



April 14, 2017

Water Quality Permit Coordinator
Department of Ecology
Eastern Regional Office
4601 North Monroe Street
Spokane, WA 99205-1295

Re: NPDES Permit No. WA-0093317 Operations and Maintenance (O&M) Manual Update 2017

Dear Water Quality Permit Coordinator,

According to section S5.G. of the Permit No. WA-0093317 the Permittee must review the O&M manual at least annually and confirm this review by letter to Ecology by April 15th of each year. The Spokane County Regional Water Reclamation Facility O&M Manual has been reviewed for the year of 2017 and the updated sections are attached.

Sincerely,

Adam McClymont

Adam McClymont
Facility Manager
CH2M
1004 North Freya St
Spokane, WA 99202
509.536.3702

cc. Dave Moss, Spokane County

Spokane County Regional Water Reclamation Facility Operations Manual



Final

November, 2011

Updated: April 15, 2014

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Table of Contents

General

Introduction.....	7
Hydraulic Profile.....	12
Design Criteria.....	13

Influent Screening System

Overview.....	15
Operating Strategies	20
Alarm List.....	24
UPCP.....	27

Aerated Grit System

Overview.....	32
Operating Strategies	37
Alarm List.....	42

Septage

Overview.....	43
Operating Strategies	45

Primary Clarifiers

Overview.....	49
Operating Strategies	54
Alarm List.....	57
UPCP.....	58

Sludge/Scum Pumping

Overview.....	63
Operating Strategies	67
Alarm List.....	74

Aeration Basins

Overview.....	75
Operating Strategies.....	86
Alarm List.....	95
UPCP.....	108

Membranes

Overview.....	118
Operating Strategies.....	123
Alarm List.....	128
UPCP.....	130

Chlorine Contact

Overview.....	136
Operating Strategies.....	139
UPCP.....	143

Blended Storage/Pumping

Overview.....	148
Operating Strategies.....	151
Alarm List	154

Gravity Belt Thickeners

Overview.....	155
Operating Strategies.....	159
Alarm List.....	166

Dewatering

Overview.....	168
Operating Strategies.....	173
Alarm List.....	186

Anaerobic/Aerobic Digesters

Overview.....	192
Operating Strategies.....	199
Alarm List.....	207
UPCP	210

Digester Gas Storage & Utilization

Overview.....	215
Operating Strategies.....	221
Alarm List.....	229

Digester Heating

Overview.....	231
Operating Strategies.....	238
Alarm List.....	250

Odor Control

Overview.....	252
Operating Strategies.....	260

Anionic Polymer

Overview.....	267
Operating Strategies.....	270
Alarm List.....	273

Sodium Bisulfite

Overview.....	274
Operating Strategies.....	278
Alarm List.....	281

Citric Acid

Overview.....	283
Operating Strategies.....	285
Alarm List	288

Sodium Hydroxide

Overview.....	289
Operating Strategies.....	294
Alarm List.....	299

Sodium Hypochlorite

Overview.....	300
Operating Strategies.....	305
Alarm List.....	309

Ferric Chloride

Overview.....	311
Operating Strategies.....	316
Alarm List.....	320

Cationic Polymer

Overview.....	322
Operating Strategies.....	327
Alarm List.....	333

Chemical Receiving & Containment

Overview.....	336
Operating Strategies.....	338
Alarm List.....	340

Potable & Non-Potable Water Systems

Overview.....	341
---------------	-----

W3 System

Overview.....	343
Operating Strategies.....	346
Alarm List.....	348

Electrical

Overview.....	349
---------------	-----

HVAC

Overview.....	353
Operating Strategies.....	357
Alarm List.....	360

Appendices

Appendix A	Managerial & Operating Responsibilities.....	367
Appendix B	Sampling and Reporting Plan.....	374
Appendix C	Record Keeping Procedures & Sample Forms.....	393
Appendix D	Maintenance Schedule.....	402
Appendix E	General Safety Policy Statement.....	403
Appendix F	Spare Parts Management Plan.....	405
Appendix G	Emergency Response Plan & Procedures.....	406
Appendix H	Chemical Management Plan.....	461
Appendix I	Communications Plan.....	471
Appendix J	Grit Plan.....	478
Appendix K	High Flow Management Plan.....	480
Appendix L	Odor Response Plan.....	483
Appendix M	Power Loss Response Plan.....	524
Appendix N	Pre-Fire Notification Response Plan.....	529
Appendix O	Process Control Management Plan.....	536
Appendix P	Laboratory QAQC Plan.....	541
Appendix Q	Security Plan.....	545
Appendix R	Septage Receiving Plan.....	548
Appendix S	Spill Control Response Plan.....	553
Appendix T	SOPs.....	601
Appendix U	Document Management System.....	611

Introduction

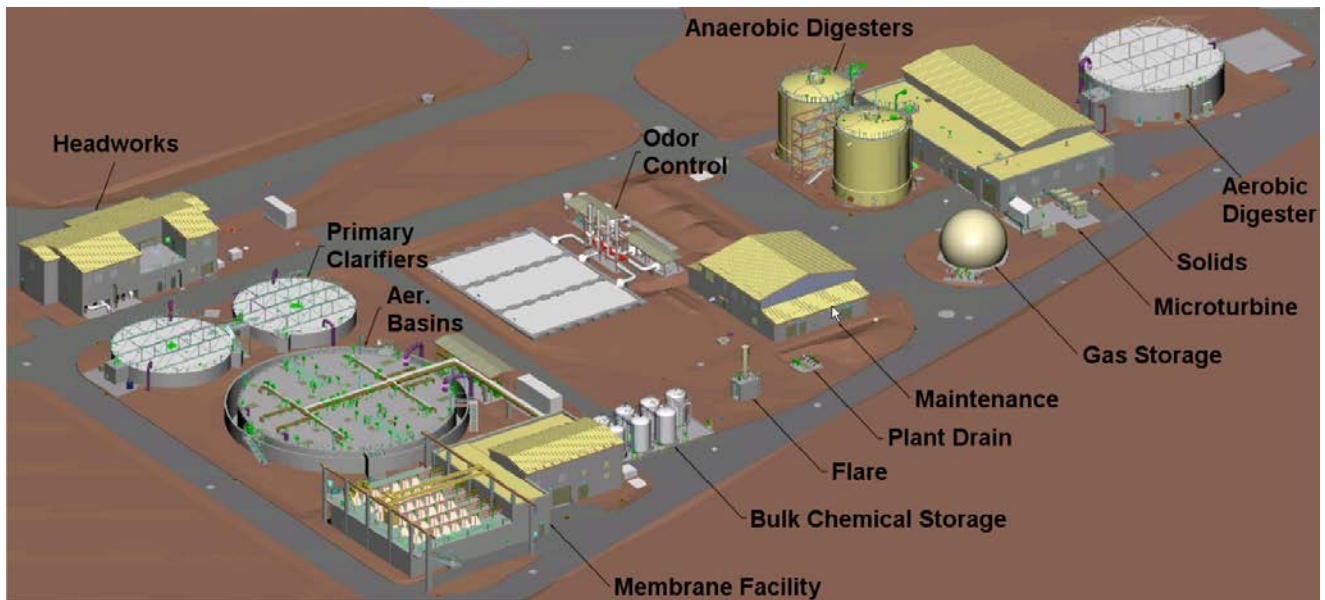
Background

CH2M HILL has been retained by Spokane County to design, build, and operate the new Spokane County Regional Water Reclamation Facility (SCRWRF), which will treat wastewater generated in Spokane County's North Valley Service Area and a portion of the wastewater generated in the Spokane Valley Service Area. Eventually, the treatment plant may also receive some wastewater generated in the eastern reaches of the City of Spokane's collection system, or even from Liberty Lake. The initial treatment plant will provide an average-day treatment capacity of 8 million gallons per day (mgd), and a peak-hour capacity of 13.8 mgd. The facility will also receive up to 24,000 gallons per day of septage hauled in by truck.

The plant will be built in phases. CH2M HILL has been contracted to construct Phase 1, which must be on line by 2012. It will provide an average-day treatment capacity of 8 mgd. Phase 2 will be implemented when needed and will increase the nominal plant capacity to 12 mgd. With the Phase 2 expansion, the plant is anticipated to provide sufficient capacity through the year 2030. The ultimate capacity requirement for the Spokane County RWRF is uncertain; however, space planning has been based on a nominal flow of 24 mgd.

Facility Process Overview

To meet the discharge requirements and provide the reliability and flexibility needed for current and future conditions, the treatment process design is based on preliminary treatment, chemically enhanced primary treatment (CEPT), and membrane bioreactor (MBR) treatment. The solids treatment process design is based on co-thickening primary and waste activated sludge (WAS), a two-stage digestion system, and a dewatering system.



Headworks

The Influent Screening System removes rags, plastics, and other medium- and large-sized debris from raw sewage, preventing their passage to downstream processes. The grit removal system removes sand, coffee ground, egg shells, and other inorganic particulate. Removing this debris protects downstream pumps and equipment, reduces maintenance required for downstream facilities, and reduces the amount of objectionable materials in the treated sludge intended for land application or compost beneficial use.

Primary Clarifiers

The primary clarifiers allow solids to be removed in the form of sludge that has settled to the bottom of the clarifiers, and as scum that is skimmed from the surface of the clarifiers. Metal salts and/or polymers can be added to aid in solids removal as part of the CEPT system.

Aeration Basin

Biological treatment removes biochemical oxygen demand (BOD), solids, and nutrients from wastewater. The biological process includes the aeration basins and membrane basins and is collectively called a membrane bioreactor (MBR).

Membrane Facility

The membrane basins contain membrane filters that separate the biomass (also called activated sludge or mixed liquor) from the wastewater and transfer the clean water (permeate) to the chlorine contact basin as secondary effluent. The filtered biomass becomes return activated sludge (RAS) and flows back to the aeration basins.

Much of the equipment associated with the membrane process is provided and controlled by the membrane system supplier, GE Water Technologies (Zenon).

Anaerobic Digesters

The Anaerobic Digester System, located to the west of the Solids Facility, consists of components that provide digestion of the primary scum and thickened combined (or separate) primary/WAS (TS) sludge. The primary components of this system include two 550,000-gallon, fixed-cover Anaerobic Digesters, two 9,200-gpm External Draft Tube Mixers with heating jackets, and two motorized sludge feed valves. Included in the Anaerobic Digester Complex but discussed in the Digester Gas Storage and Utilization process control narrative in this Operations and Maintenance (O&M) Manual is the Digester Gas Equipment Room, located to the east of the Anaerobic Digesters.

Digester Gas

The Digester Gas System can be divided into two categories: storage, and utilization. The facilities/equipment under this umbrella include Anaerobic Digesters, the Digester Gas Equipment Room (located between the two Anaerobic Digesters), Digester Gas Storage Facility (located to the south of the Anaerobic Digesters), Hot Water Boiler (located in the Boiler Room in the Solids Facility), Cogeneration Facility (located to the south of the Solids Facility), and the Waste Gas Burner (located to the west of the Plant Drain Pump Station).

