

## Past Lectures & Presentations

ECS staff is comprised of compost experts, engineers and scientists. We are relentless in our development of new products and services tailored to meet the needs of our industry, and fill the technological void that we frequently encounter. We frequently share our R&D discoveries with our industry and are a prolific and leading contributor to the science of industrial/commercial/municipal scale composting.

On average, ECS staff presents six to eight carefully researched, scientific based presentations per year to our industry. We have been at the forefront of evolving our composting industry since our inception in 1999; and we take pride in sharing our findings with the compost community and using our ever continuing, cutting-edge research to benefit our clients.

The list below represents only the past few years of ECS presentations.

**Conference Name:** USCC 2020

**Conference Date:** January 2020

**Presenter:** Tim O'Neill

**Title:** Compost Air Emissions: A Process Quality Approach to Controlling Emissions and Informing Effective Regulations

**Abstract:** The composting industry continues to struggle with a history of facilities that have failed due to odor emissions. Would-be-neighbors and regulators start with the assumption that all compost facilities will emit problematic odors, and often drive facilities add features that make layperson-sense, but not scientific sense, in an effort to control odors. Our industry hasn't established clear facility design and operational standards, based on peer-reviewed science, that can allay these fears. But the science and engineering exist. This talk will present a high-level review of that science and how it can form a basis for design and operational standards to minimize odor emissions from large scale compost facilities. This talk will also discuss how these same principles can be extended to inform sensible and effective regulations

**Conference Name:** WORC Annual Conference 2019

**Conference Date:** November 2019

**Presenter:** Tim O'Neill & Geoff Hill

**Title:** Review of Emission Factors Commonly Used in Determining Regulations

**Conference Name:** SWANA Northwest Regional 2019

**Conference Date:** April/May 2019

**Presenter:** Geoff Hill

**Title:** pH and the Compost Process

**Abstract:** Are you puzzled as to why your composting process still generates odors? Enclosures, covers, sensors, stacks, biofilters, widgets and gadgets can't circumvent mother nature; a poorly optimized compost process will generate odor despite all these end-of-pipe attempts at capture and control. This presentation unveils the mystery around pH change in the SSO composting process and provides answers to a variety of questions such as: why does the pH gets stuck between 4 and 6 for weeks on end during active composting? Why does my compost smell like burnt pickles? Why despite, the \$2M I've just sunk into this, does it *still* smell like burnt pickles? Why do covered facilities still have odor problems? Why does the pH of my compost jump from 6 to 8 near the end of the process? Why are compost specifications acidic and why is a pH 7 so hard to consistently achieve in my final product?

**Conference Name:** SWANA Pacific 2019

**Conference Date:** April 2019

**Presenter:** Tim O'Neill

**Title:** Connecting Compost Process Science to Air Emissions Regulations

**Abstract:** ECS has measured emissions from both well designed and operated facilities and poorly designed and operated facilities, and found up to a 500x difference in emission rates despite very similar feedstocks. In this presentation we will show how peer-reviewed science and measurements at full-scale compost facilities explain the relationship between air emissions and process conditions. We review example facilities that illustrate how design and operations determine process conditions and resulting odor emissions. Our emphasis will be on reducing VOC and odor generation, which is more impactful than the current industry and regulatory focus of capturing and control. We will conclude with a regulatory framework that could deliver a win-win solution to the industry by reducing permitting complexity, reducing VOC and odor emissions, and providing operators with assurance through easy to measure key process performances indicators.

