E A R T H T E C H

A tyco INTERNATIONAL LTD COMPANY

MEMORANDUM

Date: September 17, 1999

To: David Deskins

From: John K. Nelson

Copies:

Subject: Prescott Valley Report

Enclosed is the biosolids evaluation report prepared by Earth Tech for the Town of Prescott Valley

DESKINS

An Independent Evaluation of the Deskins “Quick-Dry” Filter Beds, Belt Filter Press and Autothermophilic Aerobic Digestion

BIOSOLIDS

EVALUATION

FOR THE

PRESCOTT VALLEY, ARIZONA

WASTEWATER TREATMENT FACILITY

Prepared by: Earth Tech TWM
5555 Glenwood Hills Parkway SE
Grand Rapids, Michigan 49588

Prepared for: Town of Prescott Valley
Engineering Department
7501 Civic Center
Prescott Valley, Arizona 86314

Date: June 22, 1999

BACKGROUND

As per our letter of proposal dated March 2, 1999, Earth Tech has been requested to evaluate options available to the Prescott Valley Wastewater Treatment Plant (WWTP) for biosolids beneficial reuse. Earth Tech was also to prepare cost estimates for construction, operation, and maintenance of the biosolids technologies. It was necessary for Prescott Valley to undertake an evaluation of biosolids technologies, in order to plan for the current and future growth of the area. The following study provides that evaluation.

INTRODUCTION

The WWTP in the past has utilized sand drying beds for the dewatering and stabilization of biosolids. The existing sand beds, however, have been problematic to date. Drainage through the sand beds has been poor, due to plugging of the media and/or crushed underdrains, causing a backlog of solids at the WWTP. This ahs manifested in process and aesthetic/housekeeping issues at the WWTP. To immediately rectify this problem, the WWTP employed the use of a belt filter press to dewater and remove the solids from the system at a more accelerated rate. This system, unfortunately, does not provide any form of stabilization and, as such, may necessitate the continued disposal of biosolids at a local landfill.

Stabilization of solids is dictated by federal, Environmental Protection Agency, regulations (40 CFR Part 503 – Standards for the Use or Disposal of Sewage Sludge). These regulations dictate the classification of biosolids based on the various pollutant concentrations, vector attraction, and pathogenic organism populations contained in the biosolids. Class A biosolids are considered to be of the highest beneficial reuse value with little danger to humans or animals. Class B is of a lower quality, with the main difference being the quantity of fecal coliform organisms contained in a specific volume of the biosolids. Biosolids classified below a Class B, are not suitable for beneficial reuse. Until recently, Prescott Valley's biosolids were beneficially reused as a Class B product, through a contract with Pima Gro. The return to that practice is made part of this report.

Earth Tech has evaluated a number of processes that would achieve Prescott Valley's objective of obtaining a Class A biosolid and would fit into the specific operational needs of the WWTP. Capital and operations and maintenance costs for this analysis were based on a maximum month flow and concentrations of 3.0 million gallons per day (mdg) and 250 milligrams per liter (mg/l) BOD and TSS, respectively. These values follow the full capacity of the existing phase II system (daily average flow and concentrations of 2.5 mgd and 200 mg/l, respectively). It is assumed that the capacity of the system will be reached within the next 5 to 10 years at the projected growth rate of the community. By utilizing these flow and loadings, the analysis/design will provide a system that will meet Prescott Valley's growth rate and ensure proper biosolids management well into the future.

Earth Tech evaluated the following biosolids technologies:

- Quick Dry Filter Beds
- Belt Filter Presses
- On-Site Solids Holding/Contract Hauling & Beneficial Reuse
- Agitated Air Drying and Curing
- Autothermophilic Aerobic Digestion
- Aerobic Digestion
- Land Application
- Biosolids Enrichment and Recycling

These technologies were deemed most appropriate for the WWTP. A brief description of each unity process and its advantages and disadvantages are provided below.

Composting was also briefly evaluated; however, due to the limited availability of amendment material in the area, it was deemed to not be a viable option for the WWTP.

