northeastern BIOCHAR SOLUTIONS

SARATOGA biochar solutions

Saratoga Biochar Solutions, LLC
Carbon Fertilizer™ Manufacturing Facility
Moreau, New York

April 2022

Direct Benefits of Carbon Fertilizer™ Manufacturing

The Original

CARBON FERTILIZER™

Granular Slow-Release Bio-Fertilizer that builds Soil Carbon

"MADE IN USA from recycled American organic mater, carbon and nutrients."

6
C
Carbon

MADE IN USA

About Us

- **Northeastern Biochar Solutions, LLC ("NBS") provides the most sustainable use of biosolids to the benefit of human health and the environment.**
  - Transforms dirty industries into green industries.
    - Provides a substitute for biosolids waste disposal.
    - Provides a substitute for chemical fertilizers.
  - Manufactures bio-fertilizers responsibly.
    - Recovers resources to the greatest extent possible.
    - Eliminates PFAS and other contaminants.
    - Reduces greenhouse gas ("GHG") emissions.
    - Reduces harmful, regulated air emissions.
  - Sequesters carbon in soil where it is needed.
    - Reduces fertilizer consumption.
    - Reduces nutrient pollution in waterways.

- **NBS intends to build Carbon Fertilizer™ manufacturing facilities in constrained biosolids markets throughout the U.S. and provide the technology to utilities globally.**

About Biosolids

Def. 1. "Dewatered solids from public wastewater treatment plants."

Biosolids impact:

Def. 2. "An age-old problem that has yet to be solved, until now."

- ✓ **Community Health**
- ✓ **Spread PFAS/Contaminants**
- ✓ **Pathogen & Vectors**
- ✓ **GHG Emissions**
- ✓ **Soil Contamination**
- ✓ **Landfill odors**
- ✓ **Soil Health**
- ✓ **Nutrient Runoff**
- ✓ **Aquatic Dead Zones**

The Problem is Getting Worse

- **Options are dwindling as biosolids generation increases with population.**
  - Landfills are filling up and new landfills are increasingly difficult to construct.
  - Incinerators are shutting down due to high emissions.
  - Land application is becoming prohibited in more states and counties.
  - Composting is difficult to site and has limited demand.
  - A new method is desperately needed!

NYS Biosolids Disposal Industry

- **New York State (NYS) pays the most for biosolids disposal nationally.**
  - NYS contains the largest metropolitan area in the nation.
  - NYC is coastal and biosolids can't be dumped at sea.
  - NYS is the largest exporter of biosolids in the nation.
  - NYS exports nearly 25% of its biosolids to out-of-state landfills by truck and train some having gone as far as Texas and Colorado, all at a very high cost.
  - NYS Climate Leadership and Community Protection Act's (CLPCA) highest goals are related to the reduction of landfilling biosolids and nutrient recovery from biosolids.
  - NY municipalities offer premiums for "beneficial uses."

End Use Method	Dry Tons per year	% of Total
Landfill	257,480	68.2%
In-State	164,297	43.5%
Out-of-State	93,183	24.7%
Combustion	58,031	15.4%
Reclycing[2]	60,999	16.2%
Other[3]	1,170	0.3%
Total	377,680	

https://climate.ny.gov/

- **Despite throwing a lot of money at it, the problem will get worse before it gets better.**
  - 43.5% of NYS biosolids go to landfills, but many have closed, many are reaching capacity, and no new landfills are being permitted in NYS.
  - 15.4% of NYS biosolids are incinerated, but many incinerators have closed due to the Clean Air Act, many are reaching retirement age, and no new incinerators are being permitted in NY.
  - 16.2% of NYS biosolids are composted, yet composting is expected to grow only marginally.
  - 24.7% od NYS biosolids are exported, a very expensive option that is expected to grow.

