Executive **Summary**

WATER ENVIRONMENT & REUSE FOUNDATION

Moving towards a rational and universal approach for low-cost, low-tech Class A biosolids treatment processes

A Blueprint for High-Tech Analysis of Low-Tech Methods for Sustainable Class A Biosolids Production: Phase 1 (NTRY11T15)

The Central Issue

Water resource recovery facilities (WRRFs) seek to upgrade from Class B to Class A biosolids production. However, U.S. EPA's approved methods for producing Class A biosolids, including the Processes to Further Reduce Pathogens (PFRPs), are generally energy intensive. For many WRRFs, low-cost, low-tech (LCLT) treatment methods applied at ambient conditions may be more appropriate to reach Class A status. A lack of information on the inactivation of pathogen and indicator organisms (PIOs) under ambient conditions complicates adoption of LCLT methods. WRRFs then have to use trial-and-error approaches to design LCLT treatment systems that comply with regulations.

Placement of the biosolids into a test bed, showing the a) initial placement of the biosolids around the bottom perimeter to secure the filter fabric and b) filling of a test bed with biosolids to a depth of 3 feet.

Context and Background

To improve our understanding of the key factors controlling PIO inactivation rates to develop a rational and universal design of LCLT Class A biosolids treatment processes, WE&RF developed a multi-phased research approach. The research objectives are to:

- Evaluate the impact of biosolids storage temperature, organic matter and NH_3 content, pH, and percent total solids on the inactivation of PIOs as a function of time.
- Fit inactivation constants to the data obtained for each PIO and apply these constants and a mathematical model of inactivation to determine the treatment criteria needed to achieve Class A biosolids pathogen requirements.
- Perform pilot-scale studies of four low-tech Class A biosolids treatment processes and monitor the abundance of PIOs and environmental factors to validate predictions based on laboratory studies and mathematical modeling.

Findings and Conclusions

This report documents Phase 1 of this project: Initiation of pilot-scale studies simulating high-solids, long-term storage processes. Researchers initiated pilot-scale studies simulating the high-solids, long-term storage process at two WRRFs (GIWA, located in Ironwood, MI, and PLWSA, located in Houghton, MI). Two pilot-scale tests were performed at each location. This report outlines the materials and methodologies developed to initiate those pilot-scale studies. In addition, methods are provided for monitoring the pilot test environmental conditions (e.g., ambient temperature, solar radiation, precipitation), the physical/chemical properties of the biosolids over time (e.g., in situ temperature, TS, VS, pH, volatile fatty acids, NH_3 content), and PIO densities (i.e., fecal coliforms, coliphage, enteric viruses, helminth ova) over time. Long-term monitoring of the pilot-scale test boxes will continue in Phases 2 and 3 of the multi-phased project and will be described in subsequent reports. In addition, the pilot-scale environmental data and PIO densities will later be used to verify the model created in Phases 2 and 3 of the project.

Management and Policy Implications

This report is the first step in helping WRRFs seeking to implement a LCLT method to achieve Class A biosolids and demonstrate their equivalency to PFRP regulations. It provides a guide to design and construct a pilot-scale test bed, and starts development of an experimental approach to provide the data to verify that adequate pathogen reduction is achieved in the LCLT treatment processes.

Phased Approach to Achieving Research Objectives

This Report:	Tasks
Phase 1	Initiate third research objective "high-solids, long-term storage" studies at Gogebic-Iron Wastewater Authority (GIWA), Ironwood, MI, and Portage Lake Water and Sewer Authority (PLWSA), Houghton, MI.
Future Phases:	**Tasks**
Phase 2	■ Continue the third research objective high-solids, long-term storage studies at GIWA and PLWSA. ■ Initiate first research objective, Stage 1, lab experiments and second research objective, Stage 1, Inactivation Constant Estimation. ■ Conclude the third research objective high-solids, long-term storage study at PLWSA at end of Phase 2.
Phase 3	■ Continue the third research objective high-solids, long-term storage study at GIWA. ■ Conduct third research objective high-solids, long-term storage study at Marquette Area Wastewater Treatment Facility (MAWTF), Marquette, MI. ■ Conduct air drying and cake storage studies at PLWSA per third research objective. ■ Conduct first research objective, Stage 2, lab experiments and second research objective, Stage 2, Inactivation Constant Estimation at Michigan Tech.

Related WE&RF Research

Project Title	Research Focus
Producing Class A Biosolids with Low-Cost, Low-Technology Treatment Processes (95REM2)	Reviews the available literature and municipal agency data about low-cost, low-technology biosolids treatment processes including lagoon storage, air drying, and cake storage to present design and operating guidelines.
Next Generation Tools for Assessing Death and Decay of Critical Wastewater Bacteria (U1R12)	Develops and compares protocols using next-generation biomolecular tools against standard protocols and methods to measure inactivation and decay kinetics of pathogens, pathogen indicators, and nitrifying wastewater bacteria. It supports more precise design and quality control of effluent from biological processes including nitrifying activated sludge, advanced nutrient removal, and solids treatment such as pasteurization, mesophilic and thermophilic anaerobic digestion, and biosolids storage and land application.

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