



Tokyo Water Park

Take a look at this picture of Tokyo Water Park where their slogan reads:

"Welcome to breathtaking Tokyo Water Park where you can wash away the pressure and stress of the overcrowded city and relax with your friends in the soothing enjoyment of sun, fun and splashing."

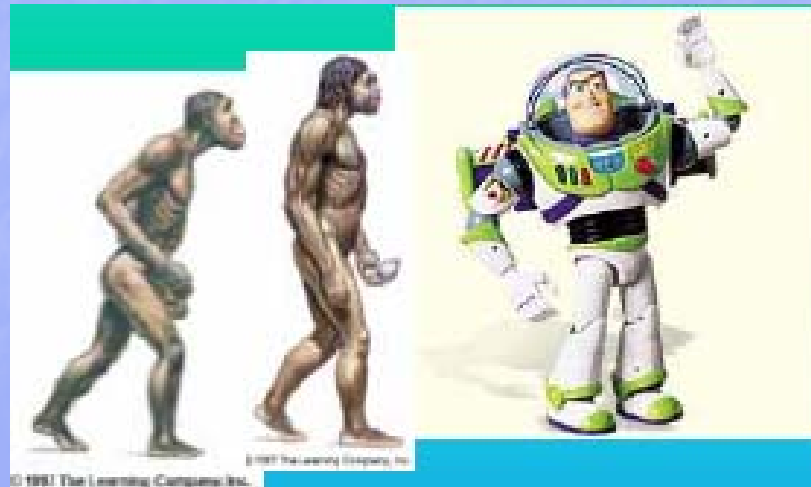


Ozone Breakthroughs

John Overby
Ozone Water Systems
May 9th, 2007

Evolution of "Ozone" over the past few years...

Then and Now



1

Ozone Safety

THEN



0.1 ppm

UV Absorption



\$ 7,000 - \$ 8,000



NOW

\$ 500 - \$ 2,000

* 0.1 ppm



HMOS

(Heated metal oxide semiconductor)

Electrochemical

SELF CHECKING SENSOR



Safety - Now

- Regulatory Agencies (Here is what they say...)

US EPA (Outdoor)

0.08 ppm, not to be exceeded more than one time daily.

OSHA (Occupational Safety and Health Administration)
(Indoors - Workers)

- PERMISSIBLE EXPOSURE LEVEL -- 0.1 ppm
- SHORT-TERM EXPOSURE LEVEL -- 0.3 ppm for 15 minutes, with only one exposure per day permitted to this level of ozone.

US Food and Drug Administration (Indoors confined 24/7)

0.05 ppm (EPA Indoor Air Quality at 0.05 ppm)

Schwarzenegger Bans Ozone in California !

OZONE... It's NOT SAFE!



AB 2276 (Pavley) requires California... develop and implement standards that reduce ozone emissions from non-commercial indoor air cleaning devices... "air purifiers" emit large amounts of ozone, an air pollutant linked to lung disease, asthma, and premature death. These devices, advertised as protection against indoor air pollution, are not only ineffective, but do significant harm by raising ozone levels.



0.05 ppm



What do we do now?

- * Add Safety Monitors
Equipment Rooms
Contact Equip. Area
Exhibit Areas
Public Places
- * Add Ozone Destructs
- * Remote Alarm Panels



