TOLAND LANDFILL - MANAGING BIOSOLIDS AND GENERATING GREEN ENERGY

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ABSTRACT

Ventura County produces approximately 8,000 tons of biosolids per month. Prior to this project, 90 percent was trucked out of the county for disposal, primarily to Kern County, a 200-mile round-trip. Growing opposition to land application of imported biosolids in Kern County inspired Ventura Regional Sanitation District (VRSD), in cooperation with Ventura County cities, to create a local biosolids management solution.

Drying biosolids to approximately 75 percent solids, beyond the 15-20 percent solids typical at wastewater treatment plants, was recognized as the best way to create a workable, pathogen-free biosolid that could be used as cover at the Toland Road Landfill in Santa Paula, with potential future use as fertilizer or fuel. A unique biosolids drying system was developed to meet the long-term disposal needs of Ventura County in an economical, environmentally responsible manner.

Mechanical biosolids dryers were chosen as the ideal approach to minimize project footprint, provide pathogen reduction, and create a marketable product. Although Ventura County cities individually produce biosolids output below that required of economical large-scale dryers, it was determined that a regional-scale dryer could amass biosolids to a greater economy of scale.

The growing quantity of landfill gas (LFG) at Toland Road Landfill was eyed as a way to reduce costs for natural gas and electricity--primary dryer operating costs. LFG would fuel process heaters, which in turn would heat oil to indirectly dry the biosolids. The LFG would also be used as a fuel to generate electricity which would provide the dryer's electrical needs.

The biosolids drying and electrical generation technology would ideally be modular, allowing easy up- or downsizing, depending on the number of cities interested in contracting with VRSD, and considering the increasing LFG output for electrical generation. The modular approach allows use of standard equipment models, instead of custom design/fabrication and the accompanying cost/operational problems.

An innovative system of condensing, treating, and using the reclaimed water extracted from the dryers' exhaust steam had to be developed. (This process is typically at the wastewater treatment plants where high flow water spray is used to condense steam, with the resulting wastewater routed into the treatment plant's headworks – not possible at a landfill.) Microturbines were chosen as a modular, low-emission, simple-operation (no contract operator needed) approach to generating power.

A Self Generation Incentive Program (SGIP) Grant from the local electric utility (Southern California Edison Company) helped finance the project. The SGIP is provided to promote self-generation of electricity. This project creates over 750kW of load, which is completely offset with dedicated on-site microturbine power generation, which equates to nearly a $1 million Grant.

At full capacity, VRSD's Biosolids Drying and Renewable Power Generation Facility will:

- Dry 320 tons of biosolids daily;
- Produce AB 939 recyclable material with multiple uses including alternative daily cover for the landfill, fertilizer, or fuel;
- Generate 3.25MW of renewable/green power (1.5MW for onsite demand and 2.25MW for export);
- Reduce truck traffic up to 1 million miles per year by disposing of biosolids locally (compared to previous longer haul to Kern County), and decrease related greenhouse gas emissions by up to 1,800 tons annually;
- Reduce the demand on existing conventional power generation facilities, thereby offsetting up to 15,000 tons of fossil-fuel-based carbon dioxide annually;
- Provide Ventura County with a local biosolids management solution;
- Serve as an innovative, first-of-its-kind, LFG-fueled regional biosolids drying system that can be replicated in other communities.

After four years of conceptualizing, designing, permitting, negotiating a power purchase contract, completing site work and equipment installation, the VRSD facility began operation in the Fall of 2009.

BACKGROUND

Ventura Regional Sanitation District (VRSD) is an enterprise pubic agency organized in 1970 to serve the sanitation needs of more than 600,000 residents of Ventura County. Comprised of eight charter cities and six special districts, VRSD provides solid waste management, wastewater treatment, water supply, and related services to its customers. VRSD's operations are funded solely through revenue derived from services; the District receives no tax-based support of any kind. VRSD is overseen by a nine-member Board of Directors who represent the cities and special districts served, and employs approximately 75 people.

Biosolids are the organic materials resulting from highly processed wastewater treatment operations. Ventura County currently produces about 8,000 tons per month. Prior to the start-up of VRSD's Biosolids Drying and Renewable Power Generation Facility in August 2009, approximately 90 percent of those biosolids were trucked out of the County for disposal, primarily to Kern County, a 200-mile round-trip.

