

2008: 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 soil conditions, agricultural practices and the mild climate allow local biosolids application during fair weather from early spring through October. Locally, soils are dominated by silty-clay deposits of Willamette River bottom sediments. Eastward of Salem the soils are predominantly clay, while to the northeast loamy soils predominate. During the winter months and periods of local inclement weather, the City of Salem transports dewatered biosolids products to established biosolids application sites in Eastern Oregon.

2008 Wastewater Processing

The City of Salem owns and operates a municipal sewage collection and wastewater treatment facility under the National Pollutant Discharge Elimination System (NPDES) Permit Number 101145. The City also manages an EPA approved pretreatment program which oversees 30 permitted dischargers, including 7 categorical industries. (See Appendix, Table 1: 2008 City of Salem - Permitted Industries)

In 2008 the Willow Lake Water Pollution Control Facility (WLWPCF) received a total flow of 13,191 million gallons of sewage. Additionally, 191,787 gallons of septage was received at the City's septage receiving facility and conveyed to the plant for treatment. The proportional breakdown of the total annual flow was:

- 61 percent residential
- 32 percent commercial
- 7 percent light industrial and institutional dischargers

The facility provides secondary treatment for a population center of approximately 222,000, which includes Salem, Keizer, Turner, and unincorporated parts of Marion County. The 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 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. WLWPCF secondary process flexibility provides excellent treatment for wide variations in Biochemical Oxygen Demand (BOD) resulting from increased loading rates during canning season. Primary solids are thickened in one of three (3) gravity thickeners. Secondary solids are thickened on a Gravity Belt Thickener.

Typically, solids are thickened to approximately five percent prior to mesophilic primary/secondary anaerobic digestion.

The City of Salem is presently in the process of 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 2010 at the Willow Lake Water Pollution Control Facility. 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.

2008 BIOGRO Management Description

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. The City of Salem retains a lease of 720.8 acres on Madison Ranch located near Hermiston, in eastern Oregon, through the year 2020 for the beneficial reuse of biosolids. In 2008 the City contracted with Parker Ag Services, LLC, for application of dewatered biosolids on sites also located in eastern Oregon, near Wasco. In 2008 a total of 383 acres were newly approved for beneficial reuse by DEQ. Additionally, older application sites continue to be re-authorized as owners and acreages are adjusted.

2008 Class B Biosolids Processing

In 2008 a total of 37,913,578 gallons of primary and thickened secondary sludge was fed to the primary digesters. The primary and secondary sludge flow streams were divided between the north and south digester facilities using magnetic flow meters and automated feed valves. In 2008 approximately 56 percent of the treatment plant's solids production was stabilized in the larger south primary digesters while the north facility received 44 percent.

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

Design organic loading on the primary digesters is approximately 0.23 pounds of volatile solids/day/cubic feet of digester volume. In 2008 the average organic loading on the primary digesters was 0.064 volatile pounds/day/cubic feet of digester volume compared to approximately 0.072 pounds in 2007. (See Appendix, Table 2: Digester Volatile Feed Pounds Loading Rates)

2008 Class B Biosolids Treatment Description

In 2008 all biosolids produced met the Class B pathogen, and Vector Attraction Reduction (VAR) requirements as specified 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.
- 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).

In 2008 the MCRT averaged (four primary digesters) between 44.2 and 58.3 days at an average temperature of 98.8 and 99.3.0 degrees Fahrenheit (36.1 degrees Celsius) and the VAR averaged 60.6 percent. (See Appendix, Table 3: Annual Digester Performance)

2008 Biosolids Analysis Reporting

In 2008 WLWPCF analyzed biosolids for metals and nutrient characteristics more frequently than the minimum requirements listed in 40 CFR 503.16, Table 1. All biosolids analysis was performed in-house. (See Appendix, Table 4: Monthly Biosolids Product Analysis)

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.

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).

2008 Class B Biosolids Products

In 2008 approximately 36,330,518 gallons of biosolids were utilized for the production of liquid, belt filter press and centrifuge biosolids products. The liquid product and biosolids feed concentrations in flow sent to the dewatering processes ranged between 1.9 percent and 2.7 percent by weight with an average volatile content of less 70 percent. The proportional breakdown of the total annual biosolids production (in gallons) was:

- 50 percent belt filter press product (18,166,833 gallons).
- 38 percent centrifuge product (13,763,685 gallons).
- 12 percent liquid product (4,400,000 gallons).

(See Appendix, Table 5: Digester Balance – gallons in versus gallons out)

Total polymer costs for dewatered biosolids production were approximately \$176,600. The 3 meter belt filter press provided an average annual cake dryness of 16.0 percent utilizing an average polymer dosage of 32.7 lbs/ton of dry feed solids and yielding an average capture rate of 91.0 percent. Belt filter press polymer consumption was 6,047 gallons at a cost of \$55,044.

The 21 inch diameter bowl centrifuge provided an average annual cake dryness of 24.7 percent utilizing an average polymer dosage of 80.2 lbs/ton of dry feed solids and yielding an average capture rate of 89.1 percent. Centrifuge polymer consumption was 12,158 gallons at a cost of \$121,514. (See Appendix, Table 6: Centrifuge/Belt Filter Press Production)

2008 Biosolids Production Quantity

In 2008 the City of Salem generated 3,022.74 dry US tons of Class B biosolids. Approximately 2,968.76 dry US tons were land applied including the approximately 47.90 dry US tons remaining from late December 2007. As a result of inclement weather limiting eastern Oregon applications during December 2008 approximately 101.88 dry US tons remain to be applied in January 2009. (See Appendix, Table 7: Total Annual Wet Tons & Gallons Produced)

2008 Application Rates

The applied biosolids contained 152,434 pounds of Plant Available Nitrogen (PAN), 129,192 pounds of P, and 20,831 pounds of K. Control of application rates was the responsibility of the City of Salem and all applications were consistent with site restrictions outlined in 40 CFR 503.32 (b)(5) and application rates specified in DEQ site authorization letters. (See Appendix, Table 8: Application Site Totals – Acreage, Tonnage & Nutrient Values)

In 2008 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 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 PAN. DEQ site approval letters approved PAN application rates from 100 pounds to 150 pounds per acre.

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

2008 Site Management

In 2008 the City of Salem managed 30 applications of Class B biosolids (liquid and dewatered) on various sections of 22 DEQ authorized sites consisting of sod, hay, grass seed, and pasture lands totaling 1,242 acres. The proportional breakdown (by location) of the total annual biosolids production was:

- 56 percent (dry US tons) were applied in eastern Oregon.
- 44 percent (dry US tons) were applied locally (May to October) in the Willamette Valley.

Biogro staff used 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 minimum buffer zone of 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. Application site worksheets and daily application maps were completed for each site.

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. The Bray 1 method was used to determine available soil phosphorus. Additionally, the organic content of application site soils was analyzed to evaluate increases in the soil's organic content as a result of biosolids applications. Cumulative loading for nutrients and pollutants were recorded for each site. A Farmer's Report was also generated to evaluate the economic value of biosolids applications.

2008 Application Record Management

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

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, the City's monitoring of site soils and domestic wells adjacent to application sites have not revealed any problems related to the City of Salem's beneficial reuse of biosolids for land application.

Oregon Administrative Rules (OAR) 340 – 050 – 0006

Policy

The Environmental Quality Commission (EQC) encourages the land application of treated domestic wastewater biosolids, biosolids derived products, and domestic septage which are managed in a manner which protects the public health and maintains or improves environmental quality. These beneficial recyclable materials improve soil tilth, fertility, and stability and their use enhances the growth of agricultural, silvicultural, and horticultural crops.