White Paper on Exceptional Quality and the TerraNew Process

Written by

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INTRODUCTION

The world of water reclamation is constantly changing, and the area of biosolids is open to new ideas, technologies, or science that will improve the industry. Economic and efficient ways of addressing biosolids treatment and disposal are increasingly appealing. When a technology can save money and at the same time help the environment and improve human health, it should be something we are all willing to consider.

TerraNew has developed one such technology that shows great potential in the field of wastewater treatment, especially in the area of sewage sludge treatment, nutrient recovery and subsequent nutrient use. For more information on nutrient removal and recovery please see TerraNew's white paper on Side Streams. TerraNew has developed a process that transforms primary, untreated, raw sludge, secondary sludge and liquid side streams into products that meet or surpass the Class A requirements of the Environmental Protection Agency's regulations found at 40 CFR Part 503. The products are and can be used as a soil conditioner and plant nutrient source. TerraNew can show that this technology meets these requirements within the current scope of Part 503, and is Exceptional Quality (EQ).

This paper will discuss all requirements of Part 503 that relate to land application of biosolids: pathogen reduction, heavy metals (Table 3), and vector attraction reduction (VAR). It also explains how TerraNew's technology results in products that meet EQ treatment standards.

CLASS A BIOSOLIDS

Part 503 of the EPA's regulations classifies biosolids primarily for the protection of human health and the environment and dictates how and where they can be used. Biosolids that meet Class B requirements, for example, can be used for agricultural or soil reclamation purposes. Class B biosolids have not been processed in conditions that reduce the pathogens to levels where they would be considered safe. When Class B biosolids are applied to the land, site restrictions are imposed to ensure there is little chance of the biosolids coming into contact with the public or harming the environment. Biosolids that meet Class A requirements have gone through further processing, pathogen reduction, and testing to ensure that they can be used safely by the public in applications such as on lawns and in gardens where they may frequently come in contact with humans. Biosolids applied to the land must meet three important requirements:

- Pathogen Reduction Process (Class A or Class B)
- Metals Table 3
- Vector Attraction Reduction

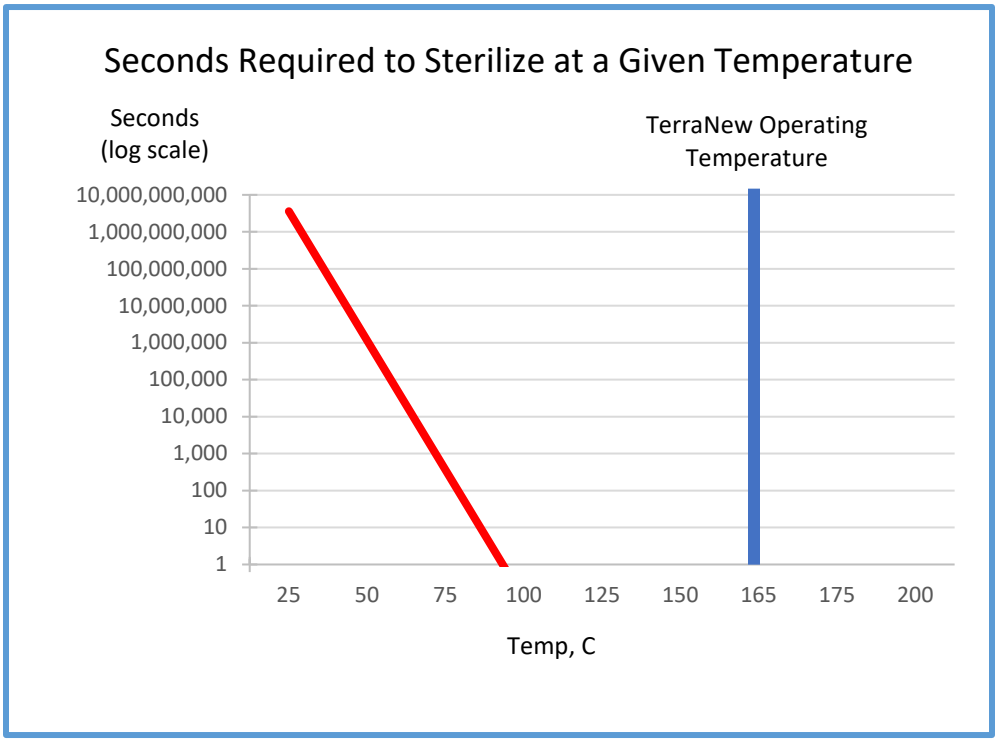
PATHOGEN REDUCTION PROCESS

TerraNew reduces pathogens by grinding the sludge to a very small particle size, then treating those particles and water at a temperature of over 165 Celsius (329 Fahrenheit) for a retention time of 1 minute at a pressure of 280 psi in the presence of acids and oxygen.

According to Part 503 regulations for Class A Pathogen Requirements, this meets the requirements for Alternative 1 Regime C, equation 2 (40 CFR 503.32(a)(3)(ii)(C)) where the sludge is less than 7% solids and is treated for at least 15 seconds, but less than 30 minutes.

