

2007: ANNUAL BIOSOLIDS REPORT

Introduction

The City of Salem, Oregon, is located in the Willamette Valley, an area of rich agricultural production. The local climate is characterized by cool, moist winters and warm, dry summers, with an average annual precipitation of 40 to 45 inches. Snowfall and extended periods of freezing weather are infrequent.

The rich soils and mild climate of the Salem area are ideal for farming. Soils are dominated by silty-clay deposits of Willamette River bottom sediments. Eastward, the soils are predominantly clay, while to the northeast, loamy soils predominate. Soil conditions and agricultural practices allow local biosolids application during fair weather from early spring through October and at our Easter Oregon application site throughout the winter months.

The City of Salem owns and operates a municipal sewage collection and wastewater treatment facility under National Pollutant Discharge Elimination System (NPDES) Permit Number 101145. The Willow Lake Water Pollution Control Facility (WLWPCF) provides secondary treatment for a population center of approximately 220,000, which includes Salem, Keizer, Turner, and unincorporated parts of Marion County.

The City of Salem's biosolids distribution program (Biogro), is charged with the task of biosolids management. Important elements of the program include digester operation, liquid and dewatered biosolids production, transport and application, and application site management.

2007 Wastewater Processing

The City of Salem is presently in the process of WLWPCF expansion and upgrades designed to provide a total of 205 million gallons per day (mgd) peak hour wet weather capacity by the end of December 2009. Willow Lake improvements and the construction of a River Road Wet Weather Treatment Facility (RRWWTF) will meet the requirements of a Mutual Agreement and Order (MAO) to eliminate sanitary sewer overflows (SSOs) under certain conditions by the year 2010.

The treatment facility is sited on 40 acres between the City of Keizer's urban growth boundary and the Willamette River. WLWPCF is designed for an average dry weather flow and peak wet weather flow of 35 and 105 million gallons per day (mgd). Treatment processes include mechanical screening, secondary treatment, sludge thickening, anaerobic digestion, cogeneration, solids dewatering, chlorine disinfection and dechlorination. Treated effluent from the treatment plant is discharged to the Willamette River (78.4 River Mile), in Marion County, Oregon.

The facility receives flow from residential, commercial, light industrial, and institutional dischargers, as well as seasonal loadings from local canneries. In 2007 approximately 118,907 gallons of septage was received at a city operated septage receiving facility and conveyed to the plant for treatment. Presently, the City manages an EPA approved pretreatment program which oversees 30 permitted dischargers, including 6 categorical industries.

The facility can operate in a variety of secondary modes, including; trickling filter, conventional air activated sludge, high purity oxygen activated sludge, trickling filter/air activated sludge, and trickling filter/high purity oxygen activated sludge in parallel. The flexibility of the secondary process allows the WLWPCF to handle wide variations in Biochemical Oxygen Demand (BOD) loading which occur between canning and non-canning seasons.

2007 Biosolids Stabilization Processes

In 2007 primary solids were thickened in one of three (3) gravity thickeners. Secondary solids were thickened on a Gravity Belt Thickener. Solids were thickened to approximately five percent prior to mesophilic primary/secondary anaerobic digestion in one of two digester facilities.

The north digester facility is composed of two (2) mechanically mixed, fixed cover, primary digesters which overflow to a floating dome, secondary digester. The south digester facility is composed of two (2) gas mixed, fixed cover, primary digesters which overflow to two (2) secondary digesters. All four primary digesters are externally heated with coiled heat exchangers using a modified hot water loop from a cogeneration system as a heat source. Additionally, each facility houses boilers as a redundant heat source. The digester facilities gas systems are common and provide fuel for the cogeneration system.

Design organic loading on the primary digesters is approximately 0.23 pounds of volatile solids/day/cubic feet of digester volume. In 2007, the average organic loading on the primary digesters was 0.072 volatile pounds/day/cubic feet of digester volume compared to approximately 0.064 pounds in 2006.

The solids flow stream is divided between the north and south digester facilities using magnetic flow meters and automated feed valves. The south facility has a larger capacity, and receives 60 percent of total plant solids production, while the north facility receives 40 percent. As a result of the 60/40 flow split and identical feed sources, the mean cell residence time (MCRT), and volatile solids loading rates are similar. There are no substantial differences in biosolids produced at either facility.

2007 Biosolids Analysis, Quantity, and Quality

In 2007 WLWPCF analyzed biosolids for metals and nutrient characteristics more frequently than the minimum requirements listed in 40 CFR 503.16, Table 1. All biosolids analyses were performed in-house.

Total and volatile solids of raw digester feed were measured daily. Primary digester feed rates and temperatures were also measured daily. Primary digester alkalinity and pH were measured three (3) times per week. Monthly averages were used to calculate total volatile solids reduction.