Aerobic Digester

The Aerobic Digester/Biosolids Storage Tank System, located to the east of the Solids Facility, is configured as a covered Aerobic Sludge Digester/Biosolids Storage Tank. The primary components of this system include a 700,000-gallon fixed-cover Aerobic Digester, two Turbo Blowers, one positive displacement blower, and a Coarse Bubble Diffuser System. The primary functions of this system are to remove nitrogen, equalize sludge loads upstream of dewatering, and aerobically digest the Anaerobic Digester effluent for a further decrease in volatile solids.

Solids Handling

Digested sludge from the Aerobic Digester is pumped to the centrifuge units by the Centrifuge Feed Pumps for dewatering by the centrifuge units before being pumped by the Dewatered Sludge Pumps to the truck loadout area. The major components of the Sludge Dewatering System consist of the Centrifuge Feed Pumps, Centrifuges, and Dewatered Sludge Pumps. This equipment along with support appurtenances are located in the Solids Facility.

The primary purpose of the solids dewatering process is to efficiently remove excess water from the biosolids and reduce the volume for cost-effective hauling to land application or compost sites. Secondary purposes are to convey liquid biosolids to the centrifuges, convey the cake solids into trucks, and return centrate to the liquid treatment process.

Chlorine Contact

To ensure the effluent is safe for use and of acceptable quality to be sent to the river outfall or used as W3 water, sodium hypochlorite is used to disinfect the water and sodium bisulfite is used to dechlorinate any water that is sent to the outfall. The effluent is sampled to check the residual chlorine levels in the Chlorine Contact Basin and W3 water and routine samples are collected to measure the residual chlorine levels in the effluent to be sent to the river outfall.

Bulk Chemical Storage

Bulk storage is provided for anionic polymer, citric acid, sodium hydroxide, sodium hypochlorite, ferric chloride, and cationic polymer.

Anionic polymer is used in conjunction with ferric chloride to supplement the CEPT process. Activated anionic polymer improves the solids removal in the Primary Clarifiers by coagulating the chemical precipitate formed by ferric chloride and phosphorus.

The Citric Acid Storage and Feed System consist of components that clean the membranes during the backwash cycle.

The Sodium Hydroxide Storage and Feed System consist of components that adjust alkalinity of the RAS and final effluent to be sent to the river outfall.

Sodium hypochlorite metering pumps pump to the permeate header upstream of the Chlorine Contact Tanks for disinfection and to the discharge side of the backpulse pump for membrane cleaning cycles.

Ferric chloride is also delivered to the membrane feed channel to achieve chemical precipitation of phosphorous in the MBR. The precipitate will not pass through the membranes and will remain in the mixed liquor and eventually be removed in the WAS stream.

Cationic polymer is used to aid in sludge thickening prior to anaerobic and aerobic digestion, aid in sludge dewatering prior to offsite disposal, and provide slip feed to the Dewatered Sludge Pumps.

Odor Control

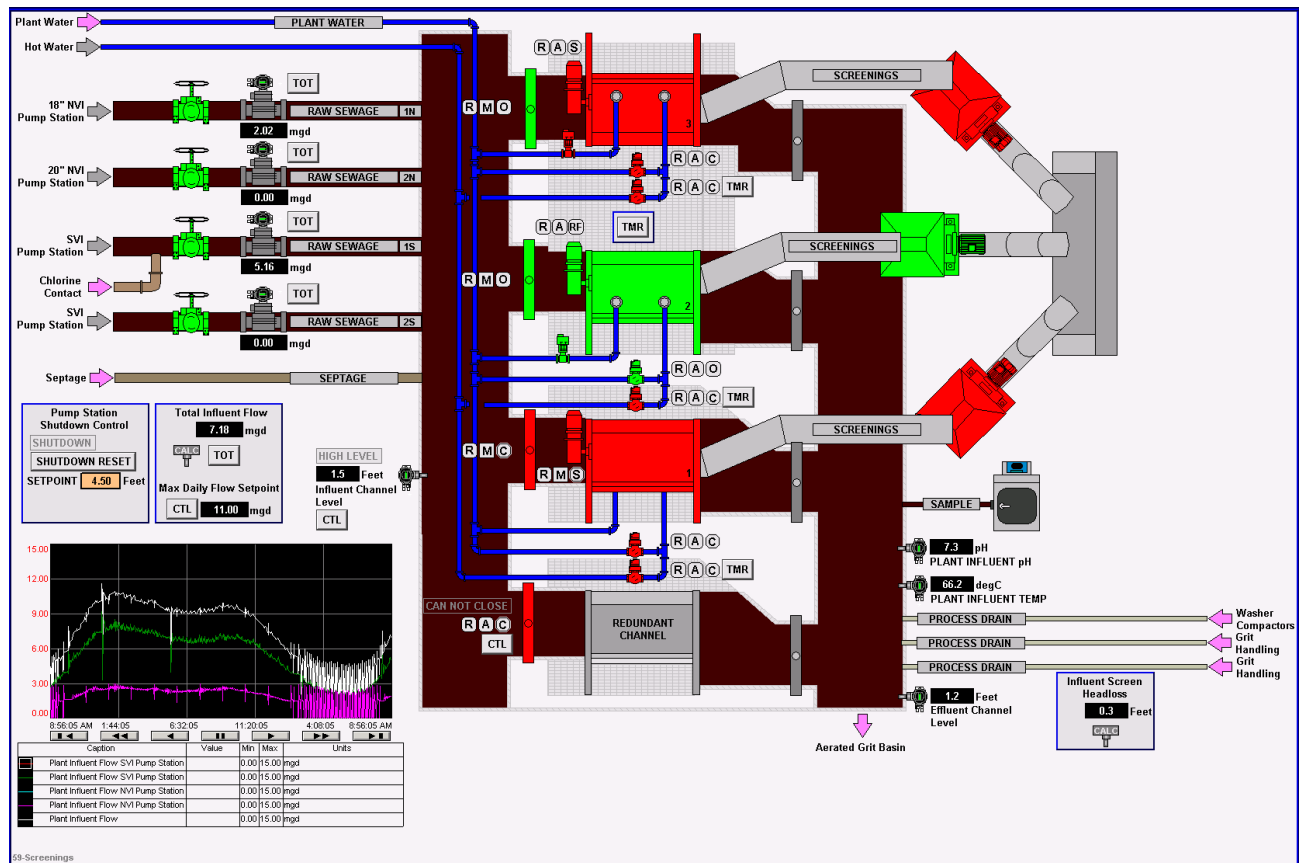
Odors result from the gas produced by microorganisms present in wastewater liquids and solids. Hydrogen sulfide and ammonia are the most common causes of odor; however, numerous other organic and inorganic compounds can create unpleasant odors. At the SCRWRF, odorous air is transferred to a bulk media biofilter through a centralized fan system for odor treatment.

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HEADWORKS		Aeration Basins		Chemical Systems	
Influent Fine Screens		Basin Size		Ferric Chloride Storage Tanks	
Type	Perforated Plate Bandscreen	Total Basin Volume, gal, each	330,000	Capacity	8700 GAL
Inlet Width, ft	3	%Anoxic, %Aerobic	40%, 60%	Number	3
Hole size, mm	3	Number of Aeration Basins	4		
Capacity per screen, MGD	13.8	Aerobic Zone SWD, ft	18	Ferric Chloride Feed Pumps	
Drive Type	Adjustable Speed			Application	Phosphate
Headloss at peak, ft (50% blocked)	2.5	Fine-Bubble Diffuser Equipment		Type	Diaphragm
Number of screens	3	Type	Polyurethane Membrane	Capacity	40 GPH (MBR); 75 GPH (CEPT)
		Diffuser Submergence, ft	18	Drive type	Adjustable Speed
		Number of Aerobic Zones per basin	2	Number	2 MBR; 2 CEPT
Screenings Washer Compactors		Anoxic Basin Mixers		Sodium Hydroxide Storage Tanks	
Capacity, ft ³ /hr	150	Type	Submersible	Capacity	8700 GAL
Number	3	Drive type	Constant Speed	Number	2
		Number per basin	5		
Rapid Mixer		Nitrified Effluent Recycle (NR) Pumps		Sodium Hydroxide Feed Pumps	
Type	Vertical Shaft	Type	Submersible horizontal, axial-flow	Application	Alkalinity
Motor Horsepower, hp	2	Capacity	5700 GPM @ 1 ft TDH	Type	Diaphragm
Velocity Gradient, G (s ⁻¹)	400	Drive type	Adjustable Speed	Capacity	30 GPH
		Number	4 (1 per basin)	Drive type	Adjustable Speed
				Number	3
Aerated Grit Tanks		Process Air Blowers		Sodium Hypochlorite Storage Tanks	
Design Criteria	5 Minutes at Peak Hour Flow	Type	Variable speed turbo	Capacity	4400 GAL
Dimensions, ft	30Lx15Wx15D	Capacity	5750 SCFM @ 10 PSI	Number	2
Air Criteria, SCFM/ft of length	10	Drive type	Adjustable Speed		
Air Required per Tank, SCFM	150	Number	3 (2 duty, 1 standby)	Sodium Hypochlorite Feed Pumps	
Number of Hoppers per Tank	2			Application	Disinfection
Number of Tanks	1			Type	Diaphragm
				Capacity	20 GPH
				Drive type	Adjustable Speed
				Number	2
Grit Slurry Pumps		Membrane Air Scour Blowers		Sodium Hypochlorite Pumps	
Type	Recessed Impeller	Type	Variable Speed Turbo	Application	Recovery/Maintenance
Size	3-inch	Capacity	4500 SCFM @ 5.4 PSI	Type	Diaphragm
Capacity	220 GPM @ 50 ft TDH	Drive type	Adjustable Speed	Capacity	300 GPH
Drive type	Constant Speed	Number	3	Drive type	Adjustable Speed
Number	3			Number	2
Septage Pump		Basin Size		Citric Acid Storage	
Type	Recessed Impeller	Basin Volume, gal, each	42,300	Number	2 in service
Size	3-inch	Number of Trains	6	Storage Type	Tote
Capacity	250 GPM @ 50 ft TDH	Overall Dimension per Train, ft	56.5Lx10Wx12D		
Drive type	Constant Speed	Basin Side Water Depth, ft	10	Citric Acid Pumps	
Number	2			Application	Recovery/Maintenance
				Type	Diaphragm
				Capacity	300 GPH
				Drive type	Adjustable Speed
				Number	2
Grit Washer Classifier		Membrane Feed Pump		Sodium Bisulfite Storage	
Type	Dual Cyclone with Auger	Type	Submersible, vertical, axial-flow	Number	2 in service
Capacity	220 GPM	Capacity	9250 GPM @ 10 ft TDH	Storage Type	Tote
Number	1	Drive type	Adjustable Speed		
		Number	4	Sodium Bisulfite Feed Pumps	
				Type	Diaphragm
				Capacity	12 GPH
				Drive type	Adjustable Speed
				Number	2
Aerated Grit Basin Scum Pump		Backpulse Pumps		Cationic Polymer Storage	
Type	Progressing Cavity	Type	Horizontal Centrifugal	Number	3
Capacity	50 GPM	Capacity	1970 GPM @ 41 ft TDH	Storage Type	Tote
Drive type	Constant Speed	Drive type	Adjustable Speed		
Number	1	Number	2	Cationic Polymer Blend Unit	
				Number	1
				Capacity	50 GPH
				Drive type	Adjustable Speed
Anionic Polymer Storage		Membrane Transfer Drain Pump		Cationic Polymer Aging Tank	
Number	1	Type	Submersible	Capacity	1450 GAL
Storage Type	Tote	Capacity	2100 GPM @ 12 ft TDH	Number	1
		Drive type	Constant Speed	Mixer Type	Vertical
		Number	1	Detention Time (min)	68
Primary Treatment Polymer System		WAS Pumps		Cationic Polymer Metering Pumps	
Type	Package Polymer Blend System	Type	Submersible	Type	Progressing Cavity
Polymer Feed Pump Capacity	0.1 to 2.5 GPH	Capacity	120 GPM @ 20 ft TDH	Capacity	250 GPH (GBT), 1485 GPH (Centrifuge)
Control	Flow Proportional	Drive type	Adjustable Speed	Drive type	Adjustable Speed
Number	1	Number	2	Number	2 (GBT), 3 (Centrifuge)

10 - Influent Screening System

Overview



Purpose

The Influent Screening System removes rags, plastics, grit, and other medium- and large-sized debris from raw sewage, preventing their passage to downstream processes. Removing this debris protects downstream pumps and equipment, reduces maintenance required for downstream facilities, and reduces the amount of objectionable materials in the treated sludge intended for land application beneficial use.