Figure 1 below illustrates how temperature and time correlation requirements are met using this equation. Only a very short time is needed at this high temperature. The TerraNew process maintains a contact time of 1 minute at this temperature--well above the minimum requirement. In addition to these temperatures, times, and pressures the acids that are injected lower the pH to 1, which assures the decrease of pathogens. This process eliminates fecal coliform counts and therefore meets the requirements for pathogen reduction. The TerraNew process achieves temperatures high enough and pH low enough that the biosolids are sterilized (Table 1, below) thereby meeting Class A pathogen reduction requirements.

FIGURE 1: TIME AND TEMPERATURE RELATIONSHIP FOR PATHOGEN REDUCTION IN BIOSOLIDS



Graph derived from the following relationship: 131700000/(10^(.14*temp C)), as found in alternative 1 Regime C of the 503 EPA regulations.

TerraNew proprietary software records operating parameters, including pressure, time and temperature of the reaction vessel. TerraNew has also confirmed through testing that pathogen reduction requirements are met (see Table 1 below). Part 503 dictates the monitoring frequency based on the dry metric tons of biosolids production. TerraNew will monitor on a more frequent schedule to prove the process fulfills this requirement and to assure consistent product quality.

TABLE 1. PATHOGEN TEST RESULTS OF TerraNew TREATED BIOSOLIDS*

Sample Location	Date/Time of Sample	**Fecal Coliform Test Result**	**Salmonella Test Result**	Class A Fecal Coliform Limit	Class A Salmonella Limit
Product Outfall	10-20-15 A	**0**	**0**	<1000 mpn/g	<3 mpn/4g
Product Outfall	10-20-15 B	**0**	**0**	<1000 mpn/g	<3 mpn/4g
Product Outfall	10-20-15 C	**0**	**0**	<1000 mpn/g	<3 mpn/4g

Note: QC controls used for Salmonella and E. coli were positive.
*Tests performed by Richards Laboratories of Utah

METALS

Testing performed by TerraNew has shown that the metal pollutant content of its biosolids product is well below the Table 3 requirements of the 503 regulations (40 CFR 503.13(b)(3)). (See Table 2, below.) The sludge that TerraNew has processed for these tests has come from conventional treatment plants that receive primarily domestic waste with industrial waste being a very small portion of the flow. These results can change based on the source of the wastewater. For example, mine waste with high levels of heavy metals would be more challenging to process to meet the Table 3 pollutant levels. TerraNew's output from the process has the potential to separate metals from the waste stream. This capability could allow for processing waste streams containing more metals. However, TerraNew is not focusing on this capability for production at this time.

TABLE 2. 503, TABLE 3 HEAVY METAL LIMITS & TerraNew PROCESS RESULTS

	Table #3	TerraNew
Pollutant	"High Quality" Pollutant Concentration Limits (mg/kg)	Test Results* (mg/kg)
Arsenic	41	0.80
Cadmium	39	0.22
Copper	1500	16.3
Lead	300	0.55
Mercury	17	0.12
Molybdenum		0.45
Nickel	420	1.64
Selenium	100	0.13
Zinc	2800	22.5

* Maximum of 4 analyses over the last two years from two laboratories: American West Analytical Laboratory in Salt Lake City, UT and Soiltest Farm Consultants in Moses Lake, WA.

Part 503 dictates sampling frequency for biosolids to determine metal content. Facilities producing up to 290 Dry Metric Tons of biosolids annually must sample at least once per year. TerraNew will sample more frequently to confirm compliance and assure product quality, especially during startup and during the proving process.

VECTOR ATTRACTION REDUCTION (VAR)

Vectors are potential disease-carrying organisms that can transmit disease directly to humans or contribute to the life cycle of a pathogen by serving as a host. Vector attraction reduction (VAR) refers to a treatment process for biosolids that makes them less attractive to vectors and therefore decreases their potential for spreading disease.

Compliance with VAR occurs via 8 options. TerraNew passes the fourth option which is the Specific Oxygen Uptake Rate (SOUR) method.

So, with respect to VAR, TerraNew technology dramatically changes the nature of the sludge. Not only are all pathogens eliminated, but the sludge is no longer an attractant to vectors; and as a liquid nutrient source, the product is contained in a tank so that any potential vectors are excluded until it is field applied.

SUMMARY

TerraNew has operating procedures and monitoring in place to ensure process temperature and acid levels, and through frequent testing it can verify the quality of its products. TerraNew has successfully been able to show that it can meet Class A pathogen, metals requirements and vector attraction reduction and thus qualifies as Exceptional Quality (EQ) sludge.

For ease of reference, *The Environmental Regulations and Technology, Control of Pathogens and Vector Attraction in Sewage Sludge*, EPA/625/R-92/013, Revised July 2003, also known as the "White House Document," chapter 3 page 20 is cited here.

> "Exceptional quality (EQ) biosolids are biosolids which have met the Part 503 pollutant concentration limits (Table 3 of Section 503.13) as well as Class A pathogen reduction requirements and one of the first eight vector attraction reduction options listed in 503.33(b)(1) through (b)(8). EQ biosolids may be land applied without site restrictions."

References:

- Code of Federal Regulations, Title 40, Chapter 1, Subchapter 0, Part 503: Standards for the use or disposal of sewage sludge. 1993.
- Environmental Regulations and Technology: Control of Pathogens and Vector Attraction in Sewage Sludge EPA/625/R-92-013 Revised July 2003

For further information, please refer to these additional white papers on our web site:

Side Streams, Nutrient Recovery and the TerraNew Process and

Land Application of TerraNew Processed Biosolids

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