In 2007 a trailer mounted centrifuge (21 inch diameter bowl) provided additional, improved dewatering capacity and redundancy to the belt filter press. When either dewatering process was in operation, daily dewatered biosolids samples were collected every four (4) hours. During local liquid application, biosolids samples were taken when filling each tanker load. Samples from the centrifuge, belt filter press and liquid biosolids products were composited

separately and analyzed monthly for all pollutants listed in 40 CFR 503.13, Table 1, as well as Total Solids, Total Volatile Solids, pH, Total Kjeldahl Nitrogen (TKN), Nitrate Nitrogen (NO₃) and Ammonia Nitrogen (NH₃), Phosphorus (P), and Potassium (K).

When centrifuge and belt filter press biosolids were combined and applied on specific sites, a weighted average was used to calculate nutrient and pollutant concentrations for application and cumulative loading rates.

In 2007 the City of Salem generated approximately 3,727.89 dry US tons of Class B biosolids. Approximately 3,699.03 dry US tons were land applied including the remaining 14.89 dry US tons remaining from late December 2006. Approximately 59.14 dry US tons generated in late December 2007 will be applied in January 2008.

The applied biosolids in 2007 contained about 183,801 pounds of Plant Available Nitrogen (PAN), 161,787 pounds of P, and 25,666 pounds of K.

All biosolids produced met the pathogen reduction requirements in 40 CFR 503.32(b)(3), Appendix B; Processes to Significantly Reduce Pathogens (PSRP), Item 3, which states:

Anaerobic digestion - Sewage sludge is treated in the absence of air for a specific mean cell residence time (MCRT) at a specific temperature. Values for the MCRT and temperature shall be between 15 days at 35 to 55 degrees Celsius and 60 days at 15 degrees Celsius.

All biosolids produced also met the vector attraction reduction (VAR) requirements in 40 CFR 503.33(b)(1) which states:

The mass of volatile solids in the sewage sludge shall be reduced by a minimum of 38 percent (see calculation procedures in "Environmental Regulations and Technology-Control of Pathogens and Vector Attraction in Sewage Sludge," EPA-625/R-92/013, 1992, U.S. Environmental Protection Agency, Cincinnati, Ohio 45268).

The overall MCRT averaged 44.8 days at an average temperature of 97.0 degrees Fahrenheit (36.1 degrees Celsius), and the VAR averaged 60.6 percent.

2007 Biosolids Management Description

In 2007 the City of Salem managed 32 applications of Class B biosolids (liquid and dewatered) on various sections of 20 DEQ authorized sites consisting of sod, hay, grass seed, and pasture lands totaling about 1,521 acres. Control of application rates was the responsibility of the City of Salem. All applications were consistent with site restrictions outlined in 40 CFR 503.32 (b)(5) and application rates specified in the individual DEQ site authorization letters.

In 2007 approximately 47 percent of the annual biosolids volume (dry US tons) were applied locally during the local application season, which runs from May to October (on most application sites).

A multi-purpose agricultural building located on the application site known as Suver, provided temporary storage for 231.96 dry tons of dewatered biosolids from April through July. All

biosolids stored at Suver were applied on Suver application sites.

During the remainder of the year, dewatered biosolids were transported to Madison Ranch, in eastern Oregon. The City of Salem retains the lease of 720.8 acres on Madison Ranch through the year 2020 for the beneficial reuse of biosolids.

In 2007 the Biogro staff continued to use a Global Positioning System (GPS) to measure acreage and lay out buffer zones around wells, structures, sensitive areas and the perimeter of the property. A buffer zone of at least 50 feet was required around property perimeters and near surface water. A buffer zone of at least 200 feet was required around all residences and wells.

Well and soil samples were collected at all local application sites. Wells adjoining beneficial reuse sites were analyzed for NO₃. Application sites soils were analyzed for background levels of pH, cation exchange capacity (CEC), total NO₃, P, K and 40 CFR 503.13, Table 1 pollutants. New in 2007, all soils were sampled for phosphorus content using the Bray method, as well as their organic content.

All analytical results were incorporated into the Biogro program database and shared with the farmer. In addition, the cumulative loading of nutrients and pollutants were recorded. To date, monitoring has not revealed any problems related to biosolids applications.

All record keeping and reporting practices including the NPDES Discharge Monitoring Report, farmer monitoring reports, and the EPA 503 Annual Compliance Report comply with 40 CFR 503.17 and 503.18.

In 2007 a total of 737 acres were newly approved for beneficial reuse by DEQ.

In 2007 liquid biosolids were applied using 6000 and 5500 gallon pressurized tanker trucks at application rates pre-approved by the DEQ. Typically, an application rate of about 1 dry ton per acre provided approximately 100 pounds of plant available nitrogen (PAN). Dewatered biosolids were also applied using a tractor and manure spreader. Typically, an application rate of about 3 dry tons per acre provided approximately 100 pounds of plant available nitrogen (PAN). DEQ site approval letters approved PAN application rates from 75 pounds to 150 pounds per acre.