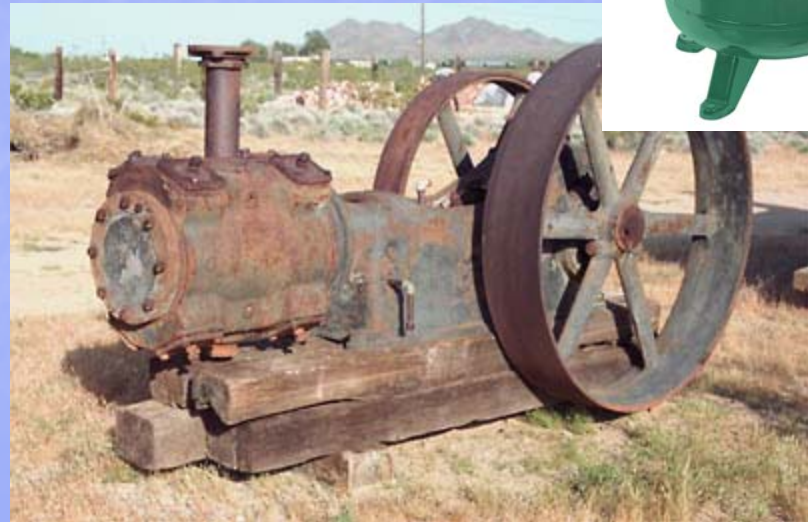
EDUCATION

2

Air Preparation

THEN

- * Reciprocating
- * Noisy
- * Oil Free
- * High Temperature





NOW

Screw/Scroll
Quite

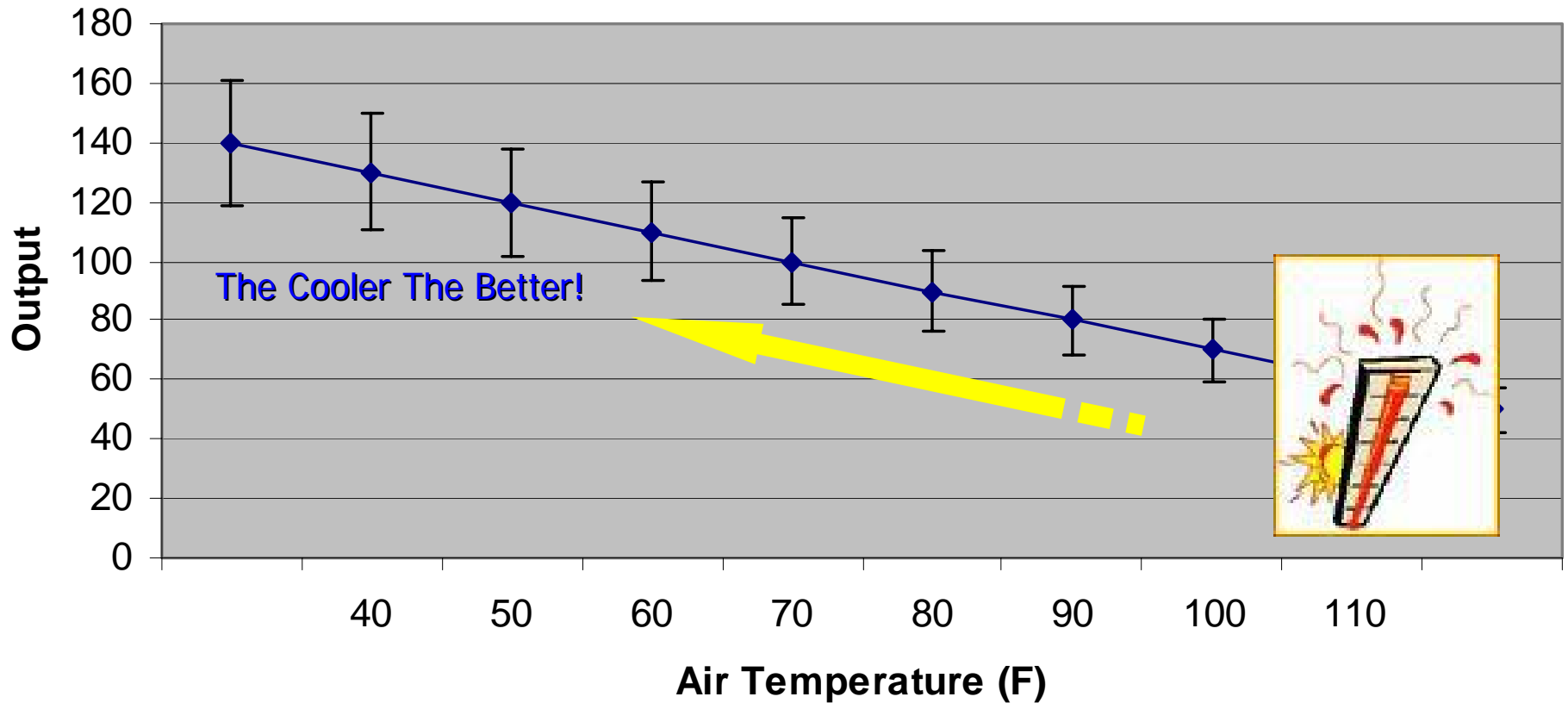
Low RPM Motor

LOW Air Discharge Temperature



Feed Gas Temperature

Ozone Output versus Feed Gas Temperature



Air Compressors

Discharge Compressor Air Temperatures

NOW	Screw (with oil aftercooler)	+ 10 F
	Scroll (with oil aftercooler)	+ 10 F
	Vane (with oil aftercooler)	+ 15 F
THEN	Oil Less	+ 100 F
	Reciprocating	+ 250-350 F



NOW

Oil Lubed
Cleans
Cools
Lubricates

~~Oil-Less
High Temperature Discharge
No Lubrication
Need Annual Rebuild
Oil Filtration Required~~

3

Ozone Generators

THEN

Line Frequency

Water Cooled

Air Fed

All Interfaces Built In

Pricey





NOW

Mid Frequency

Air/Water Cooled

Air/Oxygen Fed

NO Interfaces Built In

LOW Price



DELZONE CD-2 thru CD-45G

Tomorrow

Electrocatalytic
Chemical
Polymer Electrolytic Membrane (PEM)