Description

Plant Influent

Plant influent flows through four raw sewage force mains pumped to the site. Two force mains are from the Spokane/South Valley Interceptor (SVI) Pumping Station and two are from the North Valley Interceptor (NVI) Pumping Station.

The supervisory control and data acquisition (SCADA) system collects influent flow measurements from the flow meters located in each force main. Plant influent flow signals and monitoring data from each flow meter are available to the County for controlling the pump stations. The flow meters also provide flow pacing to SCADA, which calculates the total plant influent flow rate.

Additional provisions of the influent piping include:

- Backflow prevention from the Headworks Facility back to the force mains.
- Pig-catching provisions in the influent channel at the Headworks.
- Temporary piping provisions to accommodate startup and testing of the Spokane/South Valley Interceptor (SVI) and North Valley Interceptor (NVI) Pumping Stations.

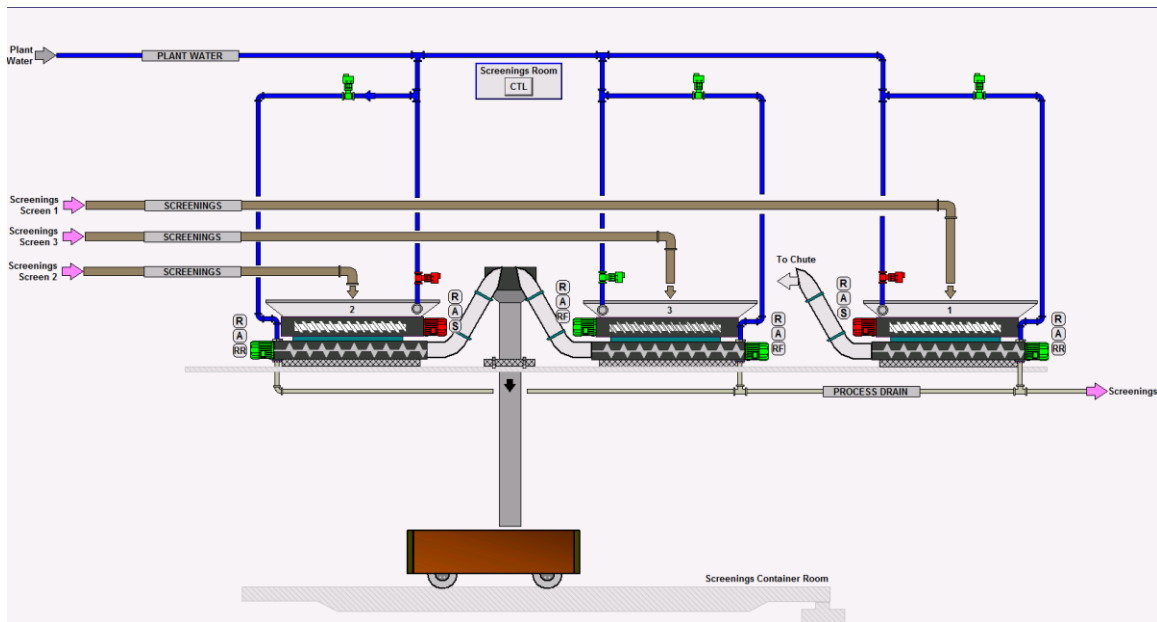
These provisions will allow one force main from each station to transmit raw sewage and the other force main from each station to send treated plant effluent back to the SVI and/or NVI pumping stations. Each raw sewage force main has an air release valve vault on site. The vaults are monitored for high liquid levels by switches that alarm to SCADA. If the vaults fill high enough to trip the level switches, portable pumps will be deployed to pump liquid from the vaults to avoid raw sewage overflow.

Influent Screening

The raw sewage and septage flows undergo preliminary treatment by screening, grit removal, and an initial dosing of ferric chloride at the Headworks Facility. There are three influent channels, each equipped with a 3-millimeter (mm) band screen. In addition, the grit basin bypass channel equipped with a modulating influent gate, a manually cleaned bar rack and two isolation gates that allow flow into the grit basin or into the primary clarifier influent. Screenings are collected in a trough and sluiced to the screenings handling process.

Influent flow is routed to the bypass channel if the influent channel water level approaches its freeboard limit. Refer to the Septage, Aerated Grit, Influent Screening, and Ferric Chloride process control narratives for other aspects of preliminary treatment.

Screenings Disposal



Screenings removed by the Influent Band Screens from the Primary Influent Channels are washed, compacted, and dewatered prior to disposal. Screenings are transferred from each fine screen through a trough to a dedicated Screenings Grinder and Screenings Washer/Compactor. Processed screenings are disposed to a screenings roll-off container.

The screenings equipment is located in the upper level of the Headworks Facility, with drop chutes to the roll-off container located on the lower level directly below. Drainage from dewatering of the screenings is returned to the Primary Influent Channel by gravity. Refer to the Influent Screening process control narrative for process drainage system descriptions.

Design Criteria and Component Lists

Exhibit 10-1 is a partial list of the components of the Influent Screening System. Exhibit 10-2 is a partial list of the components of the screenings disposal process.

EXHIBIT 10-1

Influent Screening Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Influent Sampler	59SAM01800	Quantity: 1 Type: Peristaltic Flow Rate (ft/sec): 2 Power: 120-Volt, 60-Hz Single-Phase Hardwired

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Band Screen	59SCR02301, 59SCR02302, 59SCR02303	Quantity: 3 Type: Plate, Variable Speed Perforation (mm): 3 Width (ft): 3 Flow Rate (mgd): 13.8
Manual Bar Screen	59SCR02301	Quantity: 1 Openings size (in): 3/8
Gate	59GTE01601, 59GTE01602, 59GTE01603, 59GTE01801, 59GTE01802, 59GTE01803, 59GTE01901, 59GTE01902, 59GTE01903	Quantity: 9
Spray Water Booster System	59PMP06101, 59PMP06102	Quantity: 2 pumps mounted on common skid Type: Vertical centrifugal, variable speed Flow Rate (gpm): 300 @ 105 ft TDH Power: 15HP each
NOTES: mm = millimeter ft = foot		

EXHIBIT 10-2

Screenings Disposal Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Screenings Grinder	59WSH02401, 59WSH02402, 59WSH02403	Quantity: 3
Screenings Washer/Compactor	59CPT02501, 59CPT02502, 59CPT02503	Quantity: 3 Capacity (fph): 150
Screenings Roll-off Container		Quantity: 1 Volume (yd ³): 10
NOTES: fph = feet per hour yd ³ = cubic yards		

Process Control Variables

Control Variables

- Screen Cleaning Frequency

The influent screen cleaning frequency affects the differential head loss across the screen and therefore affects the upstream water level in the raw sewage channels. Screen cleaning is triggered based on a timer, and the speed at which it cleans is based on differential water level across the screen..

Non Controllable Variables

- Wastewater flow rate

Raw sewage flow from the IPSs is weather- and flow- dependent and therefore is not controllable. Pump station operations are based on water levels in the station wet wells. The influent pumping rate affects the influent channel velocity and the screen cleaning cycle.

- Screenings Quantities

The quantities of screenings vary greatly from one season to another, and are highly dependent on wastewater flow and types of wastes (residential versus industrial). The quantity of screenings is also a function of the County's cleanings of the offsite pump stations.

Calculations

- None.

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10 - Influent Screening

Operating Strategies

Influent Screening

The Influent Band Screens operate automatically based on a combination of timers and differential water level (headloss) across the screen. Normally all screens not requiring maintenance are placed in service. The in-service screens alternate operation based on operator-entered time intervals, and sequence through the available screens one at a time so that one screen is operating in a cleaning mode, and the other(s) are idle but available. When the screen is called to operate, the speed of cleaning is determined by the headloss across the screen – as the headloss increases, the speed increases, and vice versa. Multiple screens will run if the screen speed increases to the maximum allowed speed and there continues to be headloss above the specified target. The controls are configured to start the spray wash water when the drive motor is engaged.

Radar level transmitters in the inlet and outlet channels, which are located upstream and downstream of the screens, monitor channel levels and calculate the Influent Band Screen headloss by subtracting the differences in liquid level elevations. Liquid levels are reported by height or elevation in units of feet and inches. The transmitter indicates liquid levels locally at the transmitter and remotely at the supervisory control and data acquisition (SCADA) panel. The differential level calculation allows the operator to monitor an Influent Band Screen that is clogged or that experiences a motor OVERLOAD condition. The operator can input level alarm setpoints (adjustable). ALARM DISABLE capability is provided by SCADA. Exhibit 10-3 lists the control modes available for influent screening.

EXHIBIT 10-3
Influent Screening Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	In LOCAL-MANUAL mode ON/OFF and speed of each screen is controlled at the local control panel.	
Manual/Remote	In REMOTE-MANUAL mode ON/OFF and speed of each screen is controlled at the HMI.	
Auto/Remote	Each Influent Band Screen automatically runs through a cleaning cycle while in the REMOTE-AUTO mode based	

	on a set timed interval (adjustable) or upon detection of a HIGH differential level on each side of the screen in the respective influent channel.	
Auto/Remote	SCADA monitors the LOCAL-REMOTE and ON-OFF status of the Influent Band Screen drives.	
NOTES: HMI = human-machine interface SCADA = supervisory control and data acquisition		

Screenings Grinder and Compactor/Washer

The screenings grinder reduces the size of the screenings material and breaks up some of the organic matter. The compactor/ washer removes fine material from the screenings and the compactor removes excess water. Exhibit 10-4 lists the control modes available for the screenings compactor/washer.

