Dual-BioPhase BioOxidation

A Green, Energy-Efficient Approach to VOC and HAP Emission Destruction

Atlanta, GA
4/7/2016

OXIDATION TECHNOLOGIES
For a Better Environment
Serving Industry since 1969
www.pcc-sterling.com

The PCC Experience

- ✓ **Proven Experience**
  - Over 45 Years in the APC Business
- ✓ **Diverse Technical/Application Experience**
  - Wide range of waste streams & applications)
- ✓ **Customer Oriented**
  - We Custom Design to our Clients Needs
  - We “Do What We Say We Will Do”
  - We are Flexible and Easy to Work With
- ✓ **Solid Industry Reputation, Strong PM, Experienced Personnel**

PCC BIO-OXIDATION

WHY ADD BIO-OXIDATION TO OUR PRODUCT LINE?

- PCC wanted the ability to offer a “non-thermal” solution where appropriate.
- Alternative to RTO’s in many applications
- Dual-BioPhase Technology is new and innovative
- “Green” Technology

BIOLOGICAL OXIDATION

"GREEN TECHNOLOGY"

- Does Not Consume Natural Gas
- Does Not Generate NOx SOx CO
- Produces ~90% Less CO_2 vs. Thermal Oxidation
- Operates at Ambient Temperature and Low Pressure.

BIOLOGICAL OXIDATION

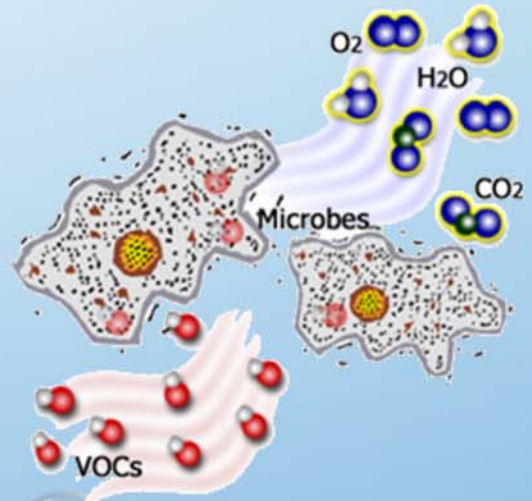
Biological oxidation (Bio-filtration):

- ✓ Process whereby contaminants transfer from air phase to biofilm
- ✓ Biodegraded by microorganisms.

Pollutant + Bacteria + Oxygen + Nutrients → CO_2 + H_2O + More Bacteria

Biofilm is the primary element of the Bio-Oxidizer involved in the destruction of the contaminants.

As Biofilm continually grows, it sloughs itself off to maintain the microbial colony health.



MICROBES a.k.a Bacteria or Bugs

"Microorganism" refers to a wide variety of single cell, live bacteria.

Given sufficient time and quantities, bacteria can biodegrade nearly anything.

e.g. sugar, starch, sulfur, and iron….