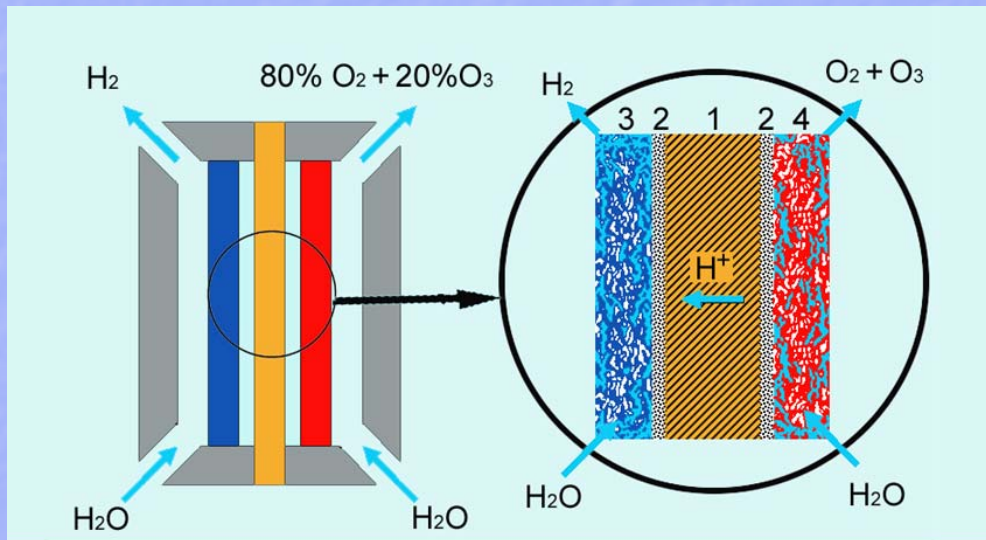


Fig.1: Basic PEM cell

1. Membrane 2. Catalyst 3. Porous cathode 4. Porous anode



Easy to Operate
Easy to Install

No Feed Gas Required

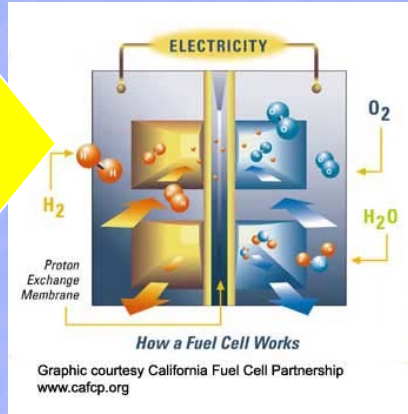
Just add electricity and pure water

Oxygen Feed Gas
8-20% weight

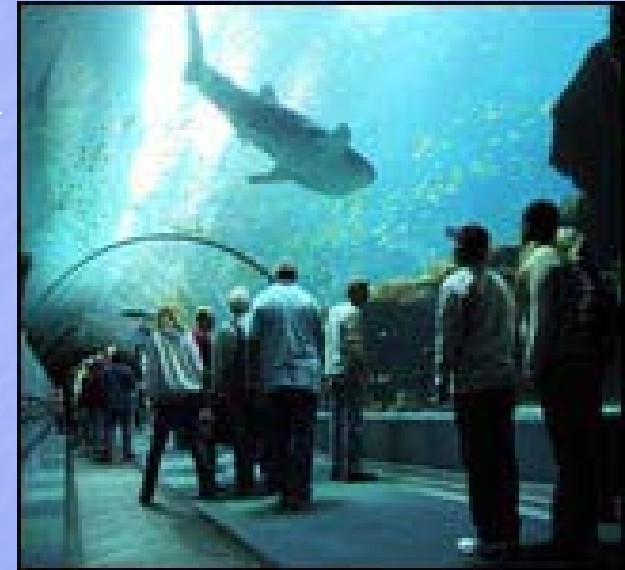
ENERGY



HYRDOGEN



OZONE



WATER

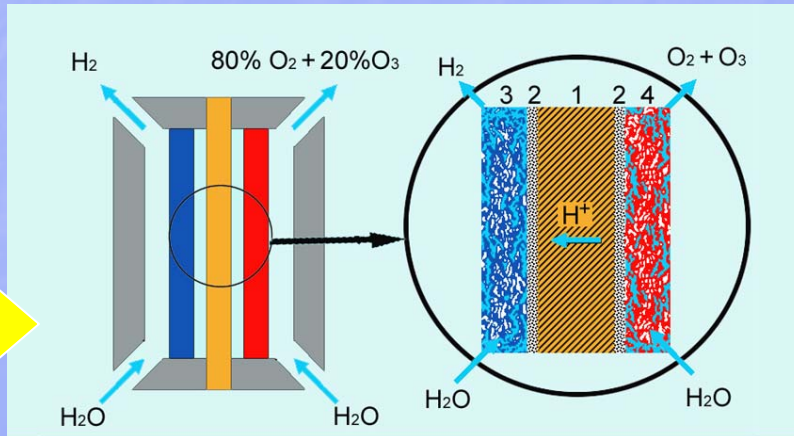


Fig. 1: Basic PEM cell

- 1. Membrane
- 2. Catalyst
- 3. Porous cathode
- 4. Porous anode

PEM Technology

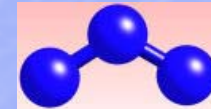
4

OZONE
CONCENTRATION

THEN

Air

1 % Wt.

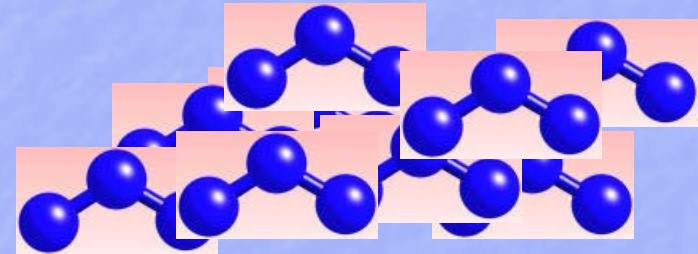


Feed Gas

NOW

Air/Oxygen

3-10 % Wt.



Feed Gas

What Changed?

Mid Frequency
Oxygen Feed
...Technology





Gas Flow

x



Ozone Concentration
%

=



=

lb/day

Rule of Thumb: 1 lb/day has 1 SCFM at 1% Wt.