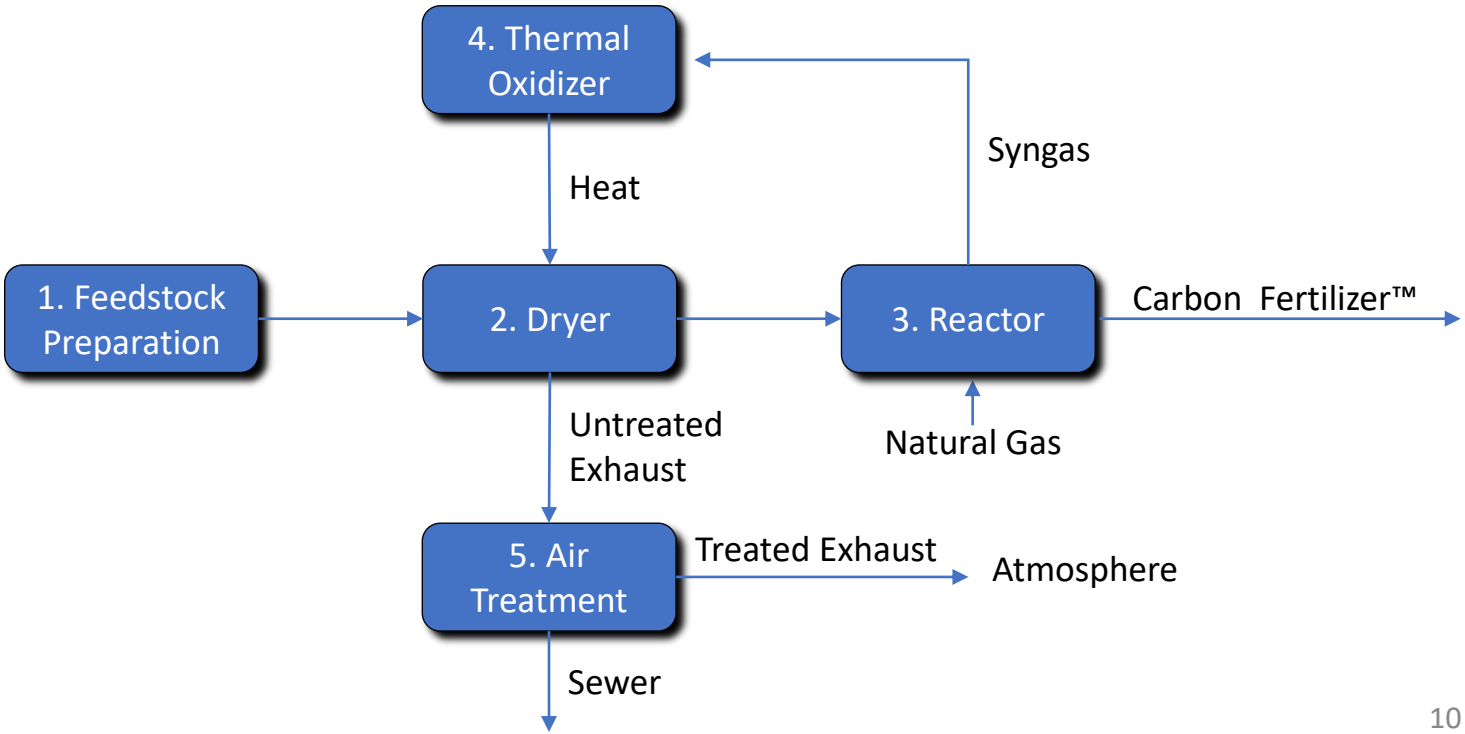
Recovering Resources Responsibly

- **SBS Pyrolysis provides highest "resource recovery" and lowest emissions.**
  - SBS maximizes "resource recovery" by generating more Carbon Fertilizer™ with lower GHG emissions, and fewer regulated air emissions.
  - Carbon Fertilizer™ is composed of "avoided emissions" that are recycled into the soil, where they are needed, instead of being emitted atmospherically.
  - SBS uses less natural gas than other process, thus allowing the process to recover much more organic matter, carbon, and nutrients.
  - Reduced GHG emissions enables the SBS Facility to safely service multiple publicly-owned treatment facilities from a single Carbon Fertilizer™ manufacturing facility.

Biosolids Disposal Options	Solids Recovered in Process	Beneficial Use of Recovered Solids	Potential for PFAS emissions	Ability to Manage PFAS emissions	Potential for NOx emissions	Ability to Manage NOx emissions	Potential for SO	Ability to Manage SO emissions	Potenital for Odor emissions	Ability to Manage Odor emissions	GHG Emissions	Energy Use
Drying Biosolids	HIGH	YES	YES	HIGH	LOW	HIGH	LOW	HIGH	HIGH	HIGH	MID	HIGH
Incineration	LOW	NO	YES	MID	HIGH	MID	HIGH	HIGH	MID	HIGH	HIGH	MID
Gasification	MID	YES	YES	MID	MID	MID	MID	HIGH	MID	HIGH	MID	MID
SBS Pyrolysis	**MID**	**YES**	**YES**	**HIGH**	**MID**	**HIGH**	**MID**	**HIGH**	**MID**	**HIGH**	**LOW**	**LOW**

5-Step Manufacturing Process

1. *Feedstock*: Biosolids, ground wood waste, and dried and sized feedstock are pre-mixed.
2. *Drying:* Feedstock is dried using heat generated by the thermal oxidizer (in Step 4).
3. *Thermal Treatment:* Dried feedstock is heated without oxygen in a thermal reactor to separate volatile organic compounds (syngas) from solids (Carbon Fertilizer™).
4. *Thermal Oxidizer:* Combusts syngas in stages to minimize NOx emissions, remediates odors and PFAS, and generates heat for the dryer.
5. *Air Treatment System:* Removes particulates, sulfur dioxide (SO_2), ammonia (NH_4), and odors.