EXHIBIT 10-4
Screenings Compactor / Washer Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Local	The operator selects the LOCAL or REMOTE control mode at the LCP for the grinder.	
Manual/Local	In LOCAL-MANUAL mode the operator controls the FORWARD-OFF-REVERSE status of the grinder at the LCP.	
Manual/Local	The operator selects the LOCAL or REMOTE control mode at the LCP for the washer/compactor.	
Manual/Local	In LOCAL-MANUAL mode the operator controls the FORWARD-OFF-REVERSE status of the washer/compactor at the LCP.	
Manual/Remote	In REMOTE the operator selects the REMOTE-MANUAL or REMOTE-AUTO control mode for the grinder at the HMI.	
Manual/Remote	In REMOTE-MANUAL mode the operator controls the FORWARD-OFF-REVERSE status of the grinder at the HMI.	
Manual/Remote	In REMOTE the operator selects the REMOTE-MANUAL or REMOTE-AUTO control mode for the washer/compactor at the HMI.	
Manual/Remote	In REMOTE-MANUAL mode the operator controls the FORWARD-OFF-REVERSE status of the grinder at the HMI.	
Auto/Remote	In REMOTE-AUTO mode...grinders	
Auto/Remote	In REMOTE-AUTO mode...washer/compactor	
Auto/Remote	SCADA monitors ON-OFF/ FORWARD-OFF-REVERSE status of the screenings grinders and indicates the	

	current control mode of operation.	
Auto/Remote	SCADA monitors ON-OFF/ FORWARD-OFF-REVERSE status of the screenings washer-compactors and indicates the current control mode of operation.	
NOTES: LCP = local control panel HMI = human-machine interface SCADA = supervisory control and data acquisition		

Startup Procedures

Remote-Auto Mode:

1. At the local control stations (LCS) for each piece of equipment, select REMOTE from the On-Off-Remote switch for the Influent Screen, or REMOTE from the Local-Remote switch for the Screenings Grinder and Screenings Washer Compactor.
2. Through the Plant Control System (PCS), set the cleaning time intervals which starts a screen cleaning.
3. Through the PCS, set Influent Screen, Screenings Grinder, and Screenings Washer Compactor to AUTO mode.
4. Open the manually operated screen channel isolation gates for the screen to operate.
5. The screen will go through a cleaning cycle for the time interval entered through the PCS. The screenings will be sluiced to the grinder and drop to the washer. The grinder and washer will continue to operate for a set time delay after the screen has completed a cleaning cycle.

Remote Manual Mode:

1. At the LCS for each piece of equipment, select REMOTE from the On-Off-Remote switch for the Influent Screen or REMOTE from the Local-Remote switch for the Screenings Grinder and Screenings Washer Compactor.
2. Through the PCS, set Influent Screen, Screenings Grinder, and Screenings Washer Compactor to MANUAL mode.
3. Open the manually operated screen channel isolation gates.

4. Monitor the differential water level across the screen. When the differential level exceeds approximately 6 inches, start the screen to initiate cleaning at low speed. If differential level increases above 9 inches, increase the speed of the screen. Continue to adjust the speed of the screen to maintain differential water level to less than approximately 12 inches. It is acceptable for differential water level to be greater than approximately 12 inches for short periods of time. If flow and loadings create high differential water level for extended period of time, start a second influent screen.
5. When the screen is in cleaning mode, start the grinder and washer.

Local Manual Mode:

1. Open the manually operated screen channel isolation gates.
2. Monitor the differential water level across the screen. When the differential level exceeds approximately 6 inches, start the screen cleaning cycle.
3. At the LCS for each piece of equipment, select ON from the On-Off-Remote switch for the Influent Screen or LOCAL from the Local-Remote switch for the Screenings Grinder and Screenings Washer Compactor.
4. The screen will start cleaning when the LCS is in the ON position. Start the grinder and washer.
5. Continue to monitor the differential water level across the screen. When the differential level decreases to an acceptable level, cleaning can be stopped. Continue operating the grinder and washer until the material is cleared from the washer.

Shutdown Procedures

Remote-Auto Mode:

1. Close the manually operated screen channel isolation gates.
2. Through the PCS, switch the Influent Screen, Screenings Grinder, and Screenings Washer Compactor to MANUAL mode, and stop the equipment.

Remote Manual Mode:

1. Close the manually operated screen channel isolation gates.

10 - Influent Screening System

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Screening Washer 1 OVERLOAD	Screenings Washer (59WSH02401) has Overloaded.	Alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Screening Washer 2 OVERLOAD	Screenings Washer (59WSH02402) has Overloaded.	Alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Screening Washer 3 OVERLOAD	Screenings Washer (59WSH02403) has Overloaded.	Alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Screening Compactor 1 OVERLOAD	Screenings Compactor (59CPT02501) has Overloaded.	Alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Screening Compactor 2 OVERLOAD	Screenings Compactor (59CPT02502) has Overloaded.	Alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Screening Compactor 3 OVERLOAD	Screenings Compactor (59CPT02503) has Overloaded.	Alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Air-Vac Vault Level HIGH (06LS00101)	HIGH LEVEL condition in the Air-Vac Vault 1.	HIGH LEVEL condition in the Air-Vac Vault 1 alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Air-Vac Vault Level HIGH (06LS00102)	HIGH LEVEL condition in the Air-Vac Vault 2.	HIGH LEVEL condition in the Air-Vac Vault 2 alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Air-Vac Vault Level HIGH (06LS00103)	HIGH LEVEL condition in the Air-Vac Vault 3.	HIGH LEVEL condition in the Air-Vac Vault 3 alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Plant Influent Channel. Level HIGH (59LSH00701)	HIGH LEVEL condition in the Plant Influent Channel.	HIGH LEVEL condition in the Plant Influent Channel, alarm shows on SCADA and shutdown commands are sent to both the Spokane/South Valley Interceptor (SVI) and North Valley Interceptor (NVI) Pump Station PLCs. Operator dispatched to area to assess the problem and correct or refer to maintenance.

ALARM	MEANING	RESPONSE OR ACTION
Plant Influent Outlet Channel HIGH DIFFERENTIAL (59LET00702)	LOW LEVEL in the Plant Influent Outlet Channel in order to achieve a HIGH DIFFERENTIAL condition between the liquid levels in the Plant Influent and Outlet channels.	HIGH DIFFERENTIAL condition, confirm that an alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Influent Band Screen 1 Motor OVERLOAD (59SCR02302)	Motor OVERLOAD condition for Screen 1	OVERLOAD condition for Screen 1, alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Influent Band Screen 2 Motor OVERLOAD (59SCR02302)	Motor OVERLOAD condition for Screen 2	OVERLOAD condition for Screen 2, alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
Influent Band Screen 3 Motor OVERLOAD (59SCR02303)	Motor OVERLOAD condition for Screen 3	OVERLOAD condition for Screen 3, alarm shows on SCADA. Operator dispatched to area to assess the problem and correct or refer to maintenance.
High Head Loss (_59LDI00700_oHiAlarm)	Influent band Screens Head loss	On High Head Loss alarm on SCADA, initiate an influent band screen cleaning cycle or start additional band screen cleaning cycles.

2. Through the PCS, switch the Influent Screen, Screenings Grinder, and Screenings Washer Compactor to MANUAL mode, and stop the equipment.

Local Manual Mode:

1. Close the manually operated screen channel isolation gates.
2. At the LCS, switch the Influent Screens to OFF, and stop the Screenings Grinder and Screenings Washer Compactor.

Abnormal Conditions

High Differential Water Level

If the differential water level across the operating screen reaches an operator-entered setpoint, the other idling in-service screens will be started. Software alarms are in place to notify Operations when this occurs. It is recommended to monitor flows and loads, and to inspect the screens for unusual fouling.

High Influent Channel Level

If the level in the influent channel reaches a high level, it will begin to spill into the diversion channel, and the automatic diversion gate will begin to open. Software alarms are in place to notify Operations when this occurs. It is recommended to stop the offsite Influent Pump Stations (IPSs) until the reason for the high water level can be determined and corrected.

The automatic diversion gate will open until the water level in the influent channel drops approximately 6 inches, then the gate will stop and maintain its current open position. If the water level continues to decrease to approximately 12 inches, then the gate will begin to close. This minimizes the amount of wastewater that flows through the manually cleaned bar rack.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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Preliminary Treatment UPCP

Project: Spokane, WA
Plant: Spokane County RWRF
Date: April 11, 2011, January 12, 2017
Unit Process Number: 59

Summary

Screenings are removed by three automated band screens capable of removing solids larger than 3 mm. Removed screenings are ground, washed, compacted, and deposited into a roll off dumpster. Grit is removed by an aerated grit chamber. Coarse air diffusers assist the settling out of grit, which is then pumped to the grit cyclones and classifiers for dewatering and deposited into a roll off dumpster.

Process Overview

Influent is carried to the plant by four pressurized influent lines, two from the South Valley Interceptor pumping station and two from the North Valley Interceptor pumping station. Raw influent enters the headworks facility and can be directed to four channels, three of these channels contain automated band screens and one contains a manual 3/8 inch bar screen. The bar screen is a backup system should all three band screens malfunction or the influent channel level reaches its free board limit. Automated gates that control the distribution of flow to the three bandscreen channels are operated manually. The manual 3/8 inch bar screen channel is operated in auto based on the influent channel level. After passing through screening the influent flows to the aerated grit chamber.

Solids in the influent are limited in size to less than 4 inches by the solids handling design of the two pump stations. Solids larger than 3 mm in size cannot pass through the band screen perforated plates and are collected in a trough and sluiced to the screenings handling process. Removed screenings pass through a grinder and a washer/compactor and are then deposited in a roll off dumpster. The bandscreens are contained and ventilated such that foul air is exhausted to the odor control system. The screenings dumpster room is also ventilated with the foul air exhausted to the odor control system.

Grit that passes through the 3 mm band screens is settled out in the aerated grit basin. Air at Low Pressure (ALP) is delivered to coarse bubble diffusers at the headworks aerated grit basin from process blowers located adjacent to the aeration basins. The addition of ALP enhances the settling of grit. Grit pumps are used to pump grit from the aerated grit basin to the grit cyclones and then to a grit classifier where grit is removed and dewatered for disposal. The drainage from these dewatering processes is returned to the influent channel and dewatered grit is transferred to a dumpster that is hauled off-site for proper disposal. The aerated grit basin is covered and ventilated such that foul air is exhausted to the odor control system. The grit dumpster room is also ventilated with the foul air exhausted to the odor control system.

Unit Physical Information

The three band screens are designed to screen peak hourly flow rates of 13.8 MGD each. The units, manufactured by JWC, are variable speed and consist of 3 foot wide perforated plates with 3 mm openings.

The aerated grit basin is configured as one tank with two sloped bottom hoppers that direct settled grit to the grit pump suction lines. Coarse bubble diffusers deliver ALP to the aerated grit basin from blowers located at the aeration basins. The dimensions of the grit basin are 30 feet long by 15 feet wide and have an average depth of 15 feet. This configuration will allow a 5 minute retention time at peak hourly flow. Three dry pit pumps (2 duty and 1 standby) remove the grit from the hoppers and pump the grit slurry to two grit cyclones. The grit cyclones perform the first stage of grit/water separation. They separate the heavier grit particles from the lighter particles by converting the liquid velocity generated by the pumps into centrifugal force within the cyclonic chamber. The grit classifier serves to further separate the grit from the lighter particles and dewater the grit particles using a screw conveyor. The grit is discharged downward to a roll off dumpster located in the lower level of the Headworks.

Scum from the surface of the aerated grit chamber is removed by a progressive cavity pump from a manually controlled telescoping intake line near the water surface of the grit chamber.

Operational Parameters and Theory

Screening is a physical process. Objects that are larger than the gap in the screens will not pass through. The screenings must be removed from the screen so that they do not accumulate and block flow through the screen. As a screen becomes blocked the flow through the screen decreases and the depth of influent in the channel upstream of the screen increases. This leads to an increase in the difference in level upstream and downstream of the screen. The SCADA system determines this difference from the level sensors and starts the motor according to a set point input by the operator. Alternatively the band screen can be run based on an elapsed time interval.