1 lb/day has 0.1 SCFM @ 10% Wt.

Result is
Lower Gas
Flow



Technology
1 % - 10%
INCREASE



Same Ozone
Output

$$\text{Gas Flow} \times \text{Ozone Concentration \%} = \text{lb/day}$$

10 lb/day @ 1% wt required 10 SCFM

NOW 10 lb/day @ 10% wt requires 1 SCFM

Lower Gas Flow =

Smaller Air Compressor (Oxygen Concentrator)

Lower Equipment Price \$

Lower Feed Gas Operating Price \$

SAME OZONE PRODUCTION (lb/day)

5

Oxygen

THEN

Never Used in this industry

Laboratory

Ultrapure Water

Pharmaceutical

Large Ozone Plants (> 600 lb/day)

Semiconductor Industry

NOW

Ozone and Oxygen generators
closed (not complete) as of
03/21/2002



Widely Used...

Double Production (lb/day)
2x to 10x Ozone Concentration (%)
SAME OZONE GENERATOR



They do make great
Mouse Traps...

Oxygen Equipment Checklist

Confirm Oxygen Purity/Dew point (Monthly)

Check for Internal Leaks Monthly

Be Careful !





Oxygen Accelerates Fire



Oxygen Monitor?

FEED GAS ?

AIR or OXYGEN

Life Support Engineer Design Question

Some ozone units only run on oxygen !



6

Ozone Equipment Safety Devices

THEN...

Gas Flow Switch

Gas Pressure Switch

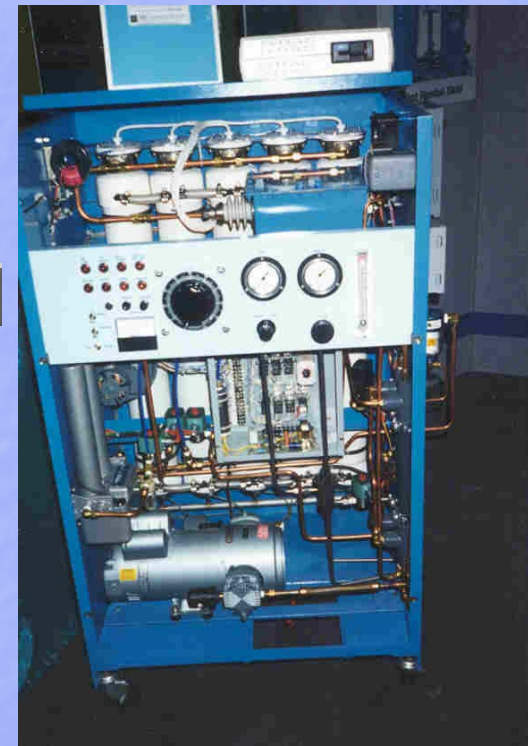
Water Flow Switch

Water Pressure Switch

Dew Point Monitor

Backflow Prevention

Thermal Oxygen Shut Off



NOW...



~~Gas Flow Switch
Gas Pressure Switch
Water Flow Switch
Water Pressure Switch
Dew Point Monitor
Backflow Prevention
Thermal Oxygen Shut Off~~