MICROBES a.k.a Bacteria or Bugs

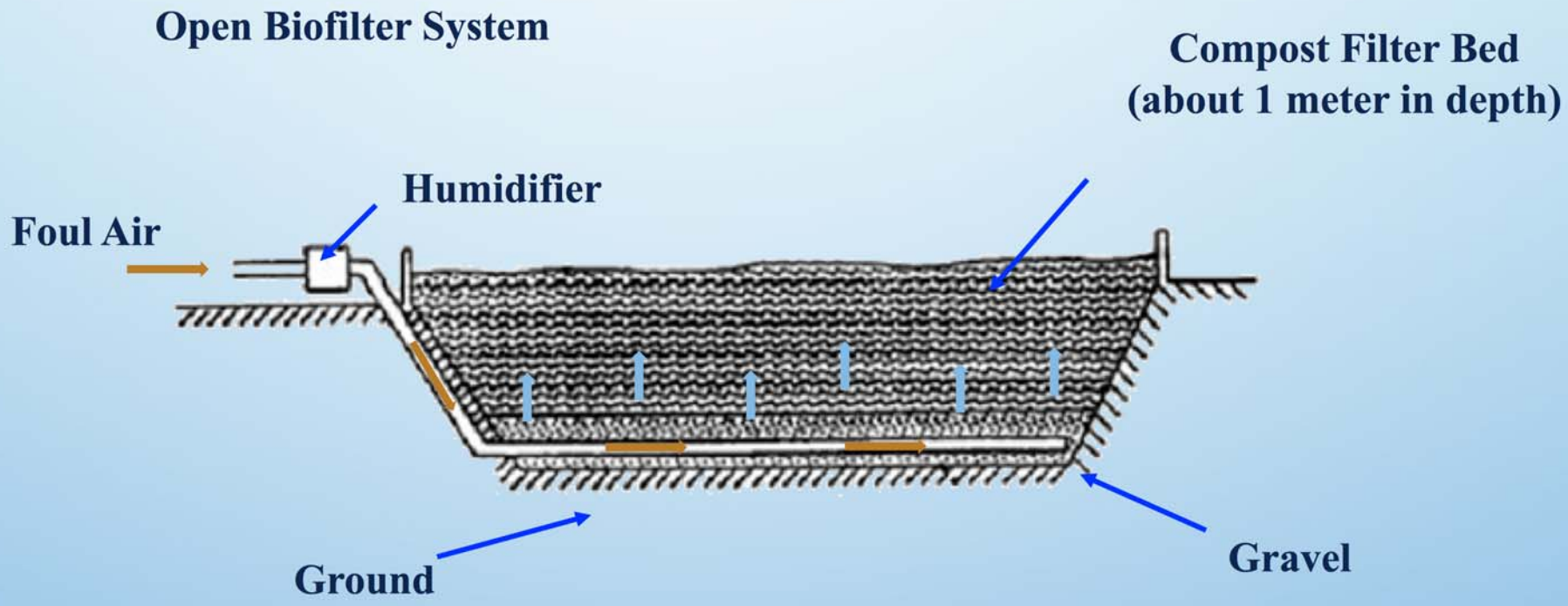
FAQ>>> “What happens if the Bugs get out of the bio-oxidizer unit?”

Nothing……..