Quick Dry Filter Beds this proprietary technology makes use of the existing sand drying bed area. The existing media is removed and a "quick dry" media is installed. The process works similar to the gravity deck of a belt filter press. The biosolids are applied to the surface of the beds and the liquid drains quickly leaving the solids to continue to dewater and dry. Removable solids (approximately 20%) can be achieved in as little as twenty-four hours; while 45% to 65% solids can be achieved in as little as one week. A specialized biosolids removal machine is then used to skim the biosolids off the media for disposal or stabilization. This unit operation can handle more than three times the biosolids volume of conventional sand drying beds in the same area.

Advantages

- Low capital costs
- Low energy costs
- Low operations and maintenance requirement
- High solids concentrations
- Low odor and noise potential

Disadvantages

- Moderate land area requirements (if no filter beds currently exist)

Belt Filter Processes This technology is currently being employed at the WWTP in lieu of the existing sand drying beds. Multiple manufactures exist of this proven dewatering technology. A gravity section exists first, where the bulk liquid is drained through a porous belt and rollers follows to squeeze additional liquid out of the biosolids/water mixture. Solids concentrations of 15%-20% can be expected from this technology, with proper operations.

Advantages

- Simple to operate and maintain
- Rapid removal and dewatering of biosolids

Disadvantages

- Moderate capital costs
- Moderate energy costs
- Moderate chemical costs
- Moderate operator attention
- Moderate solids concentrations
- Moderate noise and odor potential

On-Site Holding/Contract Beneficial Reuse This technology makes use of maintaining the dewatered biosolids on-site (on an asphalt pad) for 90 days. This would allow the biosolids to meet Class B standards. The biosolids could then be removed, by a contract hauler, for beneficial reuse outside of Prescott Valley. This process was employed prior to the current practice of dewatering followed by disposal to local landfill.

Advantages

- Low capital costs
- Low energy costs
- Low risk, with respect to biosolids reuse
- Low operations and maintenance requirements
- Low noise potential

Disadvantages

- High contract hauling and reuse costs
- Moderate odor potential
- No beneficial reuse within Prescott Valley

Agitated Air Drying and Curing This technology is a batch process in which unstabilized dewatered biosolids are spread on an impermeable paved asphalt pad and are subject to mechanical agitation. Small windrows are created approximately 12 to 16 inches in height. When unstabilized solids concentrations are low (15%-20%), an amount of drier (65%) stabilized material is mixed in (recycled) to bring the initial solids concentration up to approximately 40%. The wet surfaces of the biosolids are then dried in the windrows as the machine is moved through the material. The curing process follows this. The curing process occurs when the material is stored for an adequate period of time. The porosity of the material allows aeration by convection, with heat build-up from the aerobic biological breakdown of the residual volatile matter in the solids and from insulation. The heat build-up plus proper storage time allows for pathogenic organism destruction, required to meet Class A biosolids requirements.

Advantages

- Low/moderate capital costs
- Low operations and maintenance requirements
- Low energy costs
- Low noise potential
- Beneficial reuse options within Prescott Valley

Disadvantages

- Moderate/high land requirements
- Moderate odor potential

Autothermophilic Aerobic Digestion This technology is a batch process that makes use of a series of closed and insulated tanks. The tanks are aerated and mixed, similar to conventional aerobic digestion. When waste sludge is added to the tank the biological organisms proceed to oxidize the volatile organic compounds. This biological reactions produces heat. Since the tankage is closed and insulated the bulk liquid heats up. The temperatures reaches the thermophilic range of 120*F-135*F.

This high temperature, along with significant volatile oxidation, provides for pathogenic organism destruction, required to meet Class A biosolids requirement. In addition, this technology reduces the biosolids volume that must be dewatered and/or removed by over 50%.

Advantages

- High solids reduction
- Beneficial reuse options within Prescott Valley

Disadvantages

- High capital costs
- Moderate energy costs
- Moderate operations and maintenance requirements
- Moderate noise and odor potential.

<u>Aerobic Digestion</u> This technology is a batch process that makes use of open tank/s. The tank/s are aerated and mixed (assumed via jet aeration and centrifugal recirculation pump). When waste sludge is added to the tank the biological organisms proceed to oxidize the volatile organic compounds. Approximately a 40% volatile oxidation of the biosolids can be achieved, providing for pathogenic destruction, required to meet Class B requirements. This technology reduces the biosolids volume that must be dewatered and/or removed by approximately 40%.