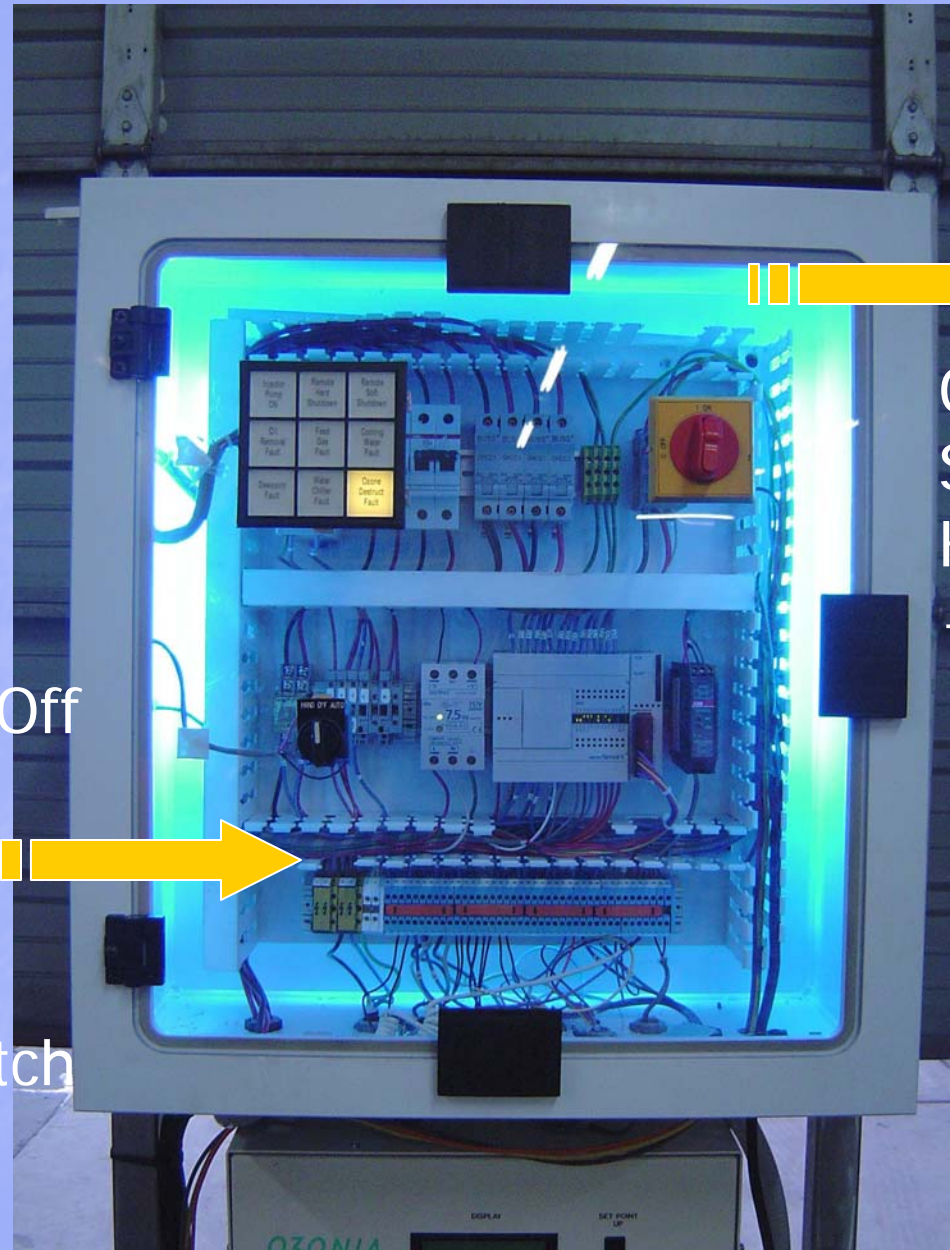


If going **NOW** ...