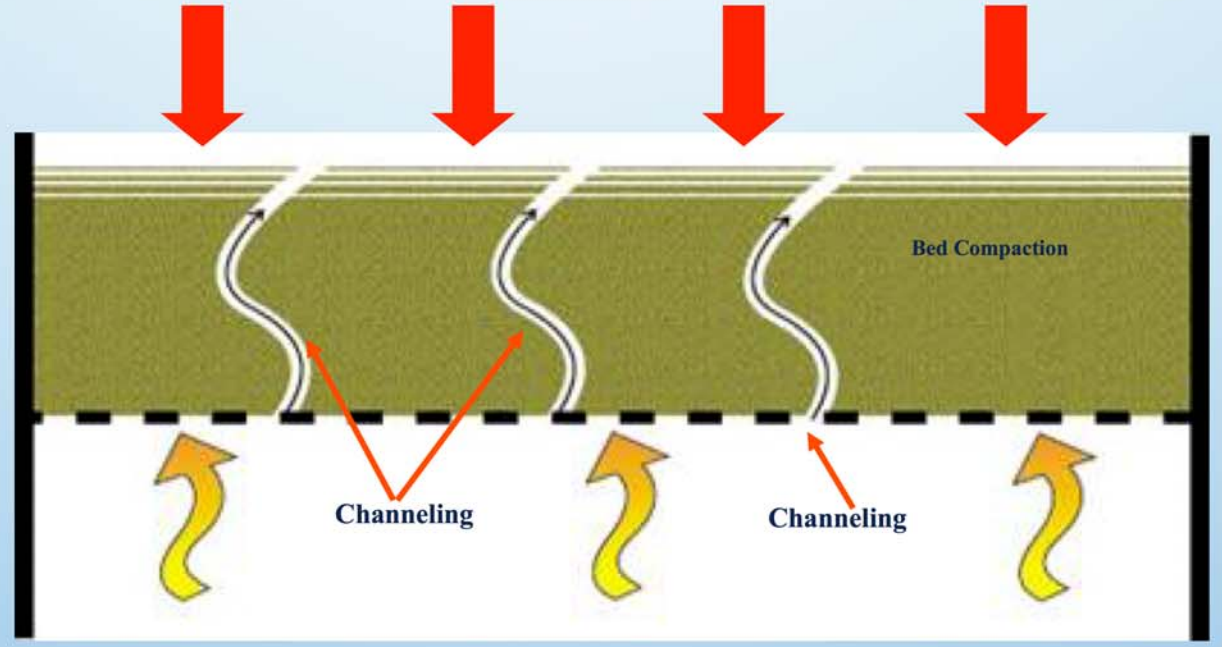
Bacteria is Everywhere in Nature

- ✓ We utilize naturally occurring bacteria.
- ✓ We create an environment which allows them to work in an enhanced and significantly more efficient manner than typically found in nature.

Early Bio-Filter Designs



Early Bio-Filter Designs



BIO-OXIDATION MEDIA

✓Types

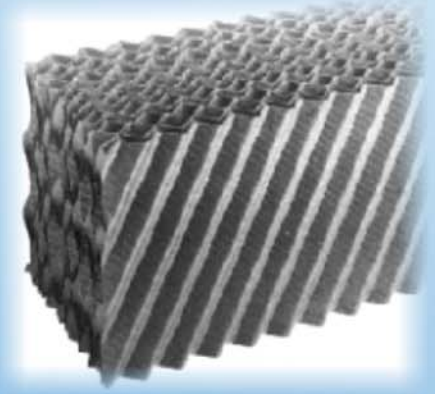
- Old technology: Natural Bio-active Media

Natural Bio-Active Media
(old technology)

- ✓ Microorganisms and Nutrients are Captive within the Media Structure
- ✓ Biomass Cannot be Separated from Media
- ✓ Media Replacement is Required due to Decomposition
- ✓ Biomass Growth Causes Media Compaction
- ✓ Continually Increasing ΔP
- ✓ Media needs Fluffed to Obtain Porosity
- ✓ Media Height is Limited Due to Maintaining Proper Moisture Content

BIO-OXIDATION MEDIA

- ✓ Types
  - New technology: Synthetic Media



NOT PCC BIO-MEDIA!!

