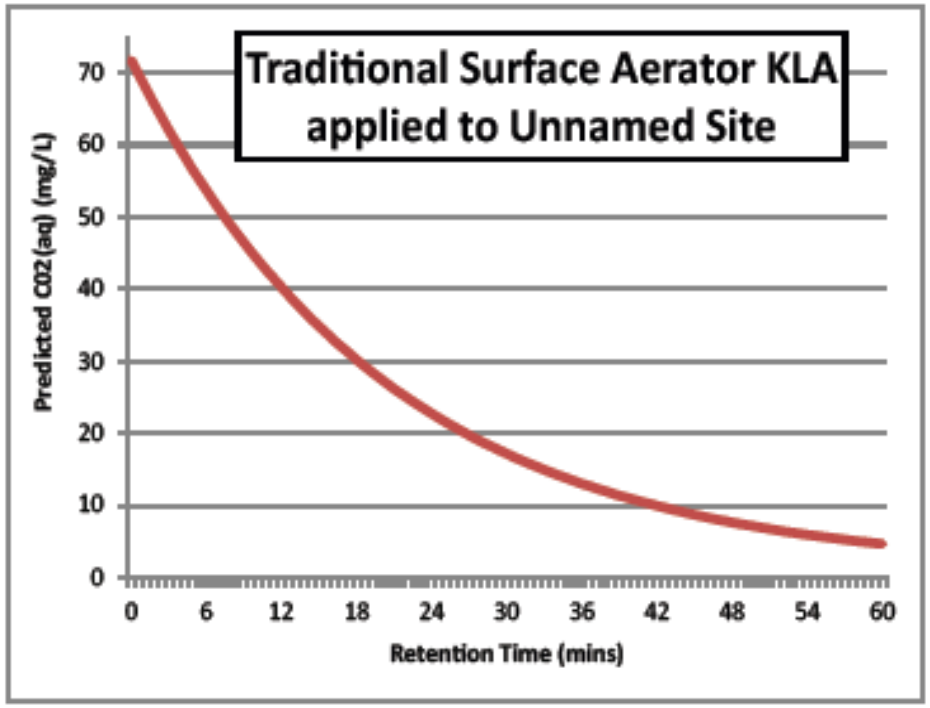
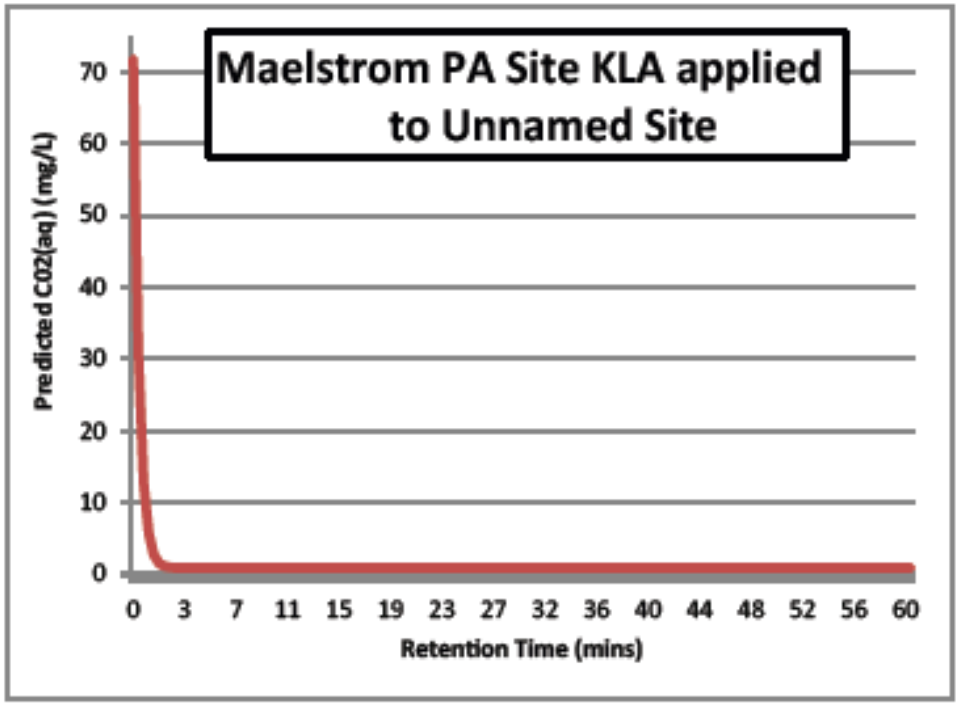
So what does a Maelstrom Oxidizer® do?



Amount of CO_2 predicted to Unnamed site over a span of 60 minutes using a Traditional Surface Aerator KLA.



Amount of CO_2 predicted to Unnamed site over a span of 60 minutes using Maelstrom PA Site KLA.

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So what does a Maelstrom Oxidizer® do?