Add an interface panel

Thermal Oxygen Shut Off
Gas Flow Switch
Dew Point Monitor
Backflow Preventer

Water Flow Switch
Gas Pressure Switches
Water Pressure Switch
Ambient Ozone



On/Off
Soft
Hard
++

10 YEARS AGO...

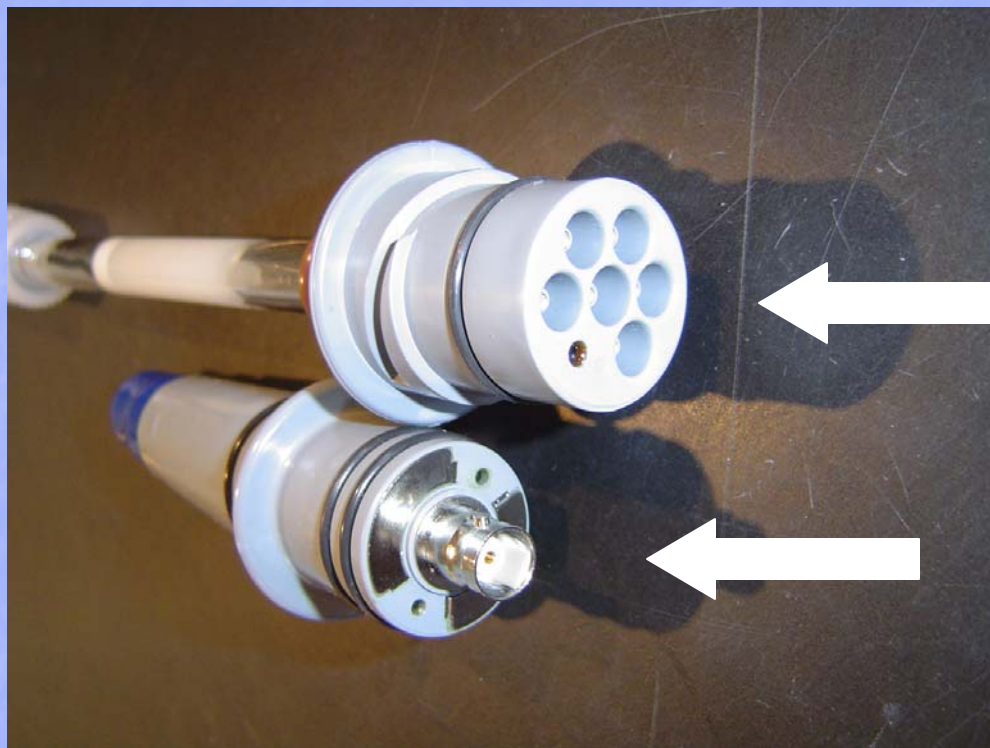
3 lbs/day of ozone cost \$ 22,000

Price Includes Air Preparation and Interface

TODAY?