**Conference Name:** USCC 2019

**Conference Date:** January 2019

**Presenter:** Geoff Hill

**Title:** ECS Biodynamic Thermal Composting Model

- Conference Name:** Biocycle Refor 2018  
**Conference Date:** September 2018  
**Presenter:** Geoff Hill  
**Title:** Biochemical Benefits of Co-Composting Alkaline Digestate with Acidic SSO  
**Abstract:** The composting of acidic SSO and yard waste can be inhibited by low pH feedstocks. High aeration rates and feedstock conditioning are two strategies used to adjust pH for optimized composting and maximum decomposition rate. Digestate is usually alkaline and can be used to adjust pH of acidic feedstocks. This presentation reviews the current research on the benefits of co-composting digestate and SSO, improvements in composting that accompany feedstocks whose pH is >6.5, and summarize bench-scale experimental data where these relationships were tested.
- Conference Name:** Komptech 2018  
**Conference Date:** November 2018  
**Presenter:** Geoff Hill  
**Title:** State of Organics in North America: The Tragedy and Opportunity in Composting Food & Yard Waste
- Conference Name:** BAAQMD ClimateTech 2018  
**Conference Date:** September 2018  
**Presenter:** Tim O'Neill  
**Title:** Optimal Composting
- Conference Name:** Compost Council of Canada National Conference 2018  
**Conference Date:** September 2018  
**Presenter:** Tim O'Neill  
**Title:** Compost Facility Enclosure – The Good, The Bad, The Ugly... and a Better Way  
**Abstract:** Why enclosing a composting facility can fail to address the key issue in compost odor production and how it can result in an excessively expensive (capital and operating) facility without delivering success.
- Conference Name:** Compost Council of Canada National Conference 2018  
**Conference Date:** September 2018  
**Presenter:** Tim O'Neill & Geoff Hill  
**Title:** pH and the Compost Process  
**Abstract:** Unveiling the mystery around pH change in the SSO composting process and providing answers to a variety of questions such as: Puzzled by why the pH of your compost end product varies dramatically near the end of the process? Why are soil and compost specifications set at ~pH 7 and why is a pH 7 so hard to consistently achieve? Why does the pH gets stuck between 4 and 6 for weeks on end during active composting and what is the significance?

**Conference Name:** BAAQMD 2018 Workshop

**Conference Date:** May 2018

**Presenter:** Tim O'Neill & Geoff Hill

**Title:** Facility Design for Better Process Control → Lower Air Emissions

**Conference Name:** SWANA Pacific 2018

**Conference Date:** May 2018

**Presenter:** Tim O'Neill & Geoff Hill

**Title:** Controlling Process Conditions to Minimize Odor Emissions

**Abstract:** There is a very strong correlation between the thermal, chemical and biological conditions within active compost piles and odor complaints registered at large compost facilities all across North America. Process conditions have proven to be a stronger determinate of odor issues over different categories of feedstocks or enclosed versus open composting. This talk will present peer-reviewed science that explains the mechanisms that generate strong odors, and how process conditions is controlled at full scale facilities to minimize odor emissions.

**Conference Name:** Waste Expo 2018

**Conference Date:** April 2018

**Presenter:** Geoff Hill

**Title:** VOC Regulation in California and the Elephant(s) in the Closet

**Abstract:** Emissions are highly regulated in California, especially in the highly populated areas where the majority of the state's food waste is produced. VOC emissions from composting and anaerobic digestion must be modelled prior to construction and measured during operations. In this presentation we explore the top six assumptions in VOC emission regulation applied to composting facilities today. Our aim is to highlight the sizeable gap between A) current scientific knowledge, modern methods, and biochemical properties of these emissions, and B) the current application of modelling and measuring in the regulatory arena today.

**Conference Name:** Waste Expo 2018

**Conference Date:** April 2018

**Presenter:** Tim O'Neill

**Title:** Large Scale Composting – The Keys to Long Term Profitability

**Abstract:** Developing an accurate business plan for a large-scale composting facility is important to achieving and maintaining profitability. Such a plan requires an understanding of both the life-cycle costs of process choices and how to optimize revenues streams from tip fees and product sales. With so many process options and market variations, these plans are a challenge to develop and optimize. But yet a fair number of

private compost operations are very profitable. In this talk we present case studies for several compost facilities. We will examine how their process choices and income diversification have impacted their bottom lines. In so doing we develop a list of key considerations and metrics that should be a part any business plan for a compost facility.