Oxidation Rate of Iron at Dissolved Oxygen Saturation

pH	Hours	Days	Minutes	Seconds
4.5	35,000	1400		
5.0	3,500	140		
5.5	350	14		
6.0	35	1.46		
6.5	3.5			
7.0			21	
7.5			2.1	
8.0				**12.6**
8.5				**1.26**

Inherent design feature of the Maelstrom Oxidizer ®

- The MO supplies oxygen to raw water in **the most effective way possible** at the lowest cost and smallest footprint of any other technology available

- Efficiency = lbs O_2 transferred per Hp-hour. Compared to a surface aerator, the MO is 60 x more efficient, therefore, operating costs will be significantly lower!

- The Maelstrom Oxidizer® has proven successful in its effects on pH, Fe, Mn, Al, CO2 removal and phosphate and ammonia reduction

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Something else the MO does . . .

less chemical means less sludge and less cost

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West Virginia Mine Drainage Task Force

2015 Symposium Papers – West Virginia Mine Drainage Task Force

Effects of Carbon Dioxide on Acidity Measurement and Water Treatment – Presentation [.pdf 4mb] | Paper [.docx 20kb] Brent Means, OSMRE, Harrisburg, PA

There was a paper presented here in 2015 by **Brent Means**, along with the help of **Brad Parker** and **Rich Beam**. This is a very involved paper with a lot of technical data on CO_2 removal using the Maelstrom Oxidizer®. We want to give a special thanks to these gentlemen for this paper and the time they put into it. We will not be doing anything as technical as they did but focused more on the functional and economics side of the Maelstrom Oxidizer® . . . so let's get to some of the actual field data from sites with the MO.

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Trent - central PA

This is a site I am very familiar with, where I first was introduced to The Maelstrom Oxidizer®.
1000 GPM, high Fe, high Mn, difficulty meeting 9 pH after treatment – had to introduce acid!
$86,000 per month to $32,000, meeting all NPDES specs!

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Rocklick – central eastern WV

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Rocklick – central eastern WV

1500 GPM, Fe and Mn issues, high cost!
The Maelstrom Oxidizer® used here to drive off CO_2 and save a whopping 90% of their chemical costs.
Approximately $430,000 in savings every year while meeting all NPDES discharge limits
. . . Couldn't get the chemical delivery pump turned down low enough!

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EMC #8 – eastern KY

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EMC – eastern KY

1000 GPM, Fe and Mn issues, medium cost
100% Lime reduction plus chemical feed system maintenance eliminated
. . . not to mention sludge disposal $

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Rico – southwest CO

600 GPM, large private company, not far from The Gold King Mine Site

This is a Bio Remediation treatment system, and mainly a passive type site except for the MO

The purpose of the MO was to raise the pH and eliminate ferrous iron in their first pond

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Rico – southwest CO

Same site with fiberglass covers
The MO also skyrockets the raw water's Dissolved Oxygen, thereby helping the Bio-Remediation process

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Somerset Environmental Solutions - Installations & Estimations

	Site Name	Location Address City, State	Year Installed	GPM	Size	Chemical Used	Issues	Chemical Reduction
1	Trent	Somerset, PA	2013	1000	10'x10'x5'	Lime Slurry	fe, Mn	> 60%
2	Mine 91	Sarver, PA	2013	80-200	5'x6'x5'	Caustic	fe, Mn	100%
3	St. Michaels	St Michaels, PA	2014	5,000 -10-000	(4) 10'x20'x6'	Lime Slurry	fe, Mn	> 65 %
4	Laynes Branch	Kimper, KY	2016	250	6'x4'x5'	Caustic	fe, Mn	80%
5	Helvetia Borehole	Helvetia, WV	2016	250	6'x4'x5'	Caustic	fe, Mn	100%
6	Indian Lake	Somerset, PA	2016	150	4'x4'x4.5'	Caustic	fe, Mn	65%
7	Rocklick	Wharton WV	2016	3,000	10'x12'x5'	Caustic	fe, Mn	85%
8	Jack's Branch	Greenwood, WV	proposal	3,000	(2) 10'x10'x5'	sodium permang	staining	75%
9	Wharton Prep Plant	Wharton WV	proposal	30	4'x4'x5'	caustic	fe, Mn	86%
10	Consol	North Branch	proposal	8,000	(4) 10'x20'x5'	Lime	fe, Mn	75%
11	Kingdom Coal	EMC DM #8	proposal	1,000	10'x10'x5'	quick lime	fe, Mn	100%
12	Consol	Laurel Run	proposal	2,600	(2) 10'x12'x5'	lime	fe, Mn	80%
13	Alpha	Mine #1 - 026	proposal	400	10x 5'x5'	caustic	fe, Mn	80%

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Rule of thumb savings . . .

Precentage Reduction with MO installed			
Type of Site	**Chem $/mo**	**Labor $**	**Sludge Handling $**
Deep	65%	25%	65%
Plant	10%	0%	10%
Refuse	10%	0%	10%
Surface	45%	25%	45%

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What is a Maelstrom Oxidizer®

- The patented Maelstrom Oxidizer® quickly and efficiently causes hazardous metals to precipitate out of your raw water with the least amount of chemical – GAURENTEED!
- The absolute best oxidizer in the business for treating raw water
  - Smallest footprint
  - Lowest operating cost
- Consistently meet state and federal water quality standards
- Field consultations are FREE!

PAYBACK OFTEN LESS THAN 1 YEAR

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