Potential challenges to this practice arose several years ago, including restrictions limiting export options. The most significant of these was passage of Measure E in 2006 by voters in Kern County. Measure E sought to halt the importing and land application of biosolids in Kern County. The measure passed but was challenged in court by the City of Los Angeles (a major

exporter of biosolids to Kern County). The City prevailed in 2007 and exporting continued; however, Kern County officials appealed the judgment in March 2008 and the issue remains in the courts (as of the publication date of this paper). Uncertainty as to the ultimate resolution of the issue was a major factor in VRSD's decision, together with its member cities, to seek a local, more reliable solution for the long term. Increasing transportation and environmental compliance costs added to the motivation.

Ultimately, the solution arrived at through cooperative effort involved proven, economical biosolids drying technology and renewable power generation, fueled by readily available and cost-effective landfill gas. This innovative idea, soon to take form in a first-of-its-kind facility, promised:

- Local control
- Environmental soundness
- Multiple benefits
- Replicability elsewhere

PROJECT OVERVIEW

Location

VRSD's Biosolids Drying and Renewable Power Generation Facility (A) is located at the Toland Road Landfill in Santa Paula, California. Owned and operated by VRSD, the landfill handles up to 1,500 tons of municipal solid waste per day. The Biosolids Facility occupies a 2.7-acre site within the 343-acre landfill property.

Cost and Funding

The facility was designed and built at a cost of approximately $19 million, broken down as follows:

- Permits, engineering, project management ($1.0M)
- Site work ($7.0M)
- Dryers (2) ($5.4M)
- Trailers (11) ($.5M)
- Microturbines (9) ($2.8M)
- Gas conveyance system ($2.0M)

The project was funded by a combination of cash, debt and the self-generated incentive power (SGIP) grant of approximately $1 million.

Biosolids contracts with Ventura County cities and sale of electricity to SCE will fund operations and debt repayment. As of the date of this paper, VRSD has negotiated 10-year contracts to accept biosolids from four Ventura County cities at a rate of $52 per ton, which is extremely competitive with costs associated with land disposal ($40-$60/ton), composting ($45-$65/ton) and other drying technologies ($75-$100/ton). VRSD also negotiated a 10-year contract for energy sales to SCE at a rate of $.10 per kilowatt hour.

Project Timeline

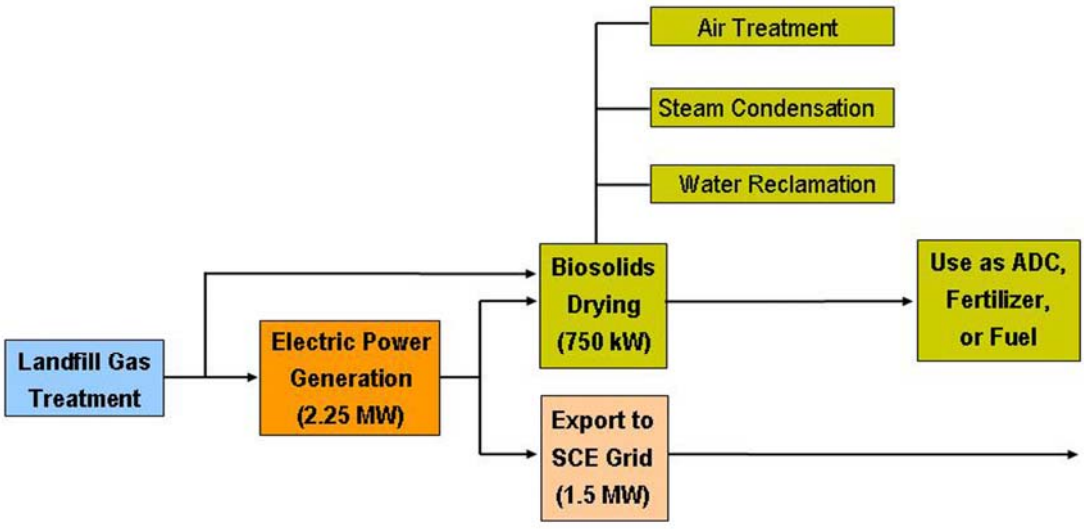
VRSD initiated a demonstration project in September 2005 to evaluate process technology and address potential environmental compliance issues. The District initiated meetings with landfill neighbors and community groups in 2006 and circulated a California Environmental Quality Act (CEQA) Mitigated Negative Declaration Document in June 2006. After receiving input from the public and addressing regulatory concerns, VRSD revised and re-circulated the document in December 2006. A conditional use permit was issued by the Ventura County Board of Supervisors in January 2007 and final design and site work started shortly thereafter. Construction was completed in July 2009 and the facility began initial operation soon thereafter.