A second band screen can be placed online if needed by manually opening the channel gates. If the channel level in the band screen channels approaches its free board limit flow will be routed to the manual bar screen channel.

Since the screenings are untreated and contain putrescible material, they are ground up and rinsed to remove organic material, and then squeeze dried in a compacting auger to remove water. These steps reduce odor formation.

Grit is removed from the treatment streams using two principles, slowing down the velocity of the grit by increasing the detention time in the grit chamber and adding diffused air. The diffused air assists in grit removal by decreasing the buoyancy of the grit particles.

Process Monitoring and Responsibilities

The operators should visually check the screen each day to ensure that the band screen is cycling on an off correctly and there are no unusual solids accumulations.

Screening Process Monitoring

Parameter	Units	Frequency	Source	Min	Max
Inlet channel level	Feet/in	Continuous	SCADA	0	x
Flow	MGD	Continuous	SCADA	0	13.8
Screen differential	Feet/in	Continuous	SCADA	0	x
Run times	Hrs	Monthly	SCADA	0	n/a
Screenings quantity	Cu. yds.	Monthly	Estimate	x	x

The following tasks should be performed once a week:

- Verify adequate wash water flow to the band screens.
- The perforated plates should be checked weekly for damage.

Operators should visually inspect the grit classifier each day to ensure that it is cycling on and off correctly and that the grit being discharged is relatively dry and free of organic materials. Operators should also inspect the aerated grit basin periodically to ensure that the coarse air bubbles are being evenly distributed by the diffusers.

Grit Process Monitoring

Parameter	Units	Frequency	Source	Min	Max
Flow	MGD	Continuous	SCADA	0	13.8
Air Flow	CFM/ft	Continuous	SCADA	0	10
Equipment Runtime	Hrs	Monthly	SCADA	0	720
Grit Removed	Cu. yds.	Monthly	Estimate	x	x

The following tasks should be performed once a week:

- Verify adequate wash water flow to the grit classifier
- Perform weekly preventative maintenance on associated equipment

Control Parameters

The controls for the screenings process are how many units are in service and how frequently they run. The SCADA system will use the set points for level or time to run the screens as needed.

The grit removal process is controlled by the grit pump run time and the diffused air. Running the grit pumps more often produces a thinner feed to the grit cyclones. The diffused air flow must be adequate to create enough air bubbles for effective grit settling. Lowering the air flow may reduce the amount of grit settled in the aerated grit chamber.

Calculations and Recordkeeping

No daily calculations are needed to operate the screening process. The run times for each unit should be recorded for maintenance purposes. The aerated grit chamber detention time will be calculated daily to monitor hydraulic loading.

The following calculations should be set up in OP10 to track long term screening removal:

Screenings Yield, cu. yds/MG = screenings removed, cu. yds/day / Flow, MGD

Grit Yield, cu. yds/MG = grit removed, cu. yds/day / Flow, MGD

Targets and Process Performance

The performance of the screenings process can be measured in terms of the parameters listed in the table below. The SCADA system will report the level information.

Operators will have to estimate the amount of screenings.

Targets for Screen Operation

Parameter	Units	Minimum	Maximum
Screen differential	Feet/inches	0	18
Inlet channel level	Feet/inches	NA	x*
Screenings yield	cubic yds/MG	x	x

*At this elevation overflow to the bypass channel will occur.

Targets for Grit Operation

Parameter	Units	Minimum	Maximum
Detention Time	Minutes	5	NA
Air per tank	SCFM	150	NA
Grit yield	cubic yds/MG	x	x

Relationship to Other Unit Processes

Screening and grit removal are the first steps in treatment at the plant. This material can cause problems in downstream units by building up on rotating mixers or clogging pump impellers. If the screening process is bypassed there is a chance that larger debris can be transported to the membrane facility and cause fouling and/or damage to the membranes. Screenings can also accumulate in other undesirable areas of the facility. Pumps that are not designed to handle grit can become damaged.

In addition to raw influent from the North and South Valley Interceptors the following flow streams pass through screening: pumped septage, headworks sump, maintenance building, and plant drains. Treated effluent can also be returned to the headworks. These return streams can increase the loading to the grit and screening removal units.

Any solids not removed by the screenings or grit removal systems will add loading to the primary clarifiers. Also the ferric chloride addition to the CEPT system occurs between the band screens and aerated grit chamber.

Common Problems and Troubleshooting

Screening Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Screen difference high	• Trash buildup on screen	• Clean screen

Condition	Possible Cause	Possible Solutions
	<ul style="list-style-type: none"> Faulty level measurement 	<ul style="list-style-type: none"> Visually verify levels
High level in inlet channel	<ul style="list-style-type: none"> Trash buildup on screen Faulty level measurement High flow 	<ul style="list-style-type: none"> Clean screen Visually verify levels Check collection system flows
Screen not running	<ul style="list-style-type: none"> HOA set to OFF SCADA set points changed 	<ul style="list-style-type: none"> Check local switch settings Verify SCADA setpoints
Alarm won't clear	<ul style="list-style-type: none"> Screen not rotating High flow 	<ul style="list-style-type: none"> Check motor and gear Put redundant screen in service
Low screenings yield	<ul style="list-style-type: none"> Change in flow Grinder/compactor plugged 	<ul style="list-style-type: none"> Check influent flow totals Clean grinder/compactor
Screenings wet	<ul style="list-style-type: none"> Compactor not draining 	<ul style="list-style-type: none"> Clear drain

Grit Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Grit accumulation in chamber	<ul style="list-style-type: none"> Pump malfunction Low air SCFM 	<ul style="list-style-type: none"> Inspect pump Inspect air delivery system Inspect air blowers
Low cyclone header pressure	<ul style="list-style-type: none"> Grit pump clogging 	<ul style="list-style-type: none"> Inspect/clean grit pump
High cyclone header pressure	<ul style="list-style-type: none"> Cyclone plugged 	<ul style="list-style-type: none"> Remove blockage
Excess organics in grit	<ul style="list-style-type: none"> Classifier detention time high 	<ul style="list-style-type: none"> Adjust classifier internal weir
Low grit removal	<ul style="list-style-type: none"> Change in flow 	<ul style="list-style-type: none"> Check influent flow totals
Grit wet	<ul style="list-style-type: none"> Classifier plugged 	<ul style="list-style-type: none"> Inspect/clean classifier

Alternate Modes of Operation

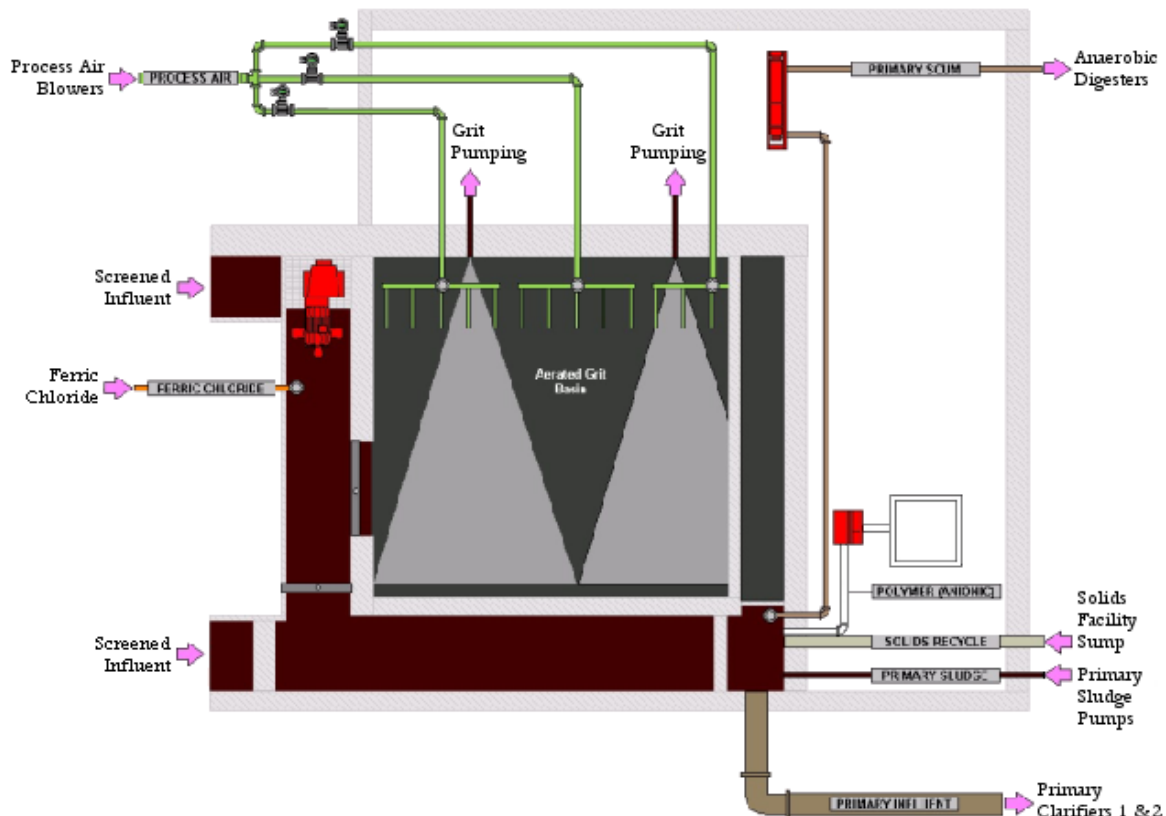
The screens can be operated in a Local-Manual mode at their respective local control panels. In addition to operating based on level differential the screens can be set to run based on an elapsed time.

It is possible to close the inlet gates to the screen channels and force all flow through the manual bar screen. Since each band screen is capable of handling 13.8 mgd, whenever one is down for maintenance the second unit can handle flows easily. Flows less than design will not affect this process. Raw influent should be sent through the fine screening process whenever possible.

In the event that either of the two grit pumps feeding the grit cyclones and grit classifier becomes plugged, there is one fully redundant standby grit pump. There is also a bypass channel at the rapid mixer around the aerated grit basin. If bypass is necessary, the grit will settle out in the primary clarifiers where it is incorporated into the primary sludge and pumped to the blended sludge storage tank.

12 - Aerated Grit System

Overview



Purpose

The aerated grit removal process removes grit from the wastewater for offsite hauling and disposal at the waste-to-energy facility by allowing the grit to settle in the Aerated Grit Basin and then pumping the grit to dewatering processes where the grit is loaded into a dumpster and hauled offsite.

The Aerated Grit Basin also has a secondary function, providing a flocculation zone after the ferric chloride addition in the Headworks.

Description

The Aerated Grit Basin is located on the south side of the Headworks Facility. The pumps associated with the Aerated Grit Basin are located in the lower level.

of the Headworks, and the Grit Cyclones and Classifier are located in the Screenings Room on the upper level of the building. The top of the basin is accessed from the Screenings Room.