7

ORP



NOW

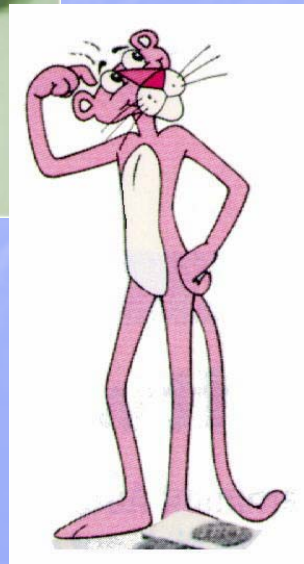
THEN

Wet Tap Device - Signet

New Preamp Required

8

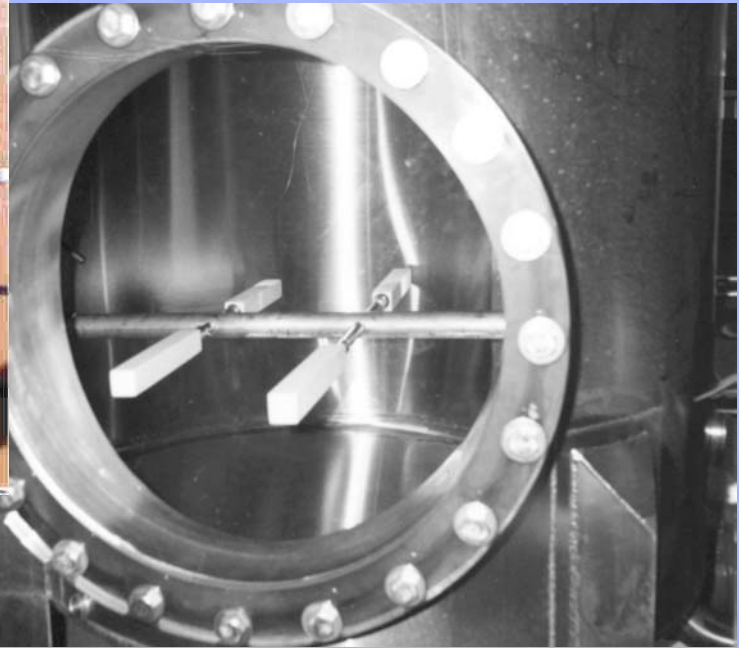
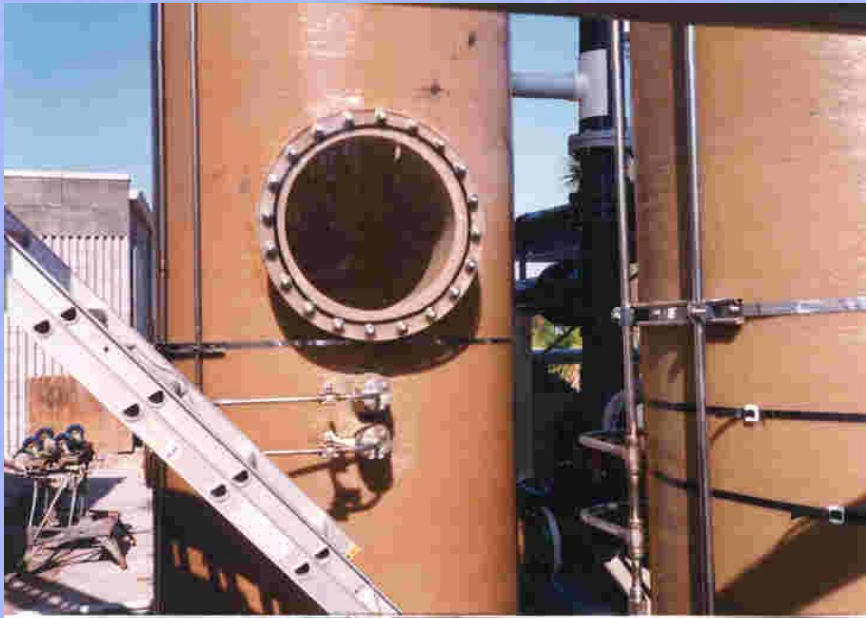
Value Engineering



9

Ozone Gas Contacting

THEN



NOW



Soil Remediation

Agriculture

Wine Industry

Swimming Pools

Food Applications

10

Storm Water Treatment

Laundry

Shrimp Farming

Ozone

Ice Machines

Garment Processing

Wastewater

Bottled Water

Drinking Water

Cooling Tower

Brewery

Clean In Place

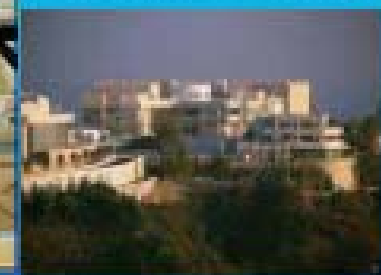
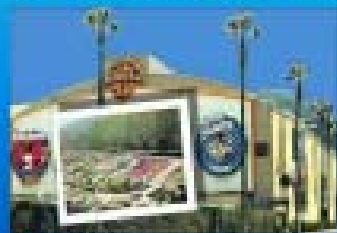
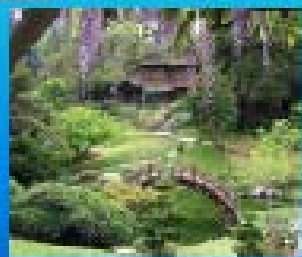
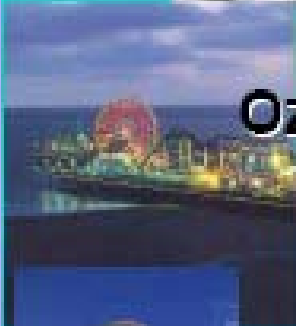
Urban Water Treatment



**- World Congress on
Ozone and Ultraviolet Technologies -
Los Angeles
27-30 August 2007**

www.iuva.org

www.io3a.org



August 27th - 30th



OZONE WATER SYSTEMS, INC.



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Ozone Water Systems
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