Who’s Attending...

**Biochar 2016 Participants by Sector**

- **Fundamental, Applied, Extension, Dissemination**: 82 (28%)
- **Research/Education**: 60 (21%)
- **Biochars, Media with Biochar, Energy, Co-Products**: 34 (12%)
- **User-Producers, Systems, Equipment**: 25 (9%)
- **Policy - Energy, Economics, Climate, Environment, Resource Management**: 80 (28%)
- **Forest, Ag, Food, Landscape, Urban Waste, Stormwater, Organic Recycling, Retail**: 80 (28%)
- **Other**: 2%
It Works!!

99% Removal Rates
Limited Success Removing...

Phosphorus
15
P
30.974

BOD
COD
Versatile

Easy to deploy on sites keeping costs affordable and workable.
Timeline

- Proven in the field
  - 2010-2016
- Proven University Research
  - 2014-2015
- Consistent Sourcing & Product
  - 2015-2017
- Acceptance & Usage
  - 2016-2017
We have had multiple Universities help us with the research on the biochar we currently use for both efficiency and other ways to utilize the benefits of biochar for stormwater.
Not all Biochar is Equal!

Mean Copper and Zinc Removal

- Copper (% Removal)
- Zinc (% Removal)

Biochar #1: Copper 90%, Zinc 40%
Biochar #2: Copper 95%, Zinc 70%
Biochar #3: Copper 85%, Zinc 60%
Biochar #4: Copper 90%, Zinc 50%
Biochar #5: Copper 95%, Zinc 80%
Activated Carbon: Copper 40%, Zinc 20%
So Many Feedstocks & Other Factors

**Feedstock**
- Peanut Husks @ 500 C
- Waste wood @ 520 C
- Soybean stalks @ 700 C
- Paper Mill waste @ 600 C
- Pine wood (temp unstated)
- Spruce @ 1100-1200 C
- Soybean stalks @ 700 C
- Pine sawdust @ 680 C
- Spent Coffee Grounds @ 400 C
- Waste wood @ 520 C
- Wheat straw @ 650 C
- Sewer Sludge @ 300 C

**Pollutant Reduction**
- 99.2% Cadmium
- 18% Cadmium
- 99.5% PAH
- 20% PAH
- 100% Magnesium
- ADDED 25% Magnesium
- 86.4% Mercury
- <1% Mercury
- 100% Zinc
- 24% Zinc
- 24.6% Chromium
- 99% Chromium
Looking Ahead

- Affordability
- Consistency
- Availability
- Particle Size
- More Research

Keep Moving Forward
Others Needed

Ni
Nickel

Ag
Silver

Se
Selenium

Co
Cobalt

Mg
Magnesium

NO₃

Coli

SUNMARK ENVIRONMENTAL
Biochar for Heavy Metal Removal on Industrial Sites

Ryan Holman, CPESC, CESSWI
US Biochar Initiative
August 24, 2016

Questions? coming!