United States
Environmental Protection
Agency

Decentralized Systems Technology Fact Sheet

Control Panels

DESCRIPTION

In recent years, regulatory agencies have increased performance requirements for onsite wastewater treatment. This necessitates onsite alternatives that provide higher levels of treatment than standard septic tank drainfield systems are capable of achieving. Alternative systems are more complex and typically rely on uniform distribution and periodic dosing of pretreated effluent. Pumps are the primary method for dosing and distributing effluent, and dosing pump control is typically performed with a control panel using water level sensors, programmable timers, and other controls. Control panels may also be able to provide remote control and monitoring. This fact sheet discusses the use of control panels in the management of onsite wastewater treatment systems.

A control panel consists of controls and sensors that ensure the onsite system will operate efficiently as well as sound an alarm whenever malfunctions threaten efficient performance. Typical control panel functions may include high-water level alarm, pump start/stop control, low-water level alarms, programmable timers, and intrinsically safe control relays for pumping locations in a hazardous or potentially explosive environment. Telemetry, current sensing, programmable controllers, and other special options are generally considered too costly for residential applications, but have been utilized with larger commercial flows. Standard control panel features may include circuit breakers, disconnects, manual/off/automatic motor control operation, audio/visual alarms (with silencer), and automatic reset upon correction of alarm condition (Bounds 1995).

APPLICABILITY

Control panels are commonly used in municipal lift stations and pumping stations to monitor various parameters and conditions including liquid level and pressure. As costs have decreased and technology has improved, control panels are increasingly being applied to the management of decentralized or onsite wastewater treatment systems. Control panels are generally installed with new systems, but may also be retrofitted to existing systems.

Examples of onsite systems that may be equipped with control panels include the following:

- Septic tank effluent pump (STEP) and grinder pump (GP) systems associated with septic tanks and/or pressure sewers;
- Low pressure effluent dispersal systems;
- Aerobic treatment units;
- Recirculating sand filters; and
- Drip dispersal systems.

ADVANTAGES AND DISADVANTAGES

Advantages

- Reduces costs for operation and maintenance (O&M) by preventing failures and reducing the amount of service time spent gathering information about the malfunction;
- Lowers energy consumption; and
- Increases manageability and reliability of onsite systems.

Disadvantages

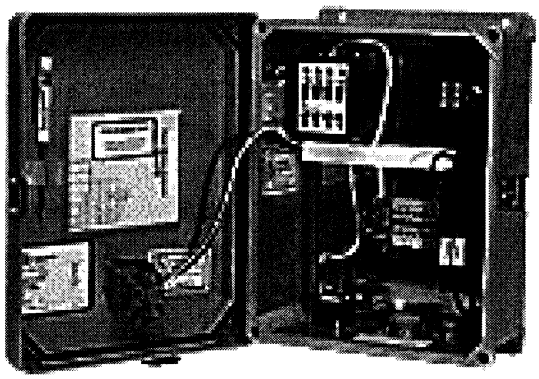
- Increases initial capital costs;

- Increased complexity requires higher level of training to install and operate (may require an electrician).

DESIGN CRITERIA

Control panels are usually conveniently located where they will be accessible for operation and maintenance. They should be within sight of the pump.

Figure 1 shows a typical control panel. The basic components and features of this control panel include the following:



Source: Orenco Systems Inc., 2001.

FIGURE 1 TYPICAL CONTROL PANEL

Programmable Timer - Precisely controls the pumping doses. The timer is programmed so that the "on" time (dosing period) is short and effluent is dosed in small volumes. The "off" setting spaces resting periods uniformly between doses throughout the day. Programmable timers are particularly beneficial in systems that require surge control, where a long period of storage is required between intermittent discharges (e.g., churches, schools, etc.). Timers are available with digital or analog features, and provide adjustable on/off duration settings. A timer can be disabled by a low level float, thereby maintaining a minimum liquid level.

Motor Contactor - Switches power to the pump on command through a signal from the programmable timer.

Toggle Switch (HOA Switch) - Allows the pumping operation to be automatically or manually controlled without interrupting the memory of the programmable timer.

Current Limiting Circuit Breaker - Provides a disconnect means and secondary overload protection for the pump circuit.

Fuse Disconnect - Provides a separate disconnect means and overload protection for the control circuitry (alarm system, motor contactor, programmable timers, relays, etc.). Power to the alarm and control circuitry is wired separately from the pump circuit, so that the alarm system remains functional if the internal overload switch or current-liming circuit breaker is tripped.

Audible Alarm - Provides an audible alarm when a high or low liquid level requires correction. The alarm should be loud enough to provide ample warning but not so loud that it causes irritation. A minimum of 80 decibels sound pressure at 24 inches is recommended. A push-to-silence feature should also be included to ensure that the alarm does not become a nuisance.