**Conference Name:** BioCycle 2018

**Conference Date:** March 2018

**Presenter:** Geoff Hill

**Title:** Compost Odor Emissions and Process Efficiency-Connecting the Science to the Practice

**Abstract:** Excess water in anaerobic digestate makes it difficult to compost and expensive to haul. In response to multiple inquiries, ECS developed a numerical thermodynamic drying rate model based on real data composting facility data in order to evaluate the process options and costs associated with digestate drying. The model can incorporate site specific climate data, digestate re-heat potential, bulking agent properties, waste heat from engines, aeration rates, and turning frequency. The model outputs include total water loss, facility size, estimated CAPEX and OPEX, and energy consumption. In this talk we will outline the major factors that drive digestate drying efficiency and cost. Two case studies will be presented, one of which concluded that over 27,000 tpy (1/3 the mass) could be eliminated in 20 days with a capital investment of \$3-5M. We will discuss the operator goals, model results, and options developed in the course of these two studies.

**Conference Name:** Compost 2018

**Conference Date:** January 2018

**Presenter:** Tim O'Neill & Geoff Hill

**Title:** Compost Odor Emissions and Process Efficiency-Connecting the Science to the Practice

**Abstract:** As our industry faces the challenges of increasing amounts of food waste, encroachment, and more demanding regulations, a deep understanding of how to control the composting process has never been more critical. ECS's founder, Tim O'Neill and lead scientist, Geoff Hill, are offering an exclusive half day workshop on Monday January 22 at the US Composting Council's Annual Conference in Atlanta to help you improve your understanding.

This workshop will present a framework for assessing process quality and determining the level of process control required for each unique compost site. We will use the findings of peer-reviewed science as basis to understand operational odor and stabilization rate data from large-scale composting facilities.

We will then discuss the process design principles that determine the degree of process control achieved. Finally, we will show how this knowledge can be used to guide facility design, infrastructure upgrades, and/or improved BMP operations to more reliably achieve success.

**Conference Name:** WORC Training- 2017 CFOT Event

**Conference Date:** October 2017

**Presenter:** Tim O'Neill

**Title:** Designing a Compost Facility

**Conference Name:** US BioCycle Refor17

**Conference Date:** October 2017

**Presenter:** Tim O'Neill & Geoff Hill

**Title:** Estimating Food Waste Yields From New Collection Programs.

**Abstract:** New legislation and ordinances are diverting more food waste tons from landfills to AD and composting facilities. To collect and process this material generators, haulers, and processors must change their operations. While numerous studies exist to define the total food waste in the MSW stream, it turns to be far more complicated to predict the yield from these new generator sources. Given the considerable costs associated with developing new hauling and processing capacity, it is important to right-size these assets, make the right technology choices, and accurately predict their performance. Predictive models from CalRecycle tend to overestimate yields. Their faults tend to lie in a lack of granularity both in predicting and in calibrating the modeled results. This talk will focus on a more detailed and testable predictive model that has shown regular results with an accuracy consistently >90%. We will discuss how this model uses census data and with numerical methods to generate predictions. And finally we'll review outcomes at major cities where this method has been applied.

**Conference Name:** CCC- National Organics Recycling Conference

**Conference Date:** September 2017

**Presenter:** Geoff Hill

**Title:** Temperature & the compost process: an exploration of the failure mechanisms behind high temperature composting

**Abstract:** the composting process is regulated provincially and federally with minimum time and temperature requirements. However, the effect of high temperature on a compost process is rarely discussed and unregulated. ECS has looked deeply into data from its >50 operating facilities and has found very close relationships between process temperature and compost quality, odor, and decomposition rate. Compost process literature from Europe confirms that high temperature processing can result in severe process inhibition, microbial exclusion, excess ammonia release, pH lock, and excess odor



and VOC release, as compared to a temperature controlled process. ECS will share data on these critical relationships, report on key scientific publications on the topic, and provide solutions for the design and operation of a temperature controlled process.

**Conference Name:** Waste Expo 2017

**Conference Date:** May 2017

**Presenter:** Tim O'Neill

**Title:** Food Waste is Coming: How Contaminated Will It Be and How to Deal with Contaminants?

**Abstract:** The trend towards diverting more organic waste from landfills is driving up the level of contaminants in compost feedstocks. This talk will identify the levels of contaminants that are being encountered and review the different methods used to try to remove them. We will look at the costs and efficiencies of these methods. Finally we will look at the operational and financial impacts of managing these contaminants.