Regulatory Oversight

Among the agencies responsible for environmental and regional regulatory compliance were the following:

- Ventura County Planning
- Ventura County Air Pollution Control District
- Ventura County Agricultural Commission
- Ventura County Environmental Health Division
- California Department of Public Health
- California Integrated Waste Management Board
- California Department of Fish and Game
- U.S. Army Corps of Engineers

The Process at a Glance

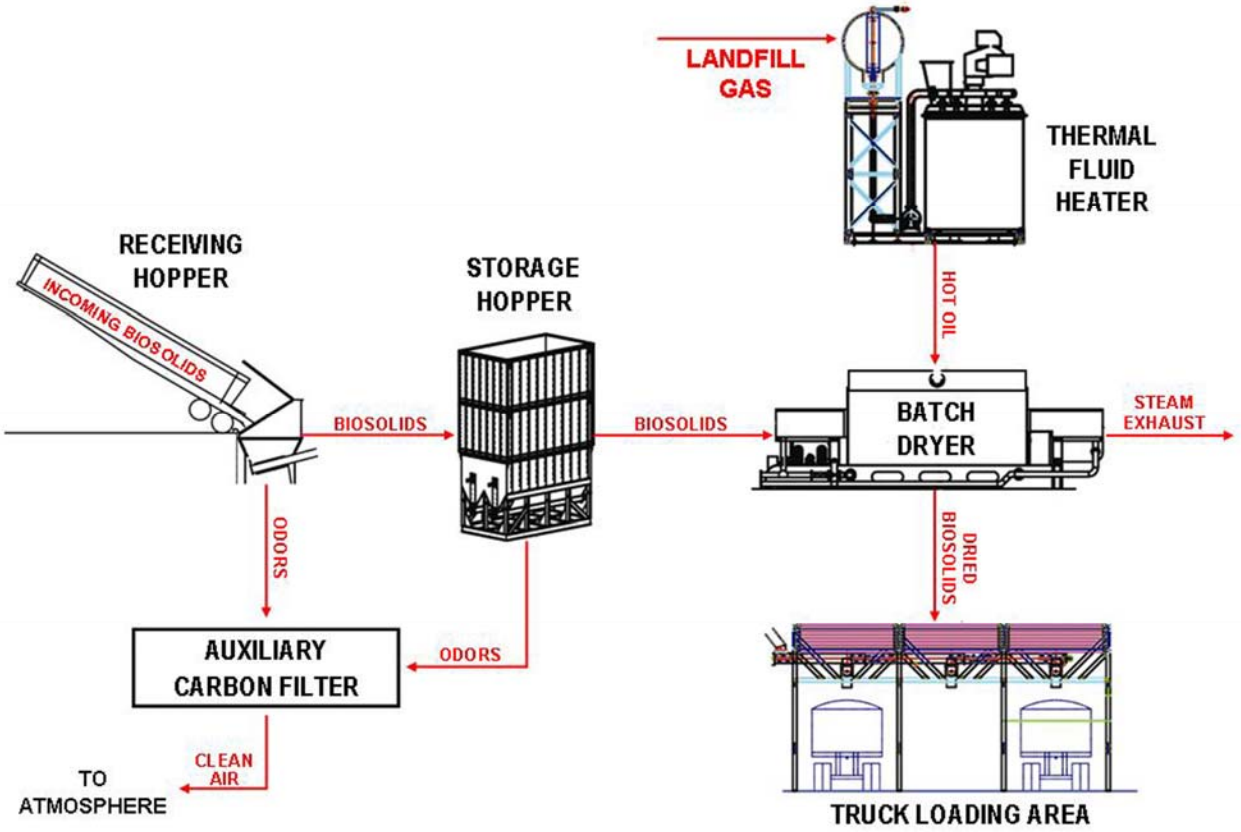


Decaying refuse produces landfill gas (LFG) with high methane content. Prior to construction of the Biosolids Facility, VRSD extracted this gas and flared it to atmosphere – a common practice at landfills. Today, that gas is captured, treated, and used to fuel the biosolids dryers and run a system of nine microturbines. The latter generates electrical power to run the facility and export to the local grid. The dried biosolids are currently used as alternative daily cover (ADC) for the landfill; VRSD is exploring alternative use of the material as fertilizer and fuel.

Landfill Gas Treatment

Before it can be used by the biosolids dryers and the microturbines, LFG must be properly treated. To eliminate fouling and remove volatile organic compounds, liquid is removed from the gas through a dew point suppression system. Sulfur is also removed from the roughly 150 ppm sulfur gas using the Sulfatreat™ media to comply with the regulatory limit of 60 parts per million. Siloxane is removed using carbon and Midas™ media. The gas is pressurized by blower and compressor units for use by the dryers (~10 psi) and microturbines (~100 psi).

