Biosolids Treatment Class B Biosolids (Digestion and Dewatering)

The initial sewage sludge treatment process at the City of Lebanon Authority Wastewater Treatment Facility produces a class B biosolids. The method to significantly reduce pathogens is option 3 – anaerobic digestion. Specifically, High-Rate Anaerobic Digestion in 2 -1.9 million gallon digesters, operating in the mesophilic range. In the course of treating wastewater, several types of solids are generated and collected at different points in the facility. Both organic and inorganic solids are collected as settled or floating solids and are handled as sludge. The anaerobic digestion process provides the sludge stabilization and reduction and when combined with dewatering, makes the resultant sludge product suitable for disposal. This is performed in three steps: solids liquefaction, volatile acids formation, and methane generation. These steps are accomplished in a two-stage high rate digestion process supported by pumped sludge recirculation and heating. This process produces Class B biosolids suitable for land disposal either as a liquid or as a cake after dewatering with centrifuges. Essentially, two different groups of microorganisms are involved in this biological process. They are the facultative acid-forming bacteria, which can survive only in an oxygen free environment. The SAPROPHYTIC ORGANISMS, "acid former", break down the sludge organics into volatile acids and the methane fomenters convert these organic acids into methane and carbon dioxide. This second step is the most critical in anaerobic solids stabilization because the volatile acids are converted into gaseous end products for removal from the system. Both sensitive microbial groups require closely controlled environments, as influenced by the organic loading, temperature, degree of mixing and the digestion time.

Under the biosolids treatment process, sludge and scum from the primary clarifiers are pumped to the high-rate primary digester, where most of the organics are reduced and gas is produced. The primary digester is classified as high-rate because of the increased food-to-microorganism contact, which permits higher organic loading as compared with conventional digesters. Sludge in the primary digester is mixed using a linear motion mixer. Following first stage digestion, sludge is automatically transferred to the secondary digester. The Secondary digester is complete mix using mixing pumps with jets. The cover of the Secondary digester is a Dystor two layer membrane which stores and maintains pressure for reuse of the biogas.

Secondary digester sludge if used as Class B can be applied to agricultural fields in two forms – liquid (treated Biosolids taken directly from the digester) or cake (treated Biosolids dewatered through 2 Alfa Laval centrifuges). Dewatered Biosolids, to be applied as Class B cake, are stored in the Cake Shed located behind the digester. They are segregated from other materials. If the cake is stored longer than 90 days it is resampled and analyzed for Fecal Coliform to confirm regrowth has not occurred. During Digester operation the Biosolids are under treatment for a minimum of 30 days. The centrifuges dewater solids throughout the year to maintain levels in the digesters.

Class A Biosolids (Drying)

The CoLA WWTP also produces Class A Biosolids by Drying. Dewatered biosolids are conveyed to a live bottom hopper. Three augers keep the wet biosolids fluidized and leveled within the hopper. From the hopper the biosolids are transported to the dryer by means of a progressive cavity pump (variable speed to adjust feed based on cake solids concentration and temperature sensors along the length of the dryer). Komline-Sanderson's (K-S) paddle dryer has a maximum capacity of 2.75 wet tons of sludge cake per hour. The Dryer uses thermal oil as the heat transfer medium. The biosolids are exposed to indirect heat by means of thermal fluid-filled hollow paddles and thermal fluid circulation shell. There are two intermeshing – counter rotating agitator shafts with the hollow paddles fabricated of 316L stainless steel. The shell of the dryer has an external jacket that is integrally welded to the dryer chamber to also provide heat transfer. The thermal fluid flows through the hollow paddles as well as the external jacket. Thermal fluid temperature is set between 300 degrees F and 400 degrees F. This provides a constant temperature throughout the paddle Dryer for the drying process. The thermal fluid temperature set point is based upon the feed rate to the Paddle Dryer and operational experience, and is maintained at its set point by the thermal fluid system. When fed at a constant wet feed rate (pounds per hour), the Paddle Dryer operated at a fixed thermal fluid temperature will result in the boiling away or removal of a fixed quantity of water. Operated this way, the Paddle Dryer requires very little in the way of active controls. Because of its large working volume relative to wet feed rate, it is not sensitive to minor fluctuations in the process. The level of the discharge weirs set the working volume of the Paddle Dryer. Material in the Paddle Dryer that is higher than the weirs is discharged. Material that is not discharged remains in the Dryer. As wet feed is transferred into the Dryer, the agitation of the paddle shafts causes a proportionate volume of dry material to be discharged. The Dryer operates with a fixed volume and retention time based on the level set by the adjustable weirs. The Dryer bed temperatures are monitored at four locations using thermocouples with transmitters. Bed temperatures are trended and displayed on a screen on the OIT (Operator Interface Terminal). Because the drying process is slow reacting, observing trends allows operators to anticipate temperature changes and take action to minimize their affects by adjusting the feed rate or thermal fluid supply temperature set point. Under normal steady state running conditions, the Dryer's rotational speed is constant, the thermal fluid supply temperature is preset, and the feed rate is adjusted to yield dry sludge at the desired final moisture level. Dry material is discharged over the discharge weir maintaining a constant level in the Dryer. The temperature profile as shown by the bed temperature sensors is indicated on the dryer control panel OIT. Wet feed rate and thermal fluid temperature are adjusted based on operational experience to achieve the desired dryness level at the dryer discharge using the bed temperature profile as a guide for wet feed rate or temperature adjustment. Dry solids are cooled then transported into a storage silo by Dense Phase Transport. Dry solids are added to the top of the silo and the oldest solids removed from the bottom. Solids will be tracked to monitor if solids are stored greater than 90 days. Solids present in the Silo for more than 90 days (will be on the bottom) – will be sampled and reanalyzed to confirm that no re-growth of fecal coliform has occurred.