**Conference Name:** Waste Expo 2017

**Conference Date:** May 2017

**Presenter:** Geoff Hill

**Title:** Food Waste is Coming – But How Much?

**Abstract:** Food waste (FW) recycling is here to stay. FW is currently being diverted from landfills at nearly 100 cities nationwide and many more are implementing programs, legislation, and incentives to promote FW recycling. FW will often garner a higher tipping/processing fee than will yard waste but FW also has the ability to create plastic contamination, odor, and moisture problems if not properly composted with sufficient bulking agent or with sufficient aeration rates.

It is therefore imperative for businesses that are planning new facilities or technology upgrades, such as those upgrading from windrow to aerated static pile (ASP) or to anaerobic digestion systems, to **accurately** determine the amount of food waste that can be **actually** diverted from the MSW stream in any given geographical boundary. This data is critical in forecasting revenue, properly siting and sizing the facility, and adequately designing the processing area and pre-processing/cleaning equipment.

To provide accurate forecasting ECS offers the Food Waste Feedstock Study: a predictive model based on quantitative Census & NAICS code data. The results using this method have proven to be 90-99% accurate in predicting actual food waste that can be diverted to organic processing facilities from large cities and counties in the USA. The Food Waste Feedstock Study can be used as a tool in predicting tonnage coming to new facilities or used to validate an expansion.

This presentation will delve into the data sources (Census), key metrics, methodologies, and results from major cities where this method has been applied.

**Conference Name:** Biocycle East Coast Conference 2017

**Conference Date:** April 2017

**Presenter:** Tim O'Neill

**Title:** Assessing Options for Aeration Floors

**Abstract:** Regulations, siting challenges, and difficult feed stocks are driving the increased use of forced aeration in composting. The aeration floor is the single most important, and is often the most expensive, component of a forced aeration system. Making the right choice for a specific facility is critical to long term success.

In this talk we will show how to evaluate aeration floors from the perspective of sustaining BMP compliant conditions inside the pile, controlling odors, and providing an adequate working surface. We will apply this evaluation to the four basic types of aeration floors using real-world examples and field data.

Further we will examine the initial capital and life-cycle costs of owning and operating these different aeration floors.

**Conference Name:** US Composting Council 2017

**Conference Date:** January 2017

**Presenter:** Geoff Hill

**Title:** Green energy without the cost and complications of an anaerobic process: a comparative cost analysis of solar panels paired with food waste composting vs. anaerobic digestion.

**Abstract:** Food waste landfill bans and green energy incentives are becoming more common. Anaerobic digestion appears an attractive solution with enclosed processing and with gas or energy output. However, the capital costs, operating cost, and biochemical complexity per unit of AD energy are exceptional. One alternative is to decouple green energy from food waste with a solar farm at an ASP food waste composting facility. This presentation compares the capital and operating costs of this robust green energy composting facility against an anaerobic digestion plant.

**Conference Name:** US Composting Council 2017

**Conference Date:** January 2017

**Presenter:** Tim O'Neill

**Title:** Using a Flexible Pilot to Optimize Performance of an Aerated Compost System.

**Abstract:** Compost facility design requires the owner/operator to consider cost and performance measures to optimize the facility's financial goals. Acquiring real data from a series of pilot scale tests allows insight into each site's unique combination of feedstocks, operational constraints, regulations and



economics. Pilot programs allow operators to vary feedstock mixes, pile design, aeration type, and process sequences while capturing real-time process variables, as well as sampling for air emissions and stabilization rates. Tim will explain how to organize a pilot program, including types of equipment and data analysis tasks in order to make informed financial and operational decisions