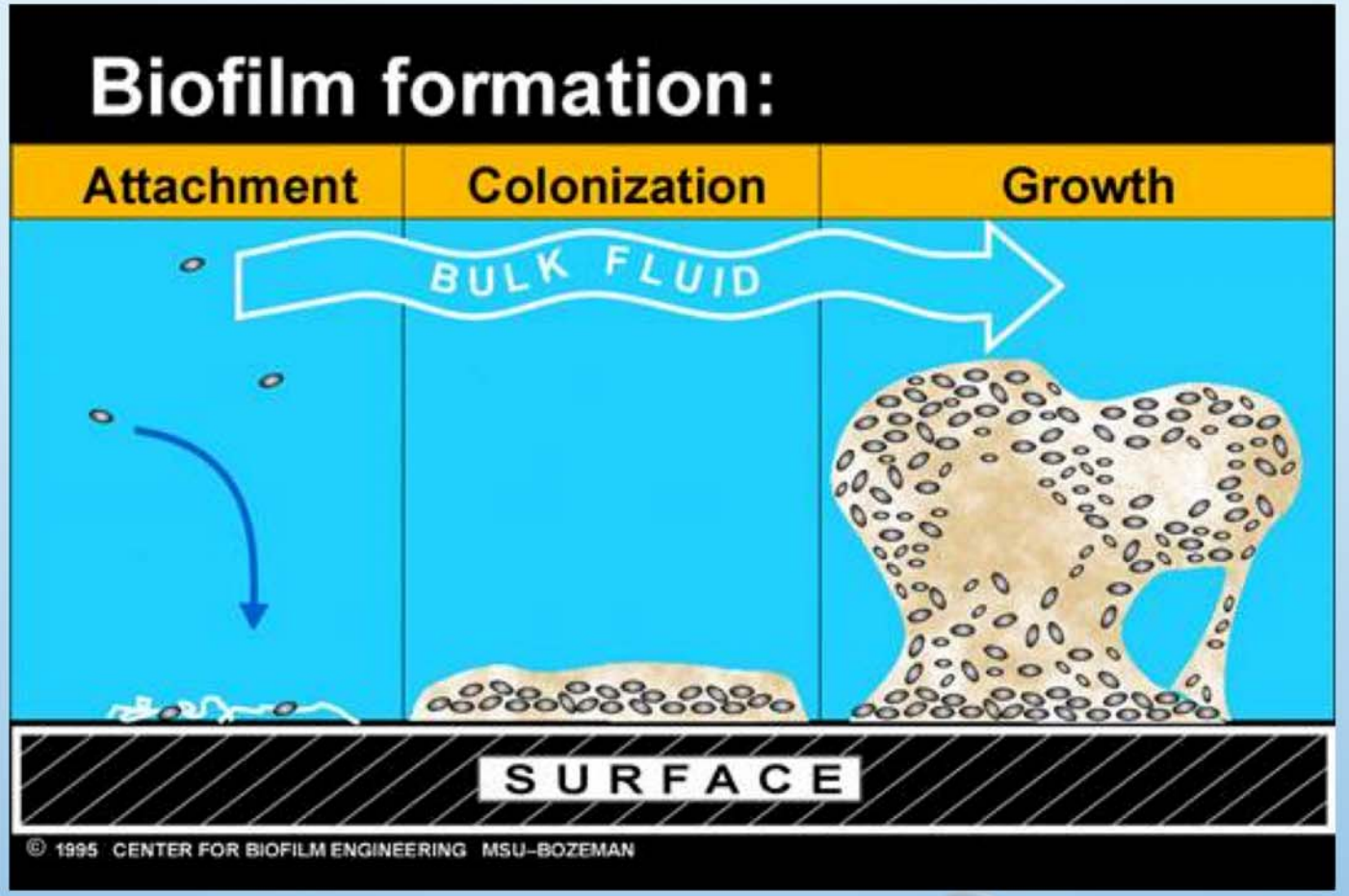
BIO-OXIDATION MEDIA

Dual-BioPhase™ Proprietary Media Configuration

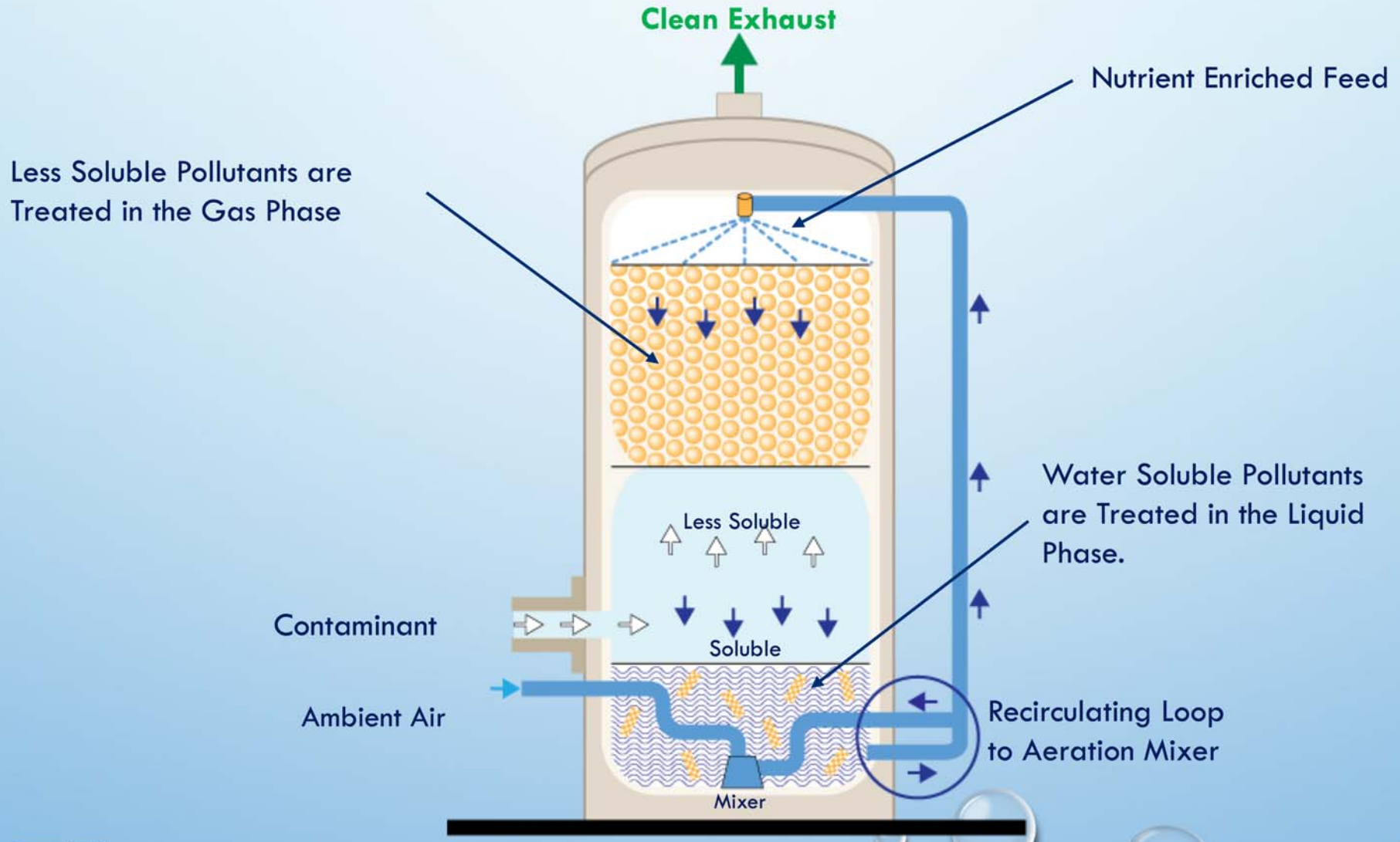
- ✓ Engineered media
- ✓ High surface area
- ✓ Structured design
- ✓ Large mean free passage diameter
- ✓ Excellent mass transfer characteristics

- ✓ Promotes a consistent biofilm platform
- ✓ Dual bed configuration

✓Biofilm – Biomass - Slough off



WHAT IS A DUAL-BIOPHASE™ SYSTEM ?



BIODEGRADABILITY OF COMPOUNDS

Contaminant	Biodegradability
Aliphatic Hydrocarbons (Methane, Propane, Butane….)	1
Chlorinated Compounds	1
Sulfur-containing carbon compounds (Dimethyl sulfide)	1-2
Nitrogen-containing carbon compounds (Amines)	1-3
Ethers	1-3
Aromatic Hydrocarbons (Toluene, Phenol, Xylene, Styrene)	2-3
Alcohols	3
Aldehydes	3
Carbonic Acids (Vinyl Acetate, Ethyl Acetate, Butyl Acetate, Isobutyl Acetate)	3
Ketones (Acetone, MEK, Methyl Isobutyl Keynote)	3
Inorganic Compounds (Ammonia, Hydrogen Sulfide)	3