Visual Alarm - Provides visual indication when a high or low liquid level requires correction. The alarm light is usually red and varies in shape and size.

Audio-Alarm Silence Relay - Automatically resets the audio alarm after the alarm condition has been corrected.

Redundant-Off/Low Level Alarm Relay - Automatically overrides the pump control circuit to shut down the pump and energize the alarm system to signal a low liquid level condition.

Terminal Blocks - Touchsafe type terminal blocks provide greater protection against accidental shorting across terminals and touching of live connections.

Enclosure - Should be constructed of noncorroding and durable materials rated NEMA 4X to ensure adequate environmental protection for the enclosed components.

Lockable Latch - Provides lock-out capability to ensure security.

Listing - All controls should be manufactured by a company listed by an approved accrediting agency (e.g., UL, CSA, or ETL). At locations where flammable or explosive materials may be present, all controls and relays should be intrinsically safe, meaning that they operate at low energy to prevent electrical devices from creating arcs, sparks, or heat (during normal or fault conditions) that could ignite an explosive substance.

Warnings and Instructional Stickers - All control systems must contain the proper electrical warnings and instructional information to ensure user awareness and safety.

Wiring Diagram - Provides float and pump wiring instructions and information regarding the intended function of each component.

PERFORMANCE

River Rock Landing, Michigan

River Rock Landing is a newly-developed residential site consisting of 29 homes outside of Lansing, Michigan. A community cluster treatment system was constructed to treat an estimated peak flow of 37,900 L/d (10,000 gpd). Wastewater is collected through a STEP system with small diameter pressure sewers, then treated with side-by-side duplex recirculating sand filters followed by side-by-side duplex intermittent sand filters. The treated effluent is returned to groundwater through an unlined pond. An NPDES discharge permit was obtained to manually discharge excess water from the pond to the nearby Grand River if necessary (Stephens 2000).

The treatment facility is required by the Michigan Department of Environmental Quality to be operated under the supervision of a qualified and certified operator. As part of the management program for the facility, a control panel was installed at the treatment site. A dedicated telephone line is connected to this control panel, enabling a computer with a modem to access it directly from any location. The panel at this site is programmed to record and report on demand the following information:

- Current high and low water alarm conditions, and a log of past alarm events;
- Pump run events and run times;
- Water level readings in the tanks and pond; and
- Amperage being drawn by pumps (Stephens 2000).

In addition to these monitoring functions, the program allows the remote operator to make system adjustments as follows:

- Adjust programmed pump run cycles (time-off and time-on settings);
- Adjust alarm characteristics such as audible delays;
- Set and adjust high-level pump override cycles; and
- Turn pumps on and off as necessary to correct a high water condition (Stephens 2000).

These monitoring capabilities do not eliminate the need for personal visits to the site to evaluate the performance of system components that are not accessible over the phone wire. However, the ability to monitor and manage the system provides the operator with confidence that common system management problems will be identified. In addition, system information logs provide performance records to help the operator recognize trends and troubleshoot problems (Stephens 2000).

Island City Academy, Michigan

Island City Academy is a new charter school located outside of Eaton Rapids, Michigan. An estimated peak wastewater flow of 18,900 L/d (5,000 gpd) enters a septic tank, then flows to a pair of side-by-side recirculating sand filters. Final effluent is discharged to a series of pressure-dosed soil absorption trenches. The wastewater treatment facility is fitted with a control panel that monitors and reports pump run times and events, as well as alarm conditions. Programmable

timing features can be adjusted and pumps can be controlled remotely through the control panel. Daily flow information is also logged for future reference. At one point an employee of the Academy reported that several of the toilets at the Academy would not flush properly. The system operator was able to check the treatment system and verify that it was operating normally. Academy staff were then able to contact a drain cleaning firm to clear a stoppage in the building plumbing which caused the toilet malfunction (Stephens 2000).

OPERATION AND MAINTENANCE

When an alarm occurs, the user should contact an accredited maintenance service. An average of 24 hours of reserve storage is provided above the alarm level (Bounds 1995), and response within this time period is adequate.

When servicing any control system, all warnings must be given strict attention. An operator must not work on any system without first disconnecting the power at the circuit breaker and/or disconnect fuse. All control panels should be provided with a lockable latch to ensure operator safety when working away from the control panel.

COSTS

Control panels range in price from approximately $1,500 to $3,000, depending on options selected (Jesperson 2000).

REFERENCES

Other Related Fact Sheets

Sewers, Lift Station
EPA 832-F-00-073
September 2000

Recirculating Sand Filters
EPA 832-F-99-079
September 1999

Sewers, Pressure
EPA 832-F-02-006
September 2002

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owm/mtb/mtbfact.htm

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