Screened wastewater flow is conveyed from the screenings channels, through an isolation gate located in the Screenings Room, to the Aerated Grit Basin. There is also a diversion channel around the Grit Basin. If diversion around the Grit Basin should become necessary, the grit settles out in the Primary Clarifiers, where it is pumped with the primary sludge to the digestion process. Flow from the solids facility pump station can be routed to the Aerated Grit Basin for grit removal or routed to mix with the Aerated Grit Basin effluent prior to primary clarification. Flow from the grit basin passes over a weir and is conveyed to the Primary Clarifiers.

The Grit Basin is configured with two sloped-bottom hoppers to collect the settled grit and route it to the grit pump suction pipes. Each hopper has a dedicated dry pit pump to remove the grit slurry. If either of the two grit pumps is out of service (for example, plugged or undergoing routine maintenance), one redundant standby grit pump can be valved to either hopper. The basin is covered so foul air can be collected and exhausted to the Odor Control System.

Separating grit from the influent flow stream is facilitated by coarse air bubbles from diffusers located at the bottom of the basin. The air bubbles cause the grit to settle and the suspended solids to rise and flow out of the basin. Low-pressure air from the process blowers located near the aeration basin is delivered to the coarse bubble diffusers in the Aerated Grit Basin. The diffusers are arranged in three sections with butterfly valves on each so that the air rate can be varied along the length of the basin.

As the grit settles to the bottom of the sloped floor it is directed to a collection pipe on the North wall of the basin where the grit pumps suction the slurry. The grit pumps move the grit slurry to the Grit Cyclones and Classifier for dewatering. The Grit Cyclones remove the majority of the water from the grit slurry and the concentrated slurry drops out into the Grit Classifier. The Grit Classifier provides the final washing and dewatering of the slurry. The Grit Classifier uses an auger to move the grit up the classifier and then falls through a shoot in the floor of the upper level and into a dumpster below in the Screenings/Grit dumpster room. The dumpster is hauled offsite for disposal. Drainage from the cyclones and classifier is returned to the Influent Channel, downstream of screening and influent composite sampling.

The Aerated Grit Basin also provides a flocculation zone for the initial phosphorous removal step. Adding ferric chloride at the Headworks is one component of the Chemically Enhanced Primary Treatment (CEPT) process. Refer to the Ferric Chloride process control narrative for more information.

For this initial phosphorus removal part of the CEPT process, Ferric Chloride is injected into the Influent Channel flow stream and is mixed by a vertical shaft mixer that creates high turbulence. This rapid mixer is included in the channel downstream of the fine screens. The Aerated Grit Basin provides the flocculation time needed for phosphorous to become part of the settleable solids before the flow stream is conveyed to the Primary Clarifiers.

A polymer blend unit is located in the lower level of the Headworks for anionic polymer injection into the Aerated Grit Basin effluent. Anionic polymer is added as part of the CEPT process to improve solids removal in the Primary Clarifiers. Refer to the Anionic Polymer process control narrative for more information.

There is an eyewash station located in the Grit Pump Room. Exhibit 12-1 lists the components of the Aerated Grit Basins.

Design Criteria and Component List

EXHIBIT 12-1
Aerated Grit Basins Component List

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Rapid Mixer	59MXR01000	Quantity: 1 Type: Vertical Power (hp): 2
Grit Pump	59PMP01301, 59PMP01302, 59PMP01303	Quantity: 3 Type: Recessed Impeller, Constant Speed Flow Rate (gpm): 220 Pressure (TDH/ft): 50 Power (hp): 15
Aerated Grit Basin		Quantity: 1 Material: Concrete Detention Time (minutes): 5 at peak hour flow Air Flow Rate (scfm): 0-150
Grit Basin Influent Gate	59GTE01700	Quantity: 1 Type: Manual Slide
Grit Basin Diversion Gate	59GTE02000	Quantity: 1 Type: Manual Slide
Scum Pump	59PMP01100	Quantity: 1 Type: Progressing Cavity, Constant Speed Flow Rate (gpm): 50 Power (hp): 6.71
Scum Valve	59VTL10200	Quantity: 1 Type: Telescoping Size (inches): 6

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Grit Cyclone	59CYC01401, 59CYC01402	Quantity: 2
Grit Classifier	59CLS01500	Quantity: 1 Type: Single Auger, Dual Cyclone Flow Rate (gpm): 220 Power (hp): 0.5
Grit Dumpster		Quantity: 1
NOTES: hp = horsepower gpm = gallons per minute TDH/ft = total dynamic head per foot scfm = standard cubic feet per minute		

Process Control Variables

Control Variables

- Air flow rate to grit basin

Plant operators shall adjust the air flow rate to each of the three zones. After extensive testing it was determined that the estimated air flow rate should be less than 1 standard cubic feet per minute (SCFM) to each of the 3 air headers.

- Grit pump operation time

Plant operators shall adjust the actual grit pump run time and the actual time between pumping cycles. Grit should be removed from the grit basins every 0.5 to 1 hours to prevent compaction and potential pump failure. There are two control settings for the grit pumps; On Run Time and Off Time. The pump ON time should be set from 5 to 20 minutes. . Select the minimum pump run time that will remove accumulated grit from the basin based on the amount of grit that accumulates. The pumps will alternate sequentially in Auto for the ON and OFF time entered by the operator.

Non Controllable Variables

- Wastewater flow rate

Raw sewage flow from the Interceptor Pump Station is weather and flow dependent and therefore non controllable.

- Grit Quantities

The quantities of grit vary greatly from one season to another, and are highly dependent on wastewater flow, types of wastes (residential versus industrial), and soil conditions.

Reported grit quantities are difficult to interpret because grit itself is poorly characterized and almost no data exists on relative removal efficiencies. The estimated grit quantity is 3.0 ft³ per 10 million gallons of raw sewage.

Calculations

- None.

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12 - Aerated Grit System

Operating Strategies

The Aerated Grit System is operated in any of the following three modes: remote auto control, remote manual control, and local manual control. Exhibit 12-2 lists and describes the control modes for the Aerated Grit Basin.

EXHIBIT 12-2
Aerated Grit Basin Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Operators adjust manually positioned butterfly valves to control air flow to the three zones of the Aerated Grit Basin. A flow meter on each ALP lateral measures air flow through each butterfly valve.	
Manual/Local	The Rapid Mixer (59MXR01000) can be turned ON/OFF at the LCS ON/OFF/REMOTE switch.	
Manual/Local	The Scum Pump (59PMP01100) is turned ON/OFF by a START-STOP switch at the LCS by the pump or at the LCS by the telescoping valve when in LOCAL mode at the pump.	
Manual/Local	The Grit Basin Scum Valve (59VTL10200) is manually opened.	
Manual/Local	The Grit Pumps (59PMP01301, 59PMP01302, 59PMP01303) are turned ON/OFF by a START-STOP switch at the LCS when in LOCAL-MANUAL mode.	
Manual/Local	Operators position the Grit Basin Influent Gate and Bypass Gate depending on whether the grit basin is in service or out of service.	
Manual/Remote	In REMOTE-MANUAL the Rapid Mixer (59MXR01000) can be turned ON/OFF at the HMI.	
Manual/Remote	The Scum Pump (59PMP01100) is turned ON/OFF by a START-STOP switch at the HMI when in REMOTE-MANUAL mode.	
Manual/Remote	The Grit Pumps (59PMP01301, 59PMP01302, 59PMP01303) are turned ON/OFF by a START-STOP switch at the HMI when in REMOTE-MANUAL mode.	
Manual/Remote	The Grit Classifier (59CLS01500) can be turned ON/OFF by a START-STOP switch at the HMI when in REMOTE-MANUAL mode.	
Auto/Remote	SCADA monitors ON-OFF status of the Scum Pump drive and reports whether the pump is being controlled in	

	LOCAL-MANUAL mode at the LCP or in REMOTE-MANUAL mode at the HMI.	
Auto/Remote	In REMOTE-AUTO mode, the Grit Pumps cycle ON-OFF by a timer. Cycle times are adjustable at the HMI. During periods of heavy grit loads, the Grit Pumps may run continuously.	
Auto/Remote	SCADA monitors the LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO modes of operation and ON-OFF status of each pump drive.	
Auto/Remote	The Grit Classifier is switched ON when a signal is received that indicates any of the Grit Pumps are running. The Grit Classifier shuts OFF after a set period of time (adjustable) following shutoff of all Grit Pumps.	
NOTES: ALP = low-pressure air LCS = local control station HMI = human-machine interface SCADA = supervisory control and data acquisition		

Startup Procedures

Remote Auto Mode:

1. Open the manually operated Grit Basin Isolation Gate.
2. At the LCS for each piece of equipment, select REMOTE operation for the Rapid Mixer, Grit Pump, and Grit Classifier.
3. Through the HMI, set the GRIT CYCLE OFF TIME (adjustable between zero and 120 minutes) and set the GRIT CYCLE ON TIME (adjustable between zero and 60 minutes).
4. Through the HMI, set the Grit Pump and the Grit Classifier to AUTO mode.
5. Through the HMI, set the Rapid Mixer to MANUAL mode.
6. When wastewater is flowing into the grit basin, through the HMI, START the Rapid Mixer.
7. When the grit basin is full, manually open the aeration butterfly valves and adjust until the desired air flow rate is obtained.

Remote Manual Mode:

1. Open the manually operated Grit Basin Isolation Gate.

2. At the LCS for each piece of equipment, select REMOTE operation for the Rapid Mixer, Grit Pump, and Grit Classifier.
3. Through the HMI, set the Rapid Mixer, Grit Pumps, and Grit Classifier to MANUAL mode.
4. When wastewater is flowing into the grit basin, through the HMI, START the Rapid Mixer.
5. When the grit basin is full, manually open the aeration butterfly valves and adjust until the desired air flow rate is obtained.
6. Through the HMI, START and STOP the Grit Pumps and Grit Classifier as desired.

Local Manual Mode:

1. Open the manually operated Grit Basin Isolation Gate.
2. At the LCS for each piece of equipment, select LOCAL operation for the Grit Pump and the Grit Classifier.
3. When wastewater is flowing into the grit basin, turn the Rapid Mixer ON with the ON/OFF/REMOTE switch at the LCS.
4. When the grit basin is full, manually open the aeration butterfly valves and adjust until the desired air flow rate is obtained.
5. START and STOP the Grit Pumps and Grit Classifier as desired from the LCS associated with that piece of equipment.

Shutdown Procedures

Remote Auto Mode:

1. Manually close the Grit Basin Isolation Gate. If bypassing the grit basin, manually open the bypass gate.
2. Through the HMI, set the Grit Pump and the Grit Classifier to MANUAL mode.
3. Initiate Rapid Mixer, Grit Pump, and Grit Classifier STOP commands through the HMI.

Remote Manual Mode:

1. Manually close the Grit Basin Isolation Gate. If bypassing the grit basin, manually open the bypass gate.
2. Initiate Rapid Mixer, Grit Pump, and Grit Classifier STOP commands through the HMI.

Local Manual Mode:

1. Manually close the Grit Basin Isolation Gate. If bypassing the grit basin, manually open the bypass gate.
2. Select OFF for the Rapid Mixer and STOP for the Grit Pump and Grit Classifier.
3. Close the manually operated butterfly valves on the ALP piping to isolate air.

Abnormal Conditions

Grit Pump Blockage

1. Switch both grit pumps to Local/Stop at the LCS
2. Align the manual valves on the intake side of the pumps to flush water in the direction of the clog.
3. Open the 2" plant water valve located on the intake pump manifold and flush in the direction of the clog.
4. Start the pump where the clog was and slowly close the 2" plant water valve.
5. Confirm flow through the pump at the check valve and confirm proper flow through the corresponding cyclone.

