VENTURA REGIONAL SANITATION DISTRICT

Ventura Regional Sanitation District Biosolids Drying and Renewable Power Generation Facility

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1) Design & Construction

In 2005, in response to region-wide environmental challenges related to the hauling of locally produced biosolids out of Ventura County for disposal (approximately 8,000 tons per month), Ventura Regional Sanitation District (VRSD) proposed to design and construct a facility to process the biosolids locally.

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 workable, pathogen-free biosolids that could be used as alternative daily cover at the landfill, 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.

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, VRSD determined that a regional-scale dryer could amass biosolids to a greater economy of scale. Further, VRSD engineers decided that the growing quantity of landfill gas (LFG) could significantly 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 meet the dryers’ 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.

The Biosolids Drying and Renewable Power Generation Facility is located at the Toland Road Landfill in Santa Paula, California, about 60 miles northeast of Los Angeles. Owned and operated by Ventura Regional Sanitation District (VRSD), the landfill handles up to 1,500 tons of municipal solid waste per day. The Biosolids Facility occupies a 2.2-acre site within the 343-acre landfill property.

Critical to the success of the project was VRSD’s ability to integrate the facility into existing LFG operations and to make optimal use of an existing space (approximately 100 x 600 feet) between the landfill and a drainage detention basin. The project was designed (by in-house engineers) to not only use that space for effective initial operation of the facility, but to allow for a doubling of capacity as future needs demanded. The LFG treatment portion of the project was sited next to the existing flare stack to minimize the need for additional piping from the LFG extraction wells.

Engineering of the site was complicated by the presence of a one-acre ancient landslide. Mitigation of the landslide (and potential for future earth movement) was accomplished through slope grading, hillside bench construction, and hydro-seeding with native grasses for erosion control.
control. Efforts included clearing and grubbing, approximately 45,000 cubic yards of engineered fill, and approximately 31,000 cubic yards of excavation.

The site was considered by the California Department of Fish and Game as riparian habitat-related; nevertheless, VRSD was able to remove the landslide and re-vegetate the area without the need for an offset from the Department of Fish and Game.

Perhaps the most significant feature of VRSD’s Biosolids Drying and Renewable Power Generation Facility is its one-of-a-kind, self-sustaining design. VRSD’s engineers had no model from which to design the facility – the unique design challenges of an LFG-powered system of this size were successfully addressed as they arose. Further, the facility generates all of its own electrical power, and significantly more besides (through LFG-fueled microturbines). All water recovered from the biosolids is treated and used on site, as are the dried biosolids themselves.

2) Environmental Controls

Biosolids are the organic materials resulting from highly processed wastewater treatment plant 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 the fall of 2009, approximately 90 percent of those biosolids were trucked out of the County for disposal, primarily to Kern County, a 300-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 exporters of biosolids to Kern County. The challenge was successful in 2007 and exporting continued; however, Kern County appealed the judgment in March 2008 and the issue remains in the courts (as of the submission date of this application). 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 LFG. The Biosolids Drying and Renewable Power Generation Facility is a model of environmental efficiency. At full capacity, the facility will:

- Eliminate up to one million miles of truck traffic per year in hauling locally produced biosolids;
- Decrease greenhouse gas emissions by approximately 1,800 tons annually;
- Reduce the demand on existing conventional power generation facilities;
- Produce AB939-compliant, multi-purpose recyclable material;
- Recycle 100 percent of recovered water;
- Serve as a first-of-its kind model system that can be replicated in other communities

The Toland Road Landfill currently produces LFG at a rate of approximately 1,560 cfm through a horizontal collection system with roughly 75 wellheads, constructed as the landfill was
developed. The LFG has a methane content of approximately 50%. Approximately 600 cfm is used to fuel the biosolids dryers; the remaining 960 cfm powers the microturbines. The green, sustainable, low-emission power complies with California’s Renewables Portfolio Standard.

The existing groundwater and leachate monitoring programs were not impacted by the Biosolids Facility.

3) Regulatory Compliance
Because this was essentially a first-of-its-kind facility, regulatory compliance was particularly extensive. The process required extensive permitting and close coordination between VRSD and multiple agencies:

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

The project included a year-long Mitigated Negative Declaration process under the California Environmental Quality Act (CEQA), which incorporated multiple public hearings and significant review from the Ventura County Planning Department.

Under the Federal Clean Air Act, the project is located in a non-attainment area (Ventura County), which mandated compliance with particularly stringent regulations and air emission guidelines. Examples:

- Landfill gas treatment includes a sulfur removal system to comply with the 60 ppm limit.
- Low-emission burners achieve a nitrous oxide standard of 9 ppm.
- Microturbines are exempt from permitting due to their ultra-low-emission performance. This is particularly significant as the project is located in a designated non-attainment area with particularly stringent air quality regulations.

The entire facility fully complies with all applicable environmental regulations.