Biosolids Drying

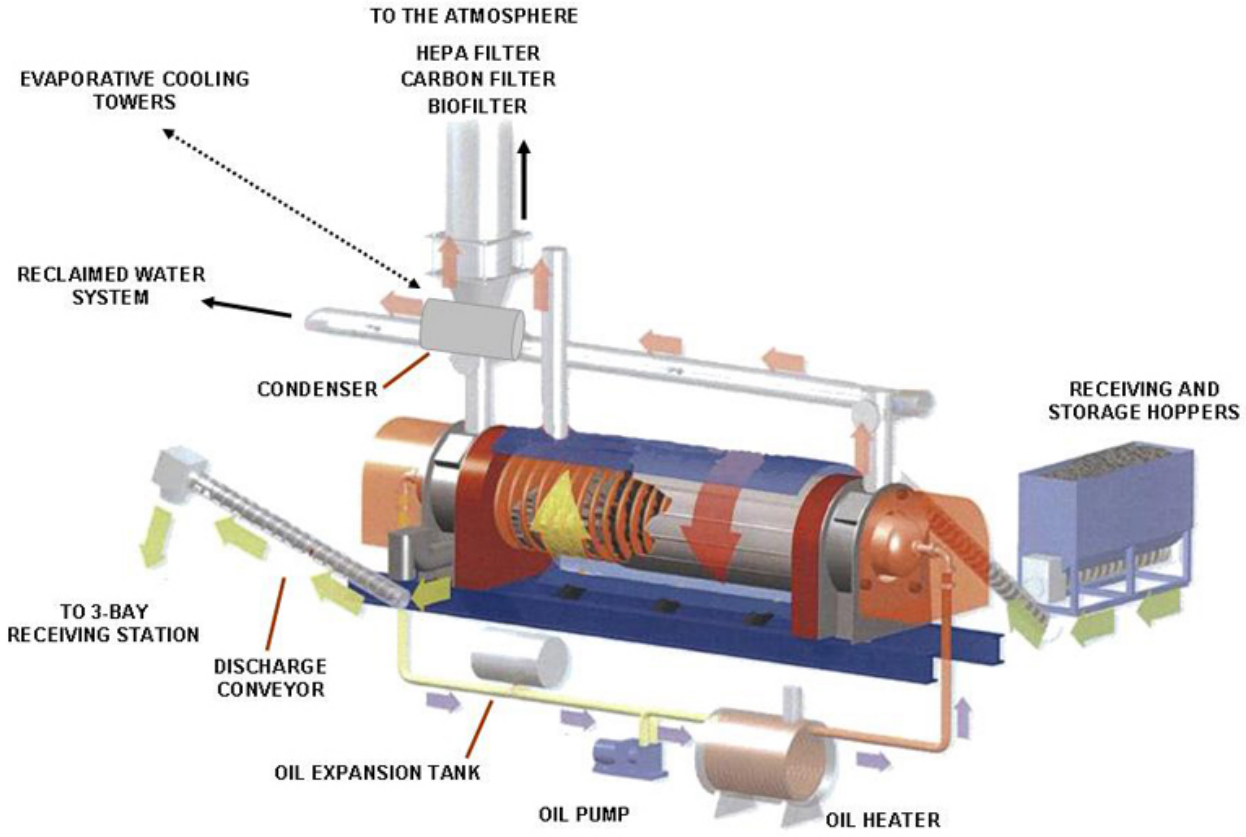


Biosolids arrive via truck from local wastewater treatment plants and are deposited into a receiving hopper at the facility. From there, they are diverted into two storage hoppers (300 cu.yds. total), which hold approximately nine truckloads of material. For every four truckloads of wet biosolids delivered, the process yields one truckload of dried material. The process, including storage, is under a vacuum routed to a carbon filtration system for odor control. Compressed landfill gas heats oil in two ultra-low-emission thermal fluid heaters to approximately 450 degrees F for the indirect drying process. The heated oil circulates through

rotors within the drum and the drum skin to bring the biosolids to the boiling point (pasteurization) for several hours to evaporate liquids. Typically, a load of biosolids remains in the dryer for 3-4 hours, depending on moisture content. Each of the two dryers has a capacity of