Sioux City Wastewater Treatment Plant

The City of Sioux City is served by a municipally-owned, 28.73 million gallon per day wastewater plant located at 3100 South Lewis Blvd. near the intersection of Interstate Highway 29 and U.S. Route 20.

Originally constructed in 1961, the Sioux City Regional Wastewater Treatment Plant serves five communities from three different states, including:

Sioux City, IA
Sergeant Bluff, IA
South Sioux City, NE
North Sioux City, SD
Dakota Dunes, SD

Wastewater Treatment Plant History:

1961:

Originally constructed in 1961, the Wastewater Treatment Plant (WWTP) consisted of the following processes: preliminary treatment, primary settling and anaerobic digestion of primary sludge. The bar screens and the primary clarifiers comprising the 1961 plant are referred to as the North plant.

1978:

In 1978, the WWTP was upgraded with the addition of a duplicate system of mechanical bar screens, grit removal and primary treatment; such additions are known collectively as the South plant. Additional anaerobic digesters, disk/nozzle centrifuges for sludge thickening, storage lagoons, and a secondary activated sludge process were added to the treatment process also. At the time of the 1978 plant upgrade, the secondary treatment train consisted of primary effluent pumping, aeration using centrifugal blowers and synthetic fabric diffuser tubes, secondary clarification, and return activated sludge pumping.

1985:

In 1985, three additional centrifugal blowers were added to the secondary system in order to reduce the overall power consumption for the aeration system during periods of lower oxygen demand.

1988:

In 1988, the disk/nozzle centrifuges were replaced with gravity belt thickeners for WAS sludge thickening. In addition, a polymer feed system for the gravity belt thickeners, miscellaneous pumping, HVAC, and electrical improvements were installed.

1999:

In 1999, a major upgrade to the WWTP was completed and included the following items:

Replacement of all primary digester covers, including new gas safety equipment and liquid level monitoring equipment.

Replacement of one secondary digester cover, including new gas safety equipment and liquid level monitoring equipment.

Addition of draft tube mixers for each of the primary digesters.

Construction of a new sludge transfer line for primary and WAS sludge to the primary digesters.

Replacement of bar screens at the headworks of the WWTP.

Installation of a non-potable water system.

2006:

In 2006, the City of Sioux City began a $31.8 million plant rehabilitation project. The following improvements were included:

New Headworks building, including bar screens, grit removal, septage dumping station, belt filter presses, sludge storage silo, polymer system, boilers for building heat, and an odor control system.

Rehabilitation of the North primary clarifiers, including an odor control system and covers.

The addition of two air basins and the modification of existing to a MLE activated sludge process.

The addition of a secondary clarifier and rehabilitation of the existing.

A new sodium hypochlorite disinfection building, including sodium bisulfite for dechlorination of effluent prior to discharge to the Missouri River.

ADA and Code compliance renovations to the Administration Building.

Wastewater Treatment Plant Process

Preliminary Treatment

Raw wastewater enters the WWTP through the Headworks Building and passes through bar screens where large solids are removed. The wastewater then flows to a vortex grit system for removal of small inorganic solids. Solids removed from the bar screens and the grit system are dewatered prior to disposal at the local landfill.

Primary Treatment

Following preliminary treatment, the wastewater flows to the primary clarifiers where heavy organic solids and grease are removed. The clarifiers are equipped with continuous chain flight collectors and primary sludge pumps. The heavy settled primary sludge and the skimmed grease is pumped to the primary digesters for further treatment.

Secondary Treatment

Primary treated wastewater is pumped from the Primary Effluent Pump Station to six aeration basins. These basins are designed to provide nitrification and denitrification using the Modified Ludzak-Ettinger (MLE) Process. Each basin includes four passes which operate in series. Pass 1 is the anoxic volume for denitrification. The first pass is divided into three biological selector zones followed by a fourth anoxic zone. Submersible mixers provide mixing in Pass 1. The other three passes have fine bubble aeration for oxygen and mixing. An internal recycle pump, located at the end of the fourth pass, returns nitrate rich mixed liquor (MLSS) to selector Zone No. 1 where it is mixed with primary treated wastewater and return activated sludge (RAS).

MLSS from the aeration basins is directed to five 115-foot diameter final clarifiers for settling. The solids settle to the bottom and are collected for return to the RAS wet well. The RAS pumps remove solids from the RAS wet well and return them to the aeration basins to maintain the MLSS concentration required for biological treatment. Excess solids are pumped to the solids handling facilities (GBTs) by the waste activated sludge (WAS) pumps. The clarified effluent flows by gravity to the chlorine contact basin.

Chlorine Contact Basin

Before leaving the WWTP, flash mixers blend the effluent with the sodium hypochlorite to provide disinfection. Sodium bisulfite is then added to dechlorinate the water prior to discharge to the Missouri River.

Solids Processing

Primary sludge and scum from the primary and secondary clarifiers is pumped directly into the anaerobic digestion process. WAS, thickened by polymer addition and gravity belt thickeners, is also pumped to the anaerobic digesters.

Two sets of four anaerobic digesters, East Complex and West Complex, are used to stabilize solids from the primary and secondary treatment processes. Each digester complex incorporates two primary and two secondary digesters to digest and stabilize the sludge. The end product is a Class ‘B’ sludge, per EPA 503 regulations, which can be disposed of within a landfill or land applied in accordance with 503 regulations.

Digested sludge is pumped to belt filter presses (BFP) for further dewatering and stored for hauling off site to either a landfill or used in land application.

Methane gas produced by the anaerobic digestion process is used within the WWTP as fuel for building heat and to heat the primary digesters.

Safety

A major priority at the Sioux City Wastewater Treatment Plant continues to be the safety of the employees, facilities, and the general public. Monthly Safety Training (including hands-on safety exercises) and Safety Committee Meetings are used to discuss and address any new or outstanding safety concerns, safety awareness and safe work ethics practiced by each of the employees. Each employee is required to participate in all monthly safety courses and/or be current with all required safety certifications.

The safety committee is made up of members from various departments, including departmental personnel, supervisors and managers. At the meetings, the committee discusses any new or outstanding safety concerns. By hosting an open forum for employees to express safety concerns, it not only gives the employees an opportunity to discuss their concerns, it also allows employees the opportunity to contribute to the resolution and awareness of any hazards that may exist.

STAFF

Administration:

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Maintenance/Operators:

Operator II (7)
Maintenance Mechanic (4)
Electrician (2)
Laboratory Technician (4)
CMMS Coordinator

Overview:

In addition to domestic wastewater, the Sioux City WWTP receives flow from approximately 20 industries throughout the region.

Following treatment, as authorized by Iowa Department of Natural Resources issued NPDES permit, treated wastewater is discharged into the Missouri River.