Remediating Contaminants

- **Biosolids have traces of many contaminants, including PFAS, that must be remediated.**
  - Pharmaceutical products, micro-plastics, hormones, cleaners, oils, fats, greases, VOCs and many other contaminants that make their way into sewage.
  - These contaminants make it through the drying stage of our competitors and are present in all dried biosolids products that are currently sold and distributed nation-wide (i.e., Milorganite).
  - In the SBS process, these contaminants are separated from the solids in the pyrolysis stage.
  - Once in a gaseous form these contaminants are quickly destroyed by thermal oxidation.
- **Pyrolysis is a decontamination technology that works extremely well with biosolids.**
  - Dried biosolids are heated in an oxygen-free environment at over 1,100°F for up to 30 minutes which causes even the toughest contaminants to separate and become part of the syngas.
  - Syngas is kept hot for the several seconds of its existence to ensure molecules don't start reconnecting and forming air emissions.
  - PFAS compounds are liberated from solids into a volatile gas state where they are destroyed by thermal oxidation (>1,600°F).
  - Syngas is thermally oxidized in stages to achieve the lowest NOx emissions possible.
- **Pyrolysis has been similarly used to remediate soil contaminants for decades, albeit without the advanced air treatment solution that we employ.**

Air Treatment

- **SBS employs benchmark air treatment to protect human health and our reputation.**
  - High-efficiency dry cyclones recover most of the dried material.
  - Venturi scrubbing removes the remaining fine particles.
  - Hydrated lime scrubbers remove sulfur dioxide (SO_2) and neutralize odor compounds.
  - Ammonia scrubbers remove ammonia (NH_4) odors.
  - Dual-stage bio-scrubbers polish odors and further remove SO_2 and other contaminants.
- **Air treatment is vital to our success.**
  - Designed to meet urban air standards in densely populated areas.
  - Public wastewater treatment facilities that need our technology are predominantly located in urban and suburban areas.
  - Ensuring our air emissions are safe, our GHG emissions are low, and our odors are impeccably managed are the primary factors that will determine our success with public utilities.

Air Treatment Supplier

- **NBS has selected CondorChem Envitech as our air treatment provider based on:**
  - Experience as a global environmental engineering firm that provides air treatment solutions to a wide range of industrial applications.
  - Its ability to apply advanced technologies to specific needs.
  - Its leading position supplying environmental engineering, design and equipment globally with numerous projects in Europe, the U.S..
- **NBS provides an odor reduction guarantee to the SBS Facility.**

Essential Green Infrastructure

- **We provide an "essential service" that alleviates a growing problem the right way.**
  - Biosolids disposal is a major source of GHG emissions and a material cost to New Yorkers.
  - The biosolids disposal problem in NY is getting worse with no inexpensive solution in sight.
  - We create a "beneficial use" byproduct that destroys PFAS and other contaminants.
  - We solve a costly, growing problem that local governments have with biosolids disposal.
- **We provide an "essential substitute" for harmful chemical fertilizers.**
  - Chemical fertilizers erode soil carbon and reduce the soil's ability to retain water and nutrients.
  - Nutrient runoff pollutes waterways and creates "dead zones" that devastate aquatic habitats.
  - Carbon Fertilizer™ restores soils with organic matter and carbon to reduce harmful chemical fertilizer use and subsequent runoff.
  - Carbon Fertilizer™ is produced domestically.
- **We provide an "essential GHG reduction."**
  - We displace two dirty industries; biosolids disposal and fertilizer manufacturing.
  - We produce Carbon Fertilizer™ which sequesters its weight in GHG emissions in soil.

Our Team

- **Raymond Apy – Chief Executive Officer**
  - Experienced CEO, entrepreneur, strategist, leader, talent and business developer.
  - 30+ years of business experience (engineering, sales, and management).
  - 15+ years in business management roles (President, CEO, Managing Partner).
  - Masters of Science - Environmental Science, Solid & Hazardous waste engineering, GIS, law and policy - Syracuse University/State University of NY.
- **Bryce Meeker – President**
  - 15+ years experience in renewable energy development and management.
  - 5+ years experience in carbon manufacturing.
  - Private equity, investment banking, and strategic consulting background.
  - Masters of International Business – Tufts University, Fletcher School.
- **Lee Wulfekuhle – Chief Operating Officer**
  - Recently sold Wulfekuhle Injection & Pumping, Inc. to pursue ECHV.
  - 25+ years operating experience with liming and spreading bio-waste in Midwest.
  - 20+ years experience contracting with wastewater treatment plants (WWTPs).
  - 1-1/133 RD Infantry in Dubuque, IA (10-years).