TECHNOLOGY COMPARISON

Category	Typical Bio-Filter	Dual-BioPhase™ Bio-Oxidizer
Footprint	Very Large	~6-8 Times Smaller
Media Replacement	Periodically possible	Not Required
Fouling/Plugging	Potential Plugging	Anti Fouling Design
Nutrients	Manual Addition, bulk	Metered delivery system
Water Blow Down	Potential Black Water	Treated Water
Start Up Inoculation	Waste Water	Bacteria Selected per Contaminant
Start Up Food Source	Molasses	Contaminant – Waste Stream
Pressure Drop	Potential Gradual Increase	Stable

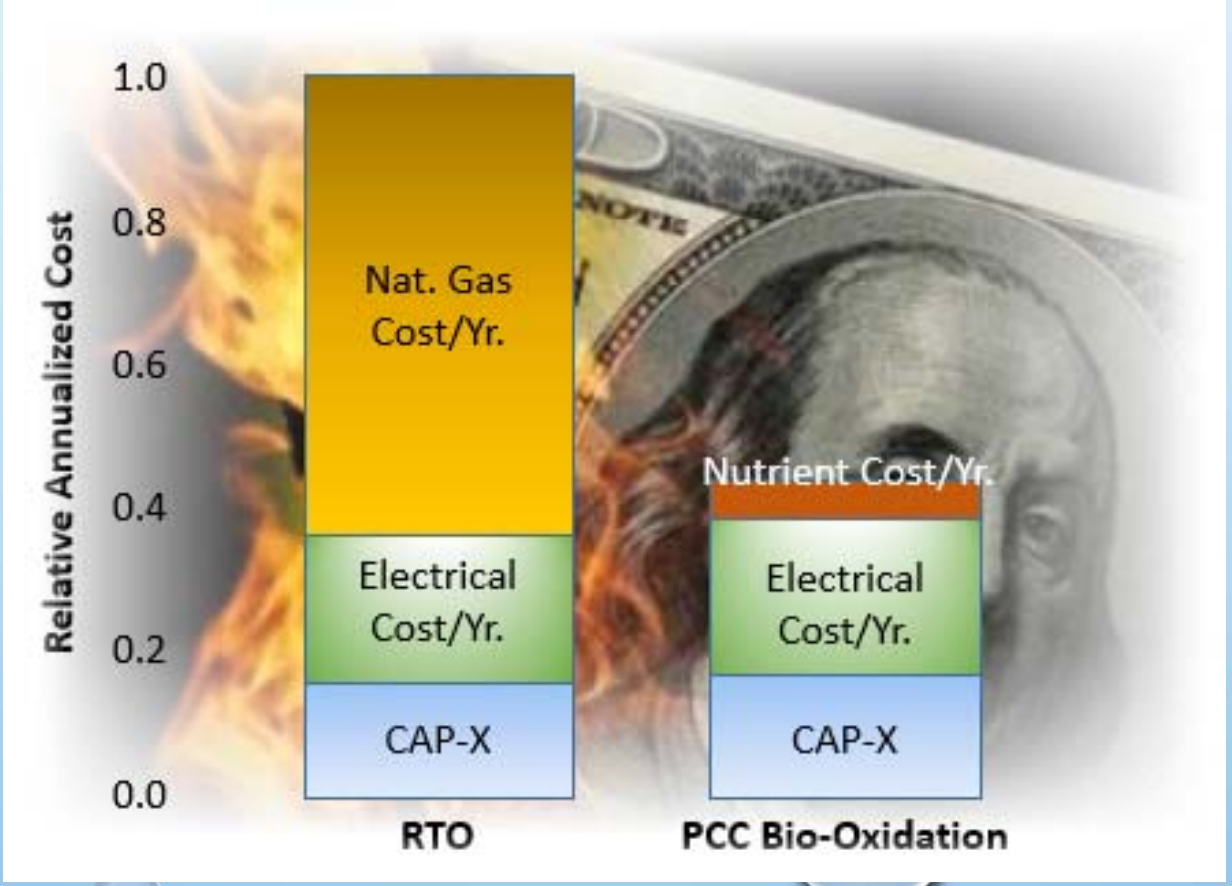
TECHNOLOGY COMPARISON

Bio-Oxidizer Footprint

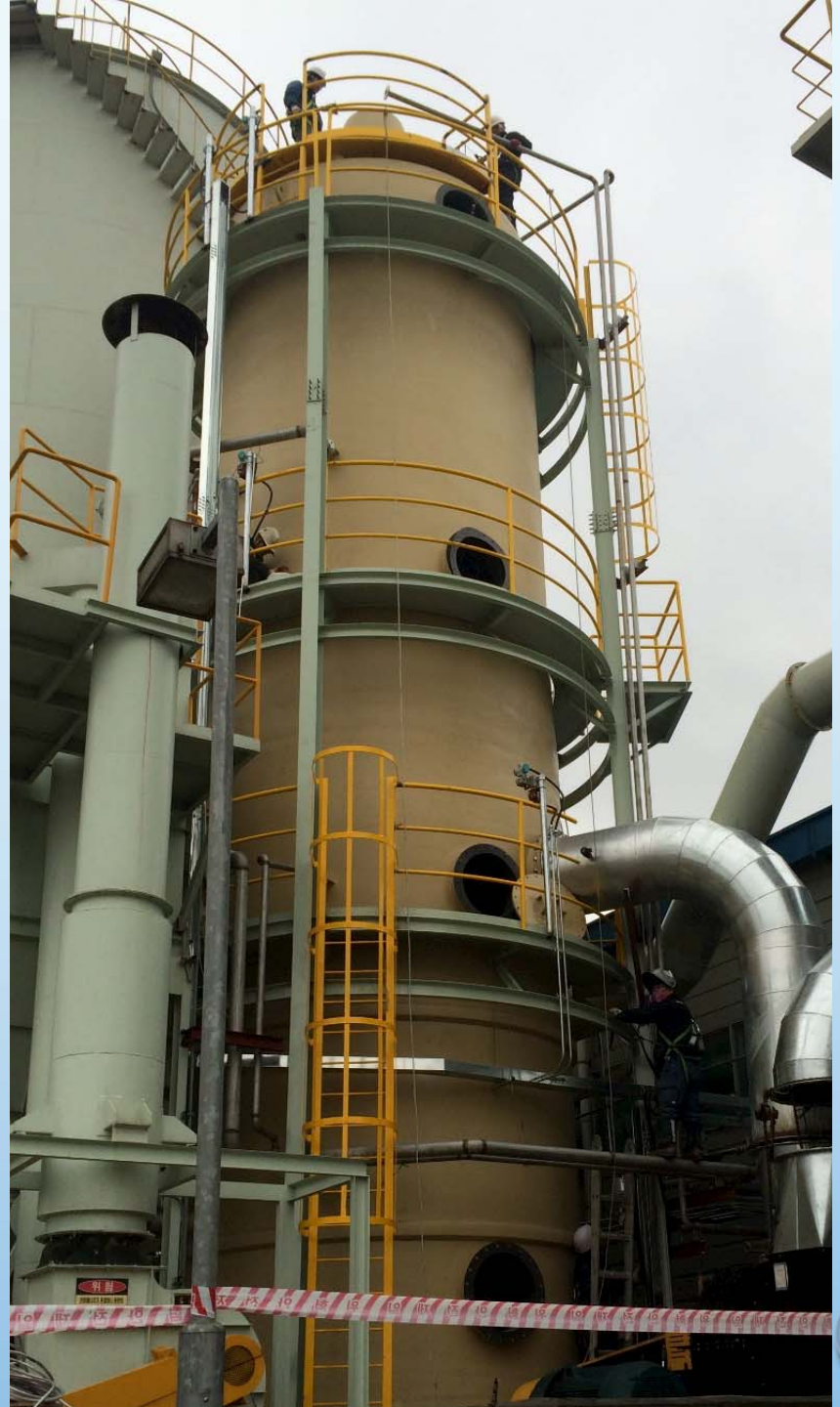
TECHNOLOGY COMPARISON

Category	Thermal	Dual-BioPhase™ Bio-Oxidizer
Natural Gas Usage	Yes $$$	None required
Operating Temp	1500F – 1600F	Ambient 60F – 150F (wet bulb)
Fire Hazard	Potential	No – Humid, Wet System