Grit Basin Scum Pump

1. Select LOCAL at the LCS associated with the Scum Pump.
2. Open (lower) the grit basin telescoping valve.

3. When the telescoping valve is below the scum level, START the Scum Pump at the LCS through the telescoping valve.
4. When scum is removed, STOP the Scum Pump at the LCS.
5. Close (raise) the grit basin telescoping valve.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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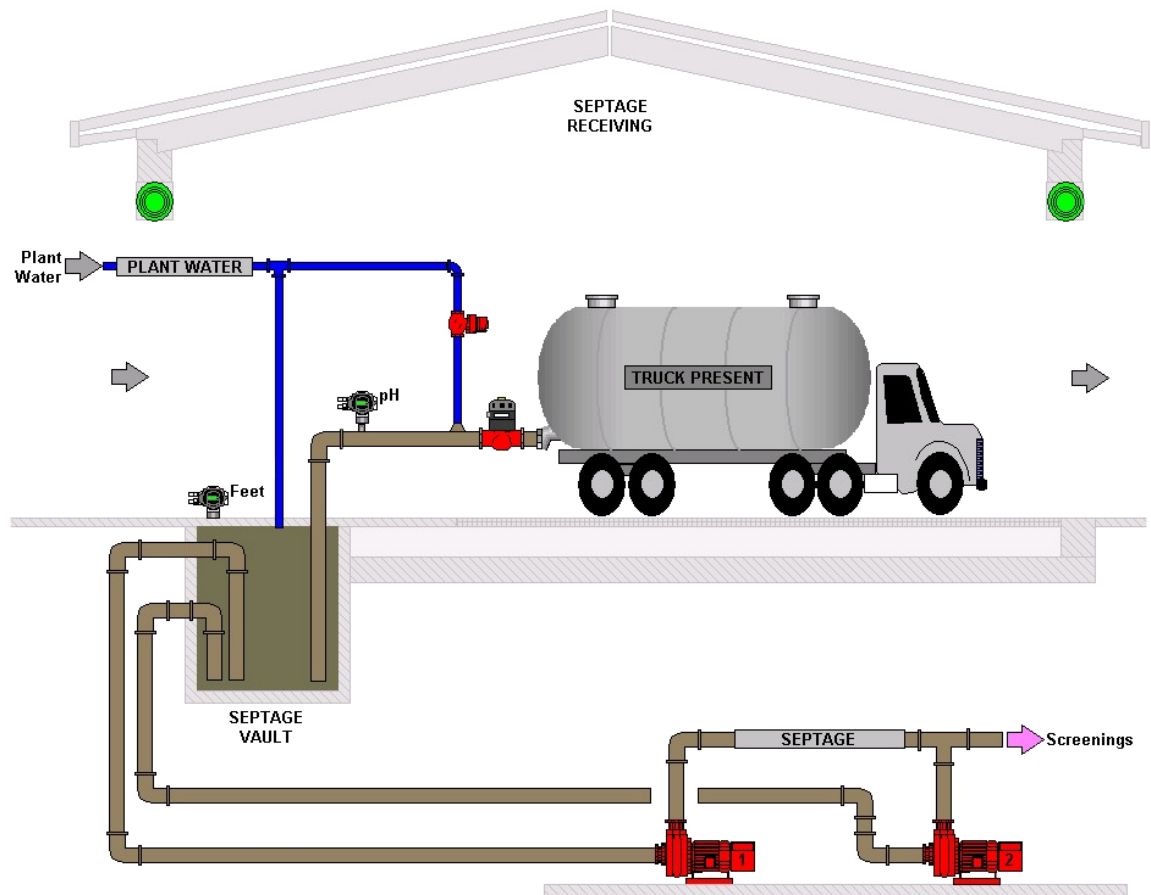
12 - Aerated Grit Basin

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Aerated Grit Basin Scum Pump HIGH DISCHARGE PRESSURE	Instrument (59PSH02100) has detected HIGH DISCHARGE PRESSURE condition for the Aerated Grit Basin Scum Pump (59PMP01100).	Alarm on SCADA pump shuts down. Inspect pump.
Aerated Grit Basin Scum Pump HIGH STATOR TEMPERATURE	Instrument (59TSH04500) has detected HIGH STATOR TEMPERATURE condition for Aerated Grit Basin Scum Pump 59PMP01100).	Alarm on SCADA pump shuts down. Inspect pump.
Grit Pump 1 (59PMP01301) FAIL-TO-START	Grit Pump 1 (59PMP01301) has Failed to Start.	Alarm on SCADA. Inspect Grit Pump 1 (59PMP01301) and try to reset Fault on SCADA or at MCC
Grit Pump 2 (59PMP01301) FAIL-TO-START	Grit Pump 2 (59PMP01301) has Failed to Start.	Alarm on SCADA. Inspect Grit Pump 2 (59PMP01301) and try to reset Fault on SCADA or at MCC
Grit Pump 3 (59PMP01301) FAIL-TO-START	Grit Pump 3 (59PMP01301) has Failed to Start.	Alarm on SCADA. Inspect Grit Pump 3 (59PMP01301) and try to reset Fault on SCADA or at MCC
Grit Classifier (59CLS01500) FAIL-TO-START	Grit Classifier (59CLS01500) has Failed to Start.	Alarm on SCADA. Inspect Grit Classifier (59CLS01500) and try to reset Fault on SCADA or at MCC

14 - Septage

Overview



Purpose

The Septage Receiving System allows septage hauling vendors to unload in a controlled manner, and for the septage to be coarsely screened prior to the material being conveyed to the treatment plant.

Description

The Septage Receiving Facility allows septage trucks to be unloaded in a weather-protected, odor-controlled truck bay. The space is ventilated at a high air exchange rate, with foul air exhausted to the Odor Control Facility. Septage

haulers discharge up to 4,000 gallons of waste from each truck through a coarse screen (3-inch spacing) to the Septage Vault. Building drains from the Screenings Grit Container Room also drain to the Septage Vault.

Septage pumps are located on the lower level of the Headworks Facility, where the waste from the Septage Vault is pumped back to the Primary Influent Channel.

Drainage from the remainder of the Headworks Facility drains, combined with wash-down water and condensate drainage, collect at the Headworks sump located in the basement pump gallery. A packaged duplex submersible pump system pumps drainage from the sump back to the Primary Influent Channel.

For odor control, fans ventilate and exhaust foul air from the Headworks and septage process spaces at air exchange rates required for classified spaces in accordance with NFPA 820. Refer to the Odor Control process control narrative for more information. Exhibit 14-1 is a partial component list for the Septage Receiving System.

Design Criteria and Component List

EXHIBIT 14-1

Septage Receiving System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Septage Holding Tank		Quantity: 1 Volume (gal): 9000
Septage Manual Bar Screen	59SCR00100	Quantity: 1 Type: 3" bar rack
Septage Pump	59PMP00401, 59PMP00402	Quantity: 2 Type: Recessed Impeller, Constant Speed Flow Rate (gpm): 250 Pressure (TDH/ft): 50 Power (hp): 15
Sump Pump	59PMP00801, 59PMP00802	Quantity: 2 Type: Submersible Flow Rate (gpm): 60 Pressure (TDH/ft): 37 Power (hp): 2.7
Septage Vault Fill Valve	59FV00100	Quantity: 1 Type: Electrically Actuated Plug Valve
NOTES: gal = gallons gpm – gallons per minute TDH/ft = total dynamic head per foot		

14 - Septage

Operating Strategies

Septage Unloading

Exhibit 14-2 lists the control modes for septage unloading.

EXHIBIT 14-2
Septage Unloading Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The septage truck contacts the operations staff for credential approval and the doors are opened by fob, SCADA, or local switch. The Septage Unloading Fill Valve or screen access hatch is opened and septage is transferred from the truck to the Septage Vault.	
Manual/Local	Once complete, the fill valve or hatch are shut, and the truck exits the bay. The bay doors are then shut.	
Auto/Remote	At the entrance and exit doors, with no septage truck inside the truck bay and upon detection of a septage truck at the bay entrance, the entrance door will automatically OPEN. Once the septage truck has cleared the entrance door, the door will automatically CLOSE.	
Manual/Remote	In REMOTE-MANUAL mode, the HIGH LEVEL alarm setpoint is adjustable by the plant operator at the HMI.	
Auto/Remote	REMOTE-AUTO mode at the Septage Unloading Bay HMI allows for OPEN-CLOSE control and OPENED-CLOSED status indication of the Entrance Door, Exit Door, Fill Valve and Flush Valve.	
Auto/Remote	In REMOTE-AUTO mode, SCADA monitors the Septage Vault HIGH LEVEL for an alarm condition displayed at the HMI. Upon detection of a HIGH LEVEL in the Septage Vault, the Septage Unloading Fill Valve is CLOSED automatically.	
NOTES: HMI = human-machine interface SCADA = supervisory control and data acquisition		

Septage Pumps

The septage pumps operate in LOCAL-MANUAL, REMOTE-MANUAL, and REMOTE-AUTO modes for the START-STOP control modes. The pump drives are monitored both LOCALLY at the LCP and REMOTELY via the SCADA system. Exhibit 14-3 lists the control modes for septage pumping.

EXHIBIT 14-3
Septage Pumping Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	In LOCAL-MANUAL control mode, the septage pumps are turned ON or OFF at the LCP.	
Manual/Remote	In REMOTE-MANUAL control mode, the septage pumps are turned ON or OFF at the HMI.	
Auto/Remote	Septage Pumps 1 and 2 operate in DUTY-STANDBY mode while in the REMOTE-AUTO mode. Should the DUTY pump FAULT, the STANDBY pump is automatically started. The pumps operate based on operator inputted wet well setpoints.	
Auto/Remote	Upon detection of a LOW-LOW liquid level, all pumps turn OFF while running in the REMOTE-AUTO mode.	
Auto/Remote	ON-OFF status is monitored and displayed at the HMI.	
NOTES: LCP = local control panel HMI = human-machine interface		

Sump Pumping

The duplex “packaged” sump pump system comes with a single manufacturer-provided LCP with integral controls. The sump and sump pump system is sized for 15 evenly spaced pump starts per hour. The LCP allows for LOCAL-MANUAL ON-OFF control of the pumps. The pumps are controlled manually or automatically by float switches that alternate the pumps between lead-lag service and provide HIGH level alarms to SCADA.

The pumps are also provided with standby power to allow drainage flows at the Headworks to continue during a power outage.

Startup Procedures

Septage Pumps

Remote-Auto Mode:

1. Open the manually operated pump isolation valves.
2. At the Local Control Station (LCS), select REMOTE.

3. Through the SCADA, set the Septage Receiving Pump to AUTO mode. When the level reaches a level setpoint, the pump should start operating.

Remote-Manual Mode:

1. Open the manually operated pump isolation valves.
2. At the LCS, select REMOTE.
3. Monitor the level in the Septage Vault.
4. Through the SCADA, start the Septage Receiving Pump. When the level reaches a level setpoint, the pump should start operating.

Local-Manual Mode:

1. Open the manually operated pump isolation valves.
2. Monitor the level in the Septage Vault.
3. When the level in the Septage Vault requires pumping, select ON at the LCS.