- Conference Name:** Washington Organic Recycling Council Annual Conference 2016  
**Conference Date:** November 2016  
**Presenter:** Wee L. Yee, USDA- Yakima Agricultural Research Laboratory, and Tim O'Neill  
**Title:** Managing Pest Problems – Exploring New Technologies to Protect Fruit Tree Health  
**Abstract:** Movement of yard waste from infested to un-infested areas for composting represents threat to the apple industry, valued at \$2.2 billion in Washington. Fruit and soil/debris under host trees entering the waste stream could also be a source of larvae and pupae. To prevent movement of the fly, yard waste in infested areas could be heat treated before it is transported for composting.
- Conference Name:** Biofest 2016  
**Conference Date:** September 2016  
**Presenter:** Geoff Hill  
**Title:** PROCESS IMPACTS: Emissions from Large-Scale Composting
- Conference Name:** CalRecycle  
**Conference Date:** November 2016  
**Presenter:** Geoff Hill  
**Title:** Composting in California: CalRecycle Zone Works
- Conference Name:** NW Biosolids Management Association  
**Conference Date:** September 2016  
**Presenter:** Chris Anderson  
**Title:** King County Biosolids Truck Odor Mitigation Study  
**Abstract:** King County, Washington is studying methods to capture and control the odorous air coming from trucks and trailers used to transport Class B biosolids. ECS was awarded this contract to apply our experience with aeration systems and odor control technologies in biosolids composting. ECS is working with King County under the direction of Kennedy/Jenks. Chris Anderson will discuss the background investigations, odor control technology, demonstration system design, and will share what has been learned to date.

**Conference Name:** Compost Council of Canada  
**Conference Date:** Sept 2016  
**Presenter:** Geoff Hill  
**Title:** LIMITING & TESTING EMISSIONS: Experience and New Methodologies

**Conference Name:** Waste Expo 2016  
**Conference Date:** June 2016  
**Presenter:** Tim O'Neill and Geoff Hill  
**Title:** The Cost of Compliance to the State of California's Water Control Board General Order: a Comparison between Windrow and Aerated Static Pile Composting  
**Abstract:** California's increasing waste diversion requirements are being closely followed by increasing regulatory constraints. A recent statewide general order requires low hydraulic conductivity for pads and ponds in order to minimize ground water impacts from composting facilities. This general order will result in greater costs to new compost projects and expensive retrofits for existing facilities. Aerated Static Pile (ASP) systems require as little as 1/4 the area of windrow operations. Considering the reduction in area, investing in site-wide surface improvements becomes substantially more viable. Tim uses a case example comparing windrow and ASP systems, including footprint, throughput, pond sizing, CAPEX, OPEX, VOC compliance, odors, and suggested maximum food waste percentages.

**Conference Name:** Biocycle West Coast 16  
**Conference Date:** April 2016  
**Presenter:** Geoff Hill  
**Title:** Food Waste Estimation Modeling Using Census Data  
**Abstract:** Food waste is North America's biggest diversion target today and for the foreseeable future. Food waste is challenging to process due to high contamination levels and rapid decay rate. Without the right infrastructure or lack of operational BMPs, managing food waste will create foul odors and attract vectors. In order to properly plan and finance food waste composting/digesting infrastructure, feedstock quantity estimates must be made. However, considerable uncertainty exists around 1) the total amount of food waste generated per city and county, 2) the amount already diverted to higher and better use (such as animal feed), 3) the amount which will divert through time based on generator size (many food waste bans ramp compliance by generator size), and 4) the source (industrial, commercial, institutional, or multifamily) as this greatly affects the quality and contamination level. This presentation will highlight a Census database method that can accurately predict food waste diversion in any County and City in the USA down to the level of key sectors and generator size classes. With this data in hand, the selection of appropriate

pre-processing and composting/digesting infrastructure can be planned to match the influx of food waste through time.

**Conference Name:** Biocycle West Coast 16

**Conference Date:** April 2016

**Presenter:** Tim O'Neill

**Title:** Cost-Effective Air Emissions Test Methods to Reflect Composting Process Variability

**Abstract:** Odor emissions can make or break the viability of a composting facility; presumably, considerable value would be obtained if odors were measured frequently, used as a Key Performance Indicator (KPI), and could be related directly to the process / BMPs employed. In practice, many operators do not have confidence in odor measurements and they are not widely used due to concerns with cost and accuracy. Conventional odor sampling and analysis methods tend to fall into three camps; i) rudimentary and nearly meaningless (most hand-held instruments); ii) stationary and overly simplistic for multiple surface emissions (electronic nose); or, iii) too expensive and point focused to actually capture the variability in a compost emission process (flux chamber and odor panels). This presentation will show how tunnel sampling methods, employed with dynamic dilution sampling, can be used to collect broad-area low-cost air samples. We will show how this approach will more accurately represent average pile emission than will a limited number of point samples. We will demonstrate that the increased sample area, coupled with a larger number of samples, more than compensates for the lower accuracy, yet much more affordable, analytical methods. This approach can be extended to VOC measurements with the same result. The net effect is that these effective and affordable emissions testing methods can provide operators with important, accurate, and cost-effective KPI's for both odor and VOC emissions.

