

Salt Lake City, UT - Central Valley WRF

Sludge Screening Increases Sludge Quality, Improving Cogeneration

Wastewater Case Study Project Profile

Objective

Egg shaped digesters used for cogeneration required cleaner sludge to operate effectively. A range of solutions to remove coarse debris were considered.

Solution

Hydro-Sludge® Screens were selected to remove coarse materials from the sludge and prevent accumulation in the digesters.

The Central Valley Water Reclamation Facility was built in 1988 and serves a total population of over 550,000 in Salt Lake County. Central Valley's entire property covers 168 acres (0.7 km) with the treatment facility using 85 acres. The facility has over 80 dedicated employees and treats a peak daily flow of 85 Mgal/d (3724 L/s). Treated effluent from the plant is used to irrigate an adjacent golf course as well as other public areas. Excess effluent is discharged to the Jordan River.

In 1998 design began on a planned upgrade to include the use of egg shaped digesters to improve electrical output from an existing cogeneration system. The resulting upgrade to the cogeneration system would generate approximately 70% of the plant's electricity requirement. Concerns about sludge quality led the design team to weigh options for pretreatment to remove coarse solids. Internal guide wires within the digesters could become fouled with debris if allowed to remain in the sludge. Coarse screens at the plant headworks would not sufficiently protect the digesters. The design team looked at replacing the headworks screens as well as in-line screening of the sludge. Ultimately, sludge screening proved to be the most cost-effective solution.

The new digestion system was started in 2001 with excellent results. Sludge from ten (10) primary clarifiers was blended with secondary sludge and screened by two in-line sludge screening systems. Scum from the primary clarifiers is blended with the sludge and fed to the screens once daily. The system ran well for several years until wear issues and spare parts availability led plant personnel to seek out a replacement technology. New headworks screens were again considered and it was determined that new

"The Hydro-Sludge® Screen is easier to operate. The new control panel design makes changes and troubleshooting much easier."

- Dan James, Maintenance Manager

Plant Equipment

- Two (2) Hydro-Sludge® Screens

Project Parameters

- 85 Mgal/d (3725 L/s) Peak Day Plant Flows
- Each screen processes 150-240 gpm (9.5-15.1 L/s) at solids concentrations of 6-7%
- Screenings are discharged at 40% TS

replacement sludge screens were the best option.

In 2009, one of the two existing sludge screens was replaced with the Hydro-Sludge® Screen manufactured by Hydro International. The replacement unit was installed with little modification to the existing piping and support structure. The unit has been in operation for one year with exceptional results.

The Hydro-Sludge® Screen is a horizontal in-line coarse material separator, comprised of four principle zones: inlet, screening, pressing (compacting) and discharge. The main components of the Hydro-Sludge® Screen are the screening area, the thickening and pressing zone area and the discharge area for the solid material. Screen and pressing zones are installed in-line, in the horizontal axis.

The screw is encapsulated by screen baskets with a backpressure cone at the end of the pressing zone to regulate the discharge opening through fluctuating contact pressure. A direct coupled 4 HP gear motor drives the Hydro-Sludge® Screen screw.

The sludge to be treated is pumped in to the screening area and flows out through the perforated screen basket. Solids larger than the chosen perforation are retained on the inside of the screen basket and are transported by the screening zone screw to the pressing zone. Screened sludge exits via a flanged connection. The separated solids are concentrated in the pressing zone, transported by the pressing screw and compacted into a plug under gradually increasing compression. This is achieved by the regulation of the retention cone against the pressing zone screw. Liquid from the pressing zone is drained through the fine perforations and exits with the screened sludge through the flanged connection. The slowly discharging plug of solids is held back by the retention cone which regulates solids discharge and seals sludge within the unit. As the screenings plug is formed, the motor / gearbox torque increases pushing the screenings against the retention cone. This torque is monitored and converted to a pneumatic pressure, which moves the cone back to release the

Project Highlights

- Sludge from 10 primary clarifiers was blended with secondary sludge and fed to the 2 in-line screening systems
- Upgrade allowed the plant to improve electrical output from cogeneration process
- Improved control panel system gave the plant much greater control of the system and reduced problems with the system
- New system reduced the cost and time to clean out digester systems



Replacement screen (left) existing system (right)



Improved PLC control panel with HMI



New Hydro-Sludge® Screen arriving on site

screened solids. The solid plug is loosened and broken up at the retention cone. The solids fall down and are collected in a solids receptacle or enclosed bag for final disposal.

Unit operations are controlled by measuring the pressure at the feed and discharge ends. Thus it is possible to determine loss in the screen area and the inner pressure on the solid plug. The main load on the drive unit originates from the pressing operation. As the thrust force is very high, the motor is equipped with overload protection.

Each new Hydro-Sludge® Screen at Central Valley processes 150-240 gpm (9.5-15.1 L/s) at a feed solids concentration of 6-7%. Screened sludge is pumped to the egg shaped digesters and then thickened / dewatered. Of the resultant sludge 80% is land applied as a class B sludge with the balance composted and made available to the public as fertilizer.

One of the biggest improvements noted in the Hydro-Sludge® Screen design over the previous unit was the control system. The Hydro-Sludge® Screen utilizes a PLC control system with VFD which makes operation much easier. The PLC combined with an easy to read HMI allows control changes more easily than the prior analog system which utilized relay logic. Trouble shooting with the analog system was very difficult and time consuming. The Hydro-Sludge® Screen control panel gave the operator direct indication of any problem and the associated component.

The Hydro-Sludge® Screen unit has run so well that a second unit was purchased in late 2009. In the summer of 2009 the first Hydro-Sludge® Screen was taken offline after one year in service to inspect for wear. Plant personnel were impressed with the lack of wear that the unit exhibited. The stellite tip on the screw flight which maintains the cutting edge showed little wear as did the screen zone screen basket. These two components are considered sacrificial wear parts and the lack of wear indicates that the Hydro-Sludge® Screens will provide years of low maintenance service. Other wear components on the unit showed little or no wear as well.

One other change that was noticed with the Hydro-Sludge® Screens was the volume of screenings produced. The previous unit produced approximately 20 yd³ (15 m³) of screenings each day. The Hydro-Sludge® Screen produces 20 cubic yards every five days. Concerns about solids bypassing the Hydro-Sludge® Screen caused plant personnel to inspect one of the digesters in 2011 but no appreciable material was found. Digester gas production had increased so it is suspected that the previous sludge screens were removing more organics which increased screenings volume but reduced digester gas production.