Headworks Sump Pump System

Local-Auto Mode:

1. Open the manually operated pump isolation valves.
2. At the LCS, select AUTOMATIC with the ON/OFF/AUTO switch.
3. The level floats in the sump will automatically start and stop the pump.
4. The lead pump is automatically alternated with each ON/OFF cycle.

Local-Manual Mode:

1. Open the manually operated pump isolation valves.
2. At the LCS, select ON with the ON/OFF/AUTO switch.

Shutdown Procedures

Septage Pumps

Remote-Auto Mode:

1. Through the SCADA, set the Septage Receiving Pump to MANUAL mode.
2. Through the SCADA, shut off the pump.
3. Continue to monitor the Septage Vault so that high levels are avoided.

Remote-Manual Mode:

1. Through the SCADA, shut off the pump.
2. Continue to monitor the Septage Vault so that high levels are avoided.

Local-Manual Mode:

1. When the level in the Septage Vault is low, select OFF at the LCS.
2. Continue to monitor the Septage Vault so that high levels are avoided.

Headworks Sump Pump System

Local-Auto Mode:

1. At the LCS, select AUTOMATIC with the ON/OFF/AUTO switch.
2. The level floats in the sump will automatically stop the pump at a low level.

Local-Manual Mode:

1. At the LCS, select OFF with the ON/OFF/AUTO switch.

Safety

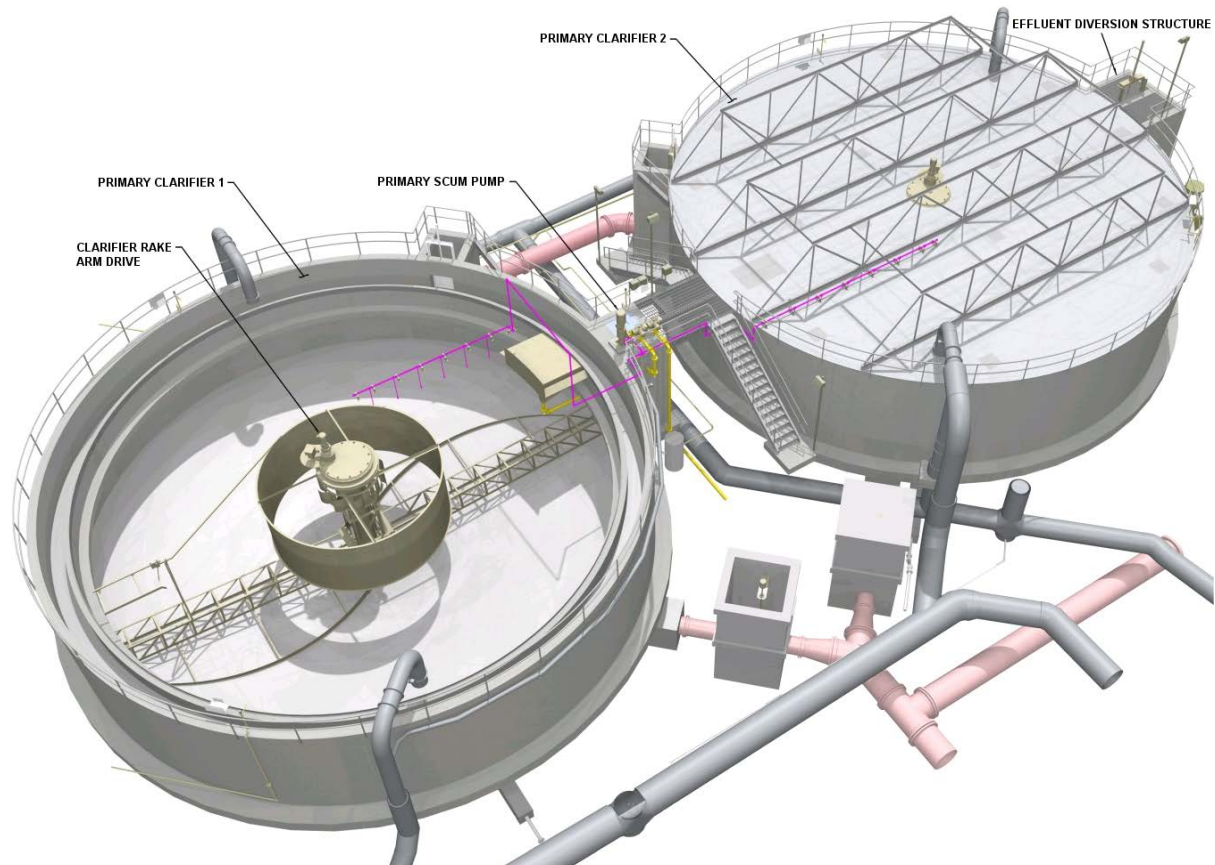
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20 - Primary Clarifiers

Overview



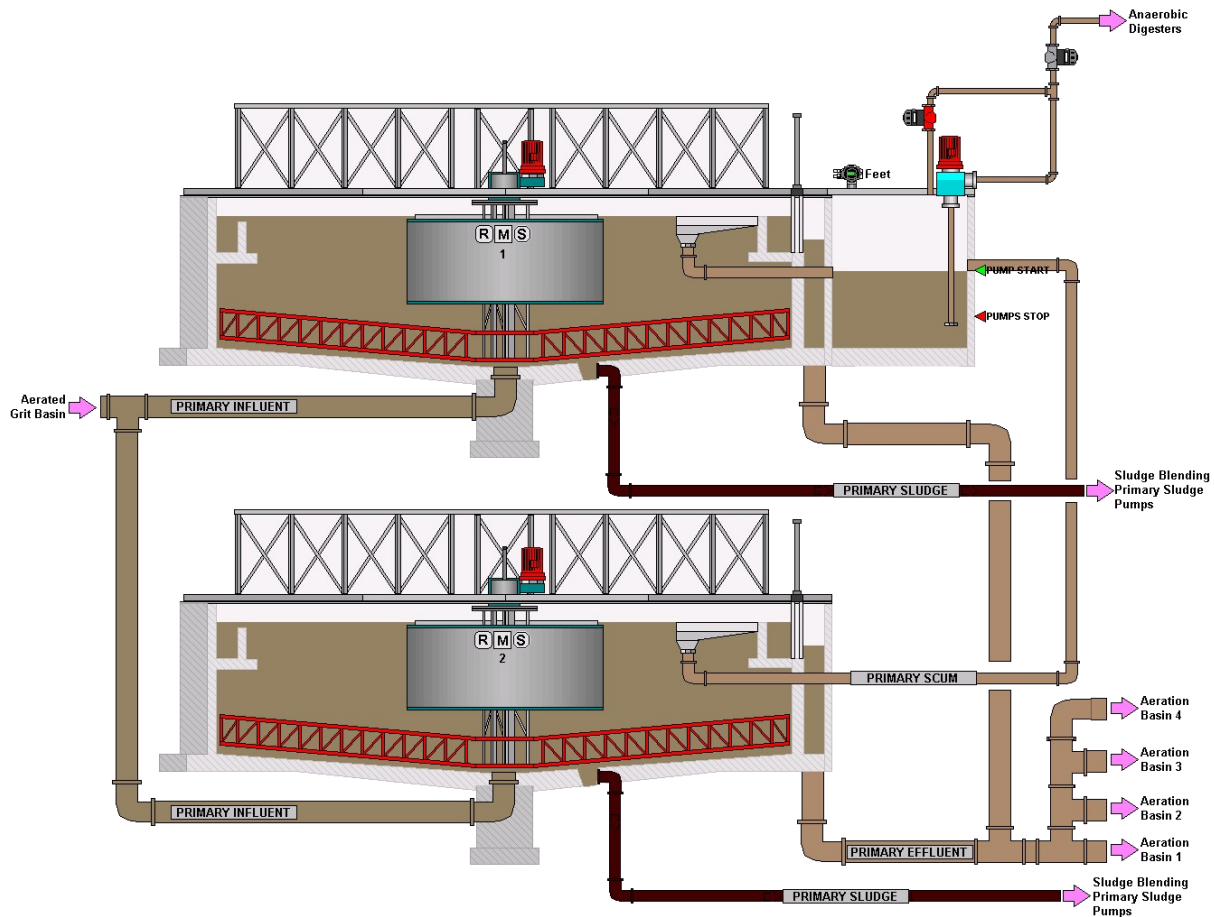
Purpose

The Primary Clarifiers allow solids to be removed in the form of sludge that has settled to the bottom of the clarifiers, and as scum that is skimmed from the surface of the clarifiers.

Description

Two Primary Clarifiers are located south of the Headworks and north of the Aeration Basins. The concrete clarifiers include aluminum covers to contain foul air so it can be collected and conveyed to the Odor Control System.

Primary influent is conveyed by gravity to the Primary Clarifiers after undergoing preliminary treatment at the Headworks. The Primary Clarifiers remove organic material from the primary influent flowstream in order to reduce loading at the secondary treatment processes. Organic material is either removed by the Primary Sludge Pumps and pumped to the Blended Sludge Tank (see Blended Storage/Pumping process control narrative), or removed by the Primary Scum Pumps and pumped to the Anaerobic Digesters (see Anaerobic/Aerobic Digesters process control narrative).



Metal salts in the form of ferric chloride and polymer are added upstream of the Primary Clarifiers at the Headworks. This method of CEPT converts soluble phosphorus and colloidal material into settleable material. The first stage flocculation process occurs at the Aerated Grit Basin. The second stage flocculation process occurs at the Clarifier Flocculation Wells. The clarifier diameter is based on full-time CEPT for a peak design flow of 13.8 mgd. The flocculate settles out and is removed from the clarifiers as sludge, which is pumped to the Blended Sludge Storage Tank. The process flowstream exits the Primary Clarifiers as primary effluent and flows by gravity to the Aeration Basins.

The Primary Clarifiers include spiral-type scraper mechanisms to move the settled sludge to the center of the clarifier, where sludge pipes are routed to the Primary Sludge Pumps in the lower level (basement level) of the Headworks Facility.

Primary scum accumulates from the primary influent flowstream in the Primary Clarifiers. The scum is skimmed from the liquid surface and collected in the Primary Scum Pit. Exhibit 20-1 lists the components for the Primary Clarifier.

Design Criteria and Component List

EXHIBIT 20-1
Primary Clarifier Component List

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Clarifier Skimmer/Sweep	60MTR00101, 60MTR00102	Quantity: 2 Type: Circular, Spiral Rake Arm Diameter(feet): 65 Side Wall Depth (feet): 3 Power (hp): 0.5 Full Load Torque (ft-lbs): 1.51 Main Gear Bearing RPM: 0.044
Clarifier		Quantity: 2 Type: Circular, Aluminum Cover Diameter (feet): 65 Sidewall Depth (feet): 12 Volume (gal): 300,000
Influent Gate Valve	59VGT10504, 59VGT10505	Quantity: 2 Type: Buried
Effluent Gate	60GTE00801, 60GTE00802	Quantity 2

Process Control Variables

Control Variables

- Number of clarifiers in service

Clarifier performance is related to the hydraulic overflow rate, which is the amount of flow per square foot of surface area on the clarifier in service. In general, a lower hydraulic overflow rate results in better performance.

The design hydraulic overflow rate for the primary clarifiers is as