Maintenance	Valve wear & Tear	No Major Moving Parts
Fouling/Plugging	Potential Plugging	Anti Fouling Design
Media Change Out	Probable	No
CO, NOx Emission	Yes	No
SOx Emission	Potential	No
CO_2 Emission	Yes	~90% Less
Post Treatment	Potential	No

BURNING YOUR PROFITS?

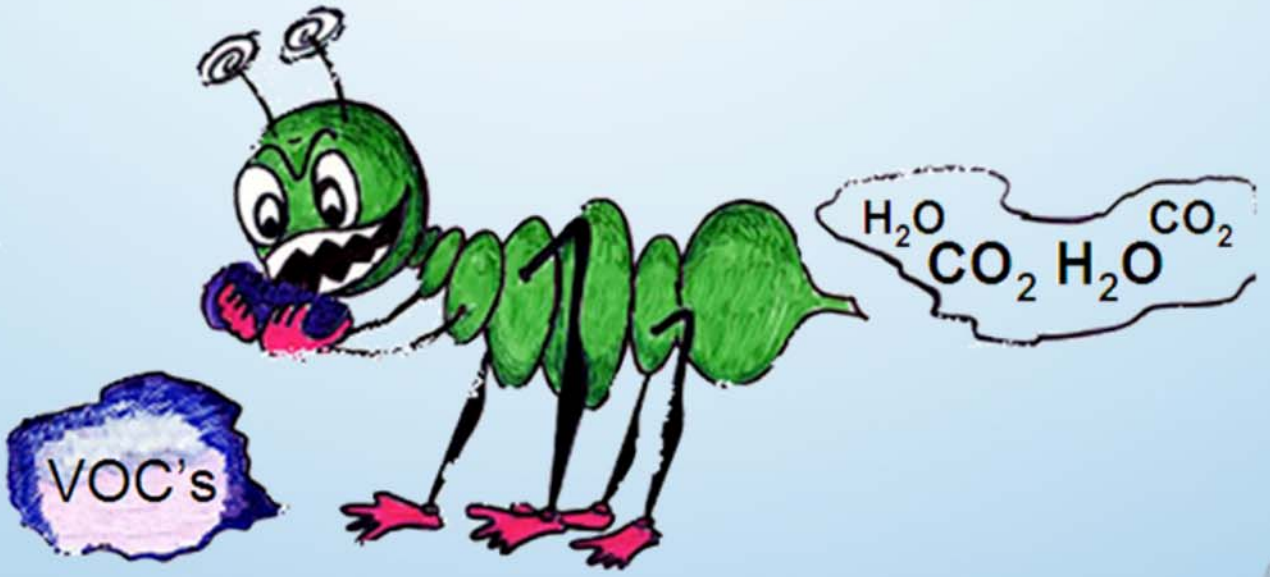


WHAT IS A DUAL-BIOPHASE™ BIO-OXIDATION SYSTEM ?



DUAL-BIOPHASE™ R&D/PILOT PLANT

THANK YOU



QUESTIONS!?