4) Planning, Operation & Financial Management
VRSD launched 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 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.
The facility was designed and built at a cost of approximately $19 million, broken down as follows:

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

The project was funded by a combination of cash, debt, and a self-generated incentive power (SGIP) grant of approximately $1 million from Southern California Edison Company (SCE).

Biosolids contracts with Ventura County cities and sale of electricity to SCE are funding operations and debt repayment. As of the date of this application, VRSD has negotiated 10-year contracts to accept biosolids from four Ventura County cities at a rate of $42 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 $0.10 per kilowatt hour.

VRSD completed an extensive pro forma financial model to estimate the long-term revenue and expense associated with the project. The facility has a first-year operating budget of approximately $1.3 million, with corresponding built-in annual CPI increases. Projections call for full debt pay-off and profitable operation by the fifth year.

Currently built to process up to 160 tons of biosolids daily and generate approximately 2.32 MW of electricity, the facility was designed for expansion to 320 tons of daily biosolids processing and 3.82 MW of power generation.

**The entire two-year construction process was completed with no lost-time injuries.** A dedicated safety officer from VRSD administered project safety oversight and inspections with the appropriate agencies. Reyes Construction (the principal contractor) also assigned a safety officer to the project. These safety officers conducted weekly tailgate sessions to address safety-related issues with personnel on site, and a formal safety plan was implemented at the start of construction. When appropriate, formal safety training sessions were conducted by outside specialists (e.g., intensive training in electrical arc flash prevention due to the high-voltage environment).

Employees also received training in first aid/CPR, program logic/SCADA controls, and operation of high-pressure hydraulic equipment.
5) Utilization of Equipment/Systems and Technologies

The Process at a Glance

Prior to construction of the Biosolids Facility, VRSD extracted LFG and flared it to atmosphere – a common practice at landfills. Today, the LFG 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 prevent equipment fouling and to eliminate 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 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, which hold approximately nine truckloads (300 cu. yds.) of material. For every four truckloads of wet biosolids delivered, the process yields one truckload of dried material. The hopper system is under a vacuum routed to a carbon filtration system for odor control. Compressed LFG heats oil in two ultra-low-emission thermal fluid heaters (80% efficiency rating) to approximately 450 degrees F for the indirect drying process. The heated oil circulates through rotors within the drum and the drum shell 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 12 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.
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 is 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 piped 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 steam condensation, as opposed to using the reclaimed water from the biosolids.

Air Treatment

Treatment of the exhaust air consists of a biofilter system, 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.
The condensed steam, or reclaimed water, is treated with a 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, specifically manufactured to run on LFG. With a 30% efficiency rating, use of the microturbines is preferable to that of internal combustion engines, the use of which would have required additional personnel for onsite maintenance. Such engines would also have had a negative effect on the permitting process. Depending on demand, the three microturbines dedicated to supplying power for the facility 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.

6) Public Acceptance, Appearance, and Aesthetics
As part of the facility permitting and municipal approval process (including preparation of an extensive mitigated negative declaration document), VRSD conducted two public meetings to address neighbor concerns, three public hearings on the conditional use permit from Ventura County, and numerous meetings with the Ventura County Planning Department. Upon completion of the project, VRSD personnel have filled requests for tours of the facility, including inquiries from local school groups. In terms of public safety, the facility is fully fenced and under closed-circuit video surveillance. The facility sits within the secured site of the landfill, over a mile from the nearest major thoroughfare.

VRSD’s Biosolids Facility was designed to make optimal use of the existing footprint. Where possible, earth-tone colors were used for aesthetic purposes and great attention was paid to native landscaping. As part of the permitting process, a number of existing eucalyptus and pepper trees were retained, and additional eucalyptus and redwood trees were planted to help create a visual shield around the facility.
7) Innovation and Creativity

Innovation and creativity have marked the development of VRSD’s Biosolids Drying and Renewable Power Generation Facility from start to finish. Recycling 100% of available resources (landfill gas, biosolids, and recovered water), VRSD’s innovative facility generates renewable electricity for its own needs and the community, offsetting up to 15,000 tons of fossil-fuel-based carbon dioxide annually. Additionally:

- The 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 personnel 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 as biosolids deliveries and LFG production increase.
- 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 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.
- Awards:
  - 2009 Climate Change Action Award – Ventura County Board of Supervisors (Ventura County Chapter)
  - 2009 Project of the Year – American Public Works Association (APWA)
  - 2009 Project of the Year – American Society of Civil Engineers (ASCE) (Santa Barbara/Ventura Chapter)
  - 2009 Project of the Year – American Council of Engineering Companies California (Santa Barbara and Ventura Counties)
  - Engineer of the Year (Greg Grant) – ASCE/APWA
Project Photographs

Landfill Gas Treatment System

Landfill Gas Blower/Compressor Unit
Biosolids Truck at Receiving Hopper

Oil Heaters
Batch Dryer

Steam Condensation and Water Treatment Unit
Dried Product Receiving Station

Microturbines