approximately nine tons. After each batch is completed, the dried biosolids are conveyed into trailers and hauled to the landfill for use as ADC. The steam exhaust is piped to the condensation/treatment process described below.

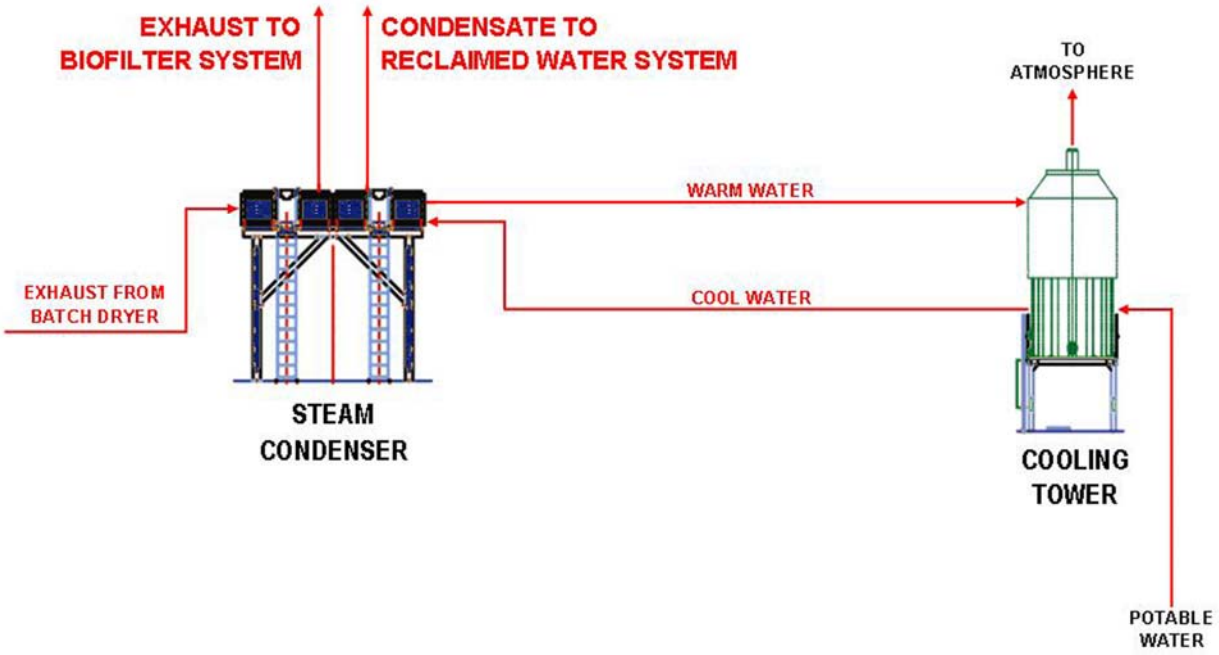
Dryer Technology

VRSD chose to employ an indirect, complete mix batch technology. These dryers are built as a modular system, allowing addition of units as demand increases. They occupy a compact footprint and are flexible enough to handle biosolids of varying mixtures and liquid content. Direct-fired dryers, on the other hand, use significant quantities of air, which must be treated using bag houses and/or thermal oxidizers (RTOs) and are generally more sensitive to biosolids of varying moisture content. They also generally require more space, a custom-design, more complex operation, and are more expensive. The dryer system selected by VRSD is designed and manufactured by Fenton Environmental Technologies.