**Conference Name:** Compost Council of Canada

**Conference Date:** Sept 2015

**Presenter:** Steve Diddy

**Title:** The Compost Process and BMPs for Minimizing Odors

**Abstract:** The capture and control of air emissions depends on the competency of both the technology and operations. A well-operated facility maintains BMP conditions (C/N ratio, density, moisture levels, porosity) throughout the process. This talk will list BMP technology and operations requirements and show examples of how CAPEX and OPEX are balanced to achieve regulatory and financial success at different locations.

**Conference Name:** Waste Expo 2015

**Conference Date:** June 2015

**Presenter:** Tim O'Neill

**Title:** Compost Facility Design – Operational Risk vs. Financial Performance

**Abstract:** his presentation will examine the often-opposing imperatives of managing operational risks while maximizing financial performance when developing a compost facility. We will review four compost facilities; two that have succeeded and two that have failed. We will analyze how the design of these facilities impacted cost and the ability to manage risks (primarily odor and product quality). We will evaluate these different facilities on the basis of:

- Ability to maintain Best Management Practices (BMP's)
- Facility Throughput
- Location
- Enclosed vs Covered vs Open Operations

We will conclude with a look at how these four factors correlate to operational success or failure, and an estimate the current unit cost for each example.

**Conference Name:** Waste Expo 2015

**Conference Date:** June 2015

**Presenter:** Steve Diddy

**Title:** Composting Systems, Process Management & Odor Control

**Conference Name:** Biocycle West Coast Conference 2015

**Conference Date:** April 2015

**Presenter:** Tim O'Neill

**Title:** Post-mortem Facility Odor Analysis -- Using Comprehensive Process Data to Improve Operations

**Abstract:** Freestanding biofilters have been used to scrub captured air emissions from compost process air for decades. Biofilter cover layers placed on top of an aerated static pile have received considerable attention in recent years. We have conducted our own research and compiled compost facility emissions data from several public sources that measured both freestanding biofilter emissions and emissions from the top of covered aerated static piles.

**Conference Name:** SWANA Western Regional Symposium

**Conference Date:** April 2015

**Presenter:** Steve Diddy

**Title:** BMPs of Forced Aeration Composting

**Abstract:** As an owner/operator, your operation depends on your ability to understand and comply with applicable air quality regulations. How do you align your best management practices to comply with the regulations in your air shed? This discussion will be useful to all composting facilities using forced aeration

systems that need to design or improve upon odor capture and control systems.

**Conference Name:** Organics on the Rise Compost 2015

**Conference Date:** January 2015

**Presenter:** Tim O'Neill

**Title:** Life-Cycle Cost Comparison of Turned Windrows and Aerated Pile Systems

**Abstract:** Do you own or manage a windrow compost facility? If you are planning to expand, add food waste, or are dealing with odor issues or new regulations, you should consider the pros and cons of implementing an aerated pile system.

Life-Cycle Cost Comparison of Turned Windrows and Aerated Pile Systems. Specific topics in this talk will include: footprint, diesel and electrical energy use, water consumption & management, air emissions (odors, VOC's), OPEX and CAPEX. If you have existing turning equipment, Tim will explain how to use it in combination with aerated systems to get the best process control possible.

**Conference Name:** Biocycle East Coast Conference 2014

**Conference Date:** October 2014

**Presenter:** Tim O'Neill and Jeffrey Dannis, Howard County Food Waste Composting Pilot Project

**Title:** Composting Source-separated Organics in an East Coast Urban Environment

**Abstract:** What does it take to develop a food waste composting facility? Jeffrey and Tim will discuss its design and the practical lessons learned, such as managing the leaf season, controlling odors, and minimizing contact water during large storm events.