Advantages

- Low operations and maintenance requirements

Disadvantages

- Moderate capital costs
- Moderate energy costs
- Moderate noise and odor potential

<u>Land Application</u> This technology has been used in many areas to apply Class B biosolids to agricultural lands to provide nutrients and moisture to promote plant growth. It has been utilized successfully around the world. Permitting is required of the lands for application. Nutrient limits and use of crop dictate application requirements.

Advantages

- Low capital costs
- Low/moderate operations and maintenance requirements
- Beneficial reuse options within Prescott Valley
- Low noise potential

Disadvantages

- High land requirements
- Moderate/high difficulty in locating and permitting land areas
- Moderate odor potential

Biosolids Enrichment and Recycling This proprietary technology makes use of a multi-step process including dewatering, chemical addition, and drying to produce a pellet like Class A biosolid. Both chemical addition and mechanical drying, at high temperatures, provides for pathogenic organism destruction, required to meet Class A biosolids requirements. Chemical additions of phosphoric acid, sulfuric acid, and ammonia can be varied to provide for a "designer" fertilizer, based on the market needs.

Advantages

- Produces a potentially marketable palletized fertilizer
- Makeup of fertilizer may be modified based on market needs

Disadvantages

- High capital costs
- High energy costs
- Moderate operations and maintenance requirements
- Moderate/high chemical costs
- Moderate noise and odor potential

SITE SPECIFIC APPROACHES

Please note that in all cases an assumption was made that no income would be made from the bioslids product. If, in fact, Prescott Valley could market these products, operations and maintenance costs could be offset somewhat to reduce the overall cost of option.

Quick Dry Filter Beds/ Curing In this approach all the existing sand drying beds would be upgraded to quick dry filter beds. This would provide a solids handling capacity of over 1,000 dry tons per year. This is approximately 15% greater capacity than would be necessitated at the design flows and loads for this study. Dewatered solids (45%-65%) would be removed from the drying beds and applied to an impervious asphalt pad measuring 80' x 500' (this evaluation assumes the purchase of 1 acre of land for installation of the pad – cost included in financial evaluation) to allow for curing. This size pad would allow for a greater than 5 month storage capacity, allowing the biosolids to meet Class A Standards. The biosolids could then be used throughout Prescott Valley as a soil conditioner/fertilizer for parks, offices, and private residences.

Quick Dry Filter Beds/On-Site Solids Storage/Contract Hauling & Beneficial Reuse In this approach all the existing sand drying beds would be upgraded to quick dry filter beds. This would provide a solids handling capacity of over 1,000 dry tons per year. This is approximately 15% greater capacity than would be necessitated at the design flows and loads for this study. Dewatered solids (45%-65%) would be stockpiled and maintained on-site 90 days on an impervious asphalt pad measuring 80' x 250' (this evaluation assumes the purchase of 0.5 acres of land for installation of the pad – cost included in financial evaluation). Class B biosolids produced in this scenario would be removed by a contractor and beneficially reused outside of Prescott Valley.

Quick Dry Filter Beds/Autothermophilic Aerobic Digestion In this approach 50% of the existing sand drying beds would be upgraded to quick dry filter beds. This would provide a solids handling capacity of over 500 dry tons per year. This is approximately 15% greater capacity than would be necessitated at the design flows and loads for this study when you consider over a 50% reduction of solids by the autothermophilic aerobic digestion (ATAD) process. An ATAD system would be installed in close proximity to the existing solids handling building (two 23'x23'x28' tanks assumed). Solids wasted from the clarifiers would be thickened using the existing SOMAT screw presses (assumed able to handle design capacity of existing facility), preheated (with spiral heat exchanger), and delivered to one of the ATAD tanks. Stabilized biosolids would then be removed from one of the ATAD tanks, cooled, and delivered to the quick dry filter beds for dewatering. When the desired dryness is reached, the solids could be removed and stockpiled at the existing solids holding area or the remaining sand drying beds for pickup and use throughout Prescott Valley as a soil conditioner/fertilizer for parks, offices, and private residences.