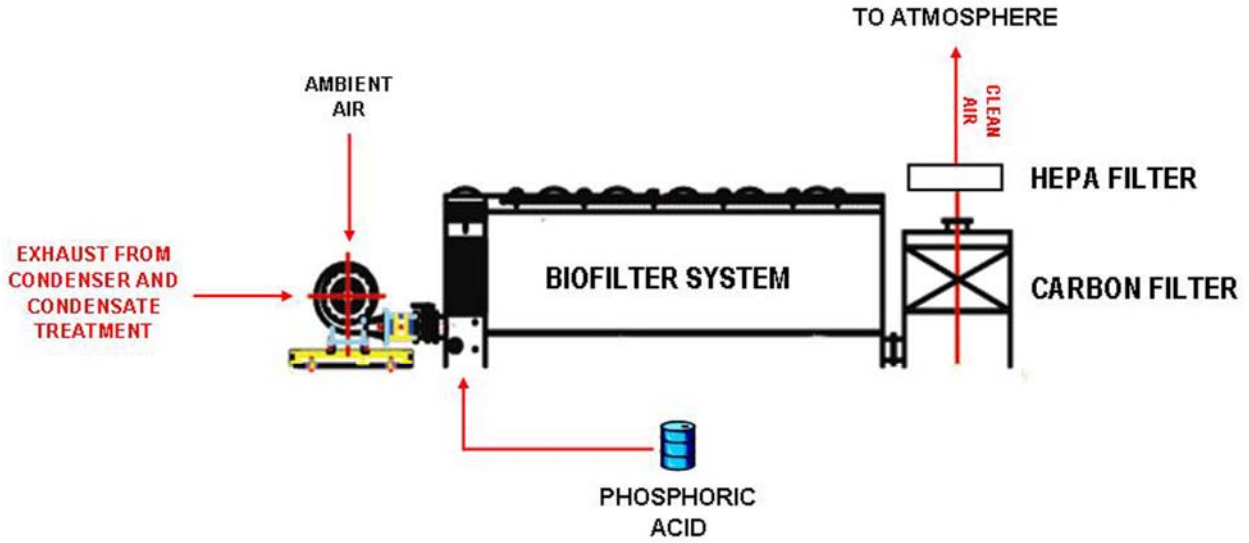
A system of internal rotors moves the biosolids material through the dryer. Hot oil circulates within the rotors and also within the dryer shell. Steam from the process is condensed and the condensate (reclaimed water) is treated and used for dust control at the landfill. The exhaust from the drying process is filtered through a series of filters (biofilter, carbon and HEPA) to remove odor and ensure environmental compliance at discharge.

Steam Condensation



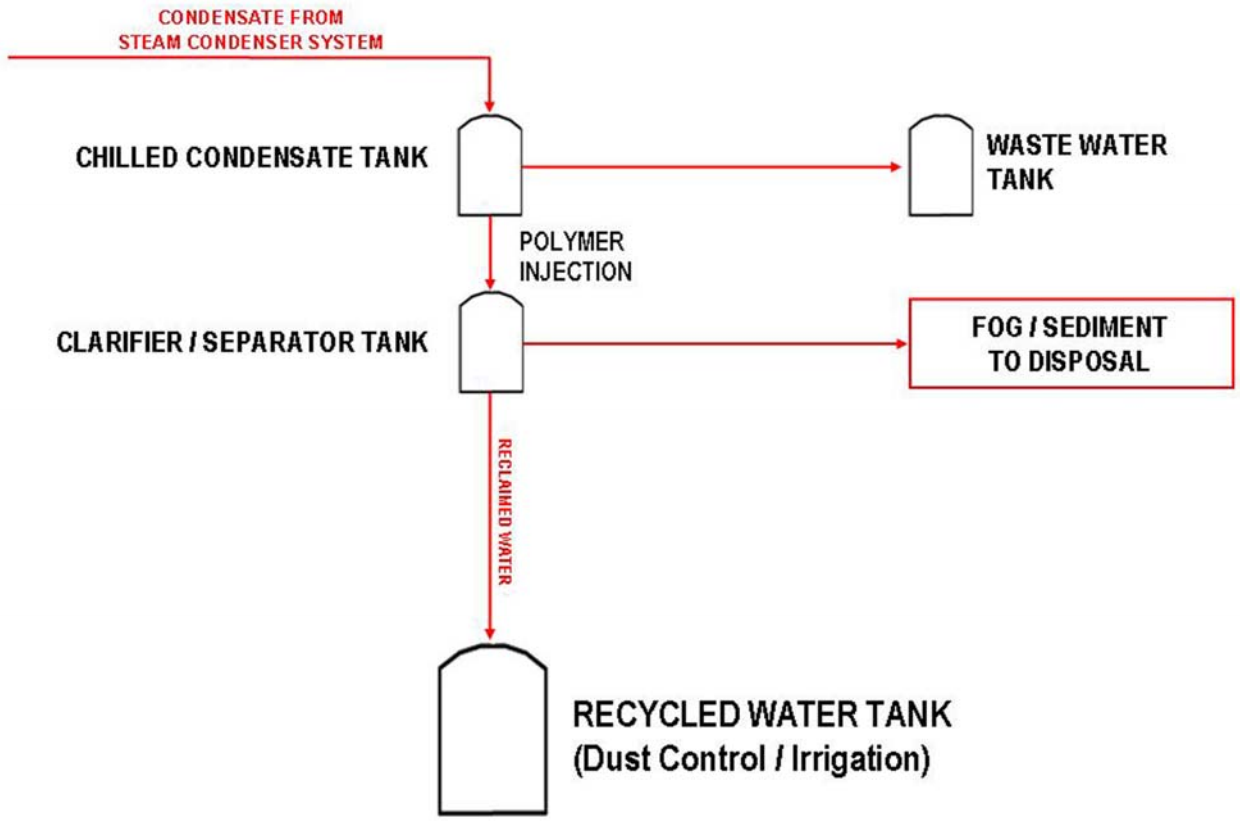
Steam exhaust from the biosolids dryers enters a condensation unit where it is condensed using cold water supplied from evaporative cooling towers. This is the only part of the entire process that does not make use of a recycled resource. As part of the permitting process, VRSD agreed to use potable water for the condensation process, as opposed to using the reclaimed water from the biosolids.

Air Treatment



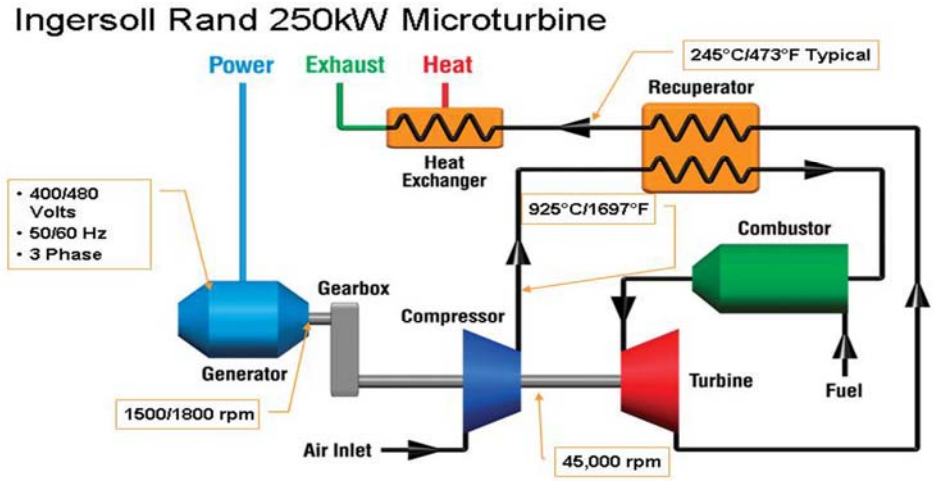
Treatment of the exhaust air consists of a biofilter system using a treated rock media, supplemented in a pre-biofilter process by the application of phosphoric acid to reduce ammonia content. Carbon and HEPA filters provide final polishing before the air is released.