Belt Filter Presses/On-Site Solids Storage/Contract Hauling & Beneficial Reuse In this approach two two-meter belt filter presses would be installed interior of a building in close proximity to the existing solids dewatering building. Two presses will be required to dewater (during a 5 day per week 8 hour per day operation – based on 71,250 gal/day wasted & 160 gal/min feed rate to press) the amount of waste sludge produced at this studies design flows and loads. The dewatered sludge (15%-20%) would be stockpiled and maintained on-site for 90 days on an impervious asphalt pad measuring 200' x 500 ' (this evaluation assumes the purchase of 2.5 acres of land – cost included in financial evaluation). Class B biosolids produced in this scenario would be removed by a contactor and beneficially reused outside of Prescott Valley.

Belt Filter Presses/Agitated Air Drying and Curing In this approach two two-meter belt filter presses would be installed interior of a building in close proximity to the existing solids dewatering building. Two presses will be required to dewater (during a 5 day per week 8 hour per day operation – based on 71,250 gal/day wasted & 160 gal/min feed rate to press) the amount of waste sludge produced at this studies design flows and loads. The dewatered sludge (15%-20%) would be applied to an impervious asphalt pad measuring 400' x 500' (this evaluation assumes the purchase of 5 acres of land – cost included in financial evaluation) to allow for additional drying and curing. Agitation of the windrows and augmentation of the 15%-20% solids with dryer (65%) stabilized solids would be necessary to expedite the stabilization process. This size pad would allow for a greater than 5 month storage capacity, allowing the biosolds to meet Class A standards. The biosolids could then be used throughout Prescott valley as a soil conditioner/fertilizer for parks, offices, and private residences.

Belt Filter Presses/Autothermophilic Aerobic Digestion In this approach two two-meter belt filter presses would be installed interior of a building in close proximity to the existing solids dewatering building. Two presses would be required even though the ATAD system will reduce the solids volume to be handled by more than 50%. This is due to the fact that a standby press would be necessary in case of a mechanical failure of the other press. The ATAD system would also be installed in close proximity to the existing solids handling building (two 23'x23'x28' tanks assumed). Solids wasted from the clarifiers would be thickened using the existing SOMAT screw presses (assumed able to handle design capacity of existing facility), preheated (with spiral heat exchanger), and delivered to one of the ATAD tanks. Stabilized biosolids would then be removed from one of the ATAD tanks, cooled, and delivered to the belt filter press for dewatering. The solids could then be removed and stockpiled at the existing solids holding area of the sand drying beds for pickup and use throughout Prescott Valley as a soil conditioner/fertilizer for parks, offices, and private residences.

Biosolids Enrichment and Recycling In this approach a biosoldis enrichment and recycling (BER) plant would be constructed at the WWTP site. The facility would include one belt filter press, chemical reaction tanks and bulk storage, one rotary drum dryer, and necessary conveyance systems (as proposed by vendor). The system would be computer monitored. The system would produce a potentially marketable fertilizer pellet. The operator would have the ability to vary the makeup of the final product by adjusting chemical feeds to the reaction tanks.

Aerobic Digestion/Land Application In this approach an aerobic digester would be constructed in close proximity to the existing solids handling building (one 65' diameter x 28' high tank was assumed). The unit would be operated to produce a Class B biosolid. The stabilized sludge would then be transferred to a storage tank (same size as aerobic digester). Adjoining property to the WWTP would be leased and the stabilized liquid biosolids would be applied with mobile reel irrigation cannons, in accordance with all state and federal regulations.

The preceding briefly describes the site-specific approaches that were evaluated as viable alternatives for the WWTP. The attached financial evaluation provides a cost comparison of these approaches and ranks them based on a ten-year cost estimate. These costs include capital as well as yearly operations and maintenance costs. Capital costs are based on vendor quotations, where possible. Yearly operations and maintenance costs are based on manufacturer's recommendations and Earth Tech's experience in operating similar systems.

CONCLUSIONS

Earth Tech has found that the quick dry filter beds in combination with an air curing process will achieve Prescott Valley's goals of properly handling all biosolids produced at the WWTP and providing Class A biosolid for beneficial reuse throughout the community at the lowest cost. This is also deemed the most viable option when applicability, site constraints, public perception, odor, noise, and future growth are considered.