Water Reclamation

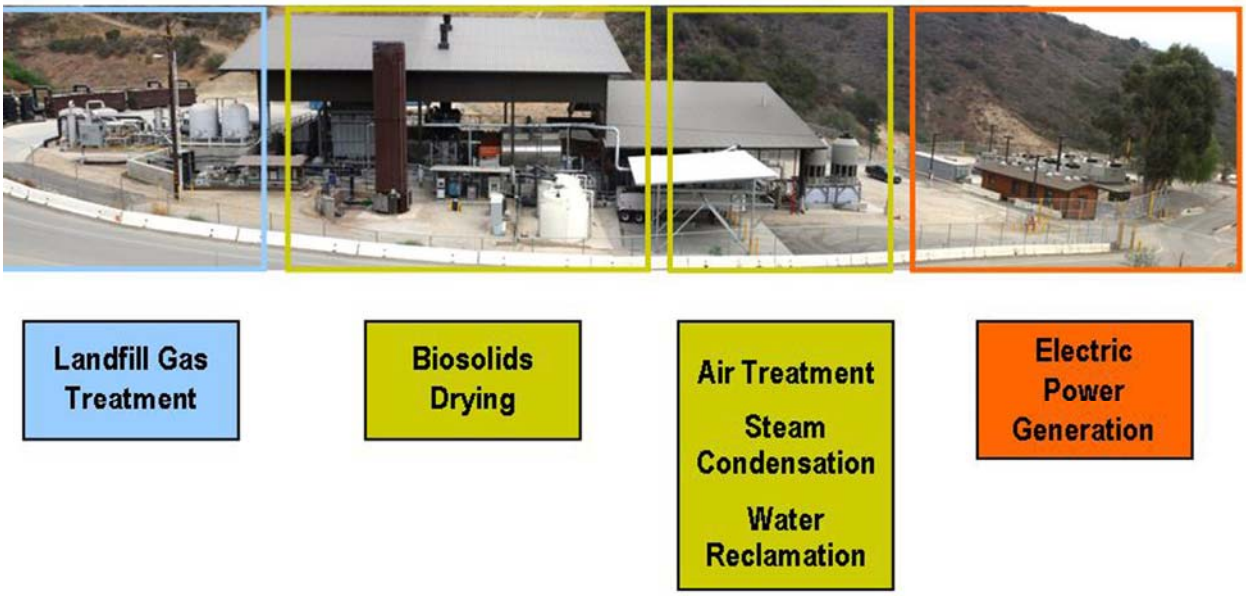


The condensed steam, or reclaimed water, is treated with a polymer clarification process to remove fats, oils, and greases (FOG) and sediment, which are trucked offsite for treatment and disposal. The reclaimed water is pumped to storage tanks for use as daily dust control on the landfill.

Electric Power Generation



The facility currently uses a system of nine Ingersoll Rand 250kW microturbines (expandable to 15). Depending on demand, the three microturbines dedicated to supplying power for the facility's 750 kW load cycle on and off automatically to match the varying load. The remaining six units exporting power to the grid run continuously. Approximately one-third of the 2.32 MW currently generated is used onsite; the remainder is transmitted to the SCE power grid.



PROJECT NOTABLES

- VRSD's Biosolids Drying and Renewable Power Generation Facility is SCADA controlled for remote operation and monitoring. While it runs 24/7, it does not require round-the-clock staffing beyond on-call staff to respond to any alerts or shutdowns.
- With a current maximum processing capacity of 160 tons of biosolids per day, the facility design is expandable to double that amount.
- The nine microturbines currently generate 2.32 MW – VRSD designed the facility to accommodate an additional six units for a total power production capacity of 3.82 MW.
- The green, sustainable low-emission power complies with the scope of California's Renewables Portfolio Standard.
- This regional biosolids drying solution is the first of its kind in the nation.
- A compact, modular system, it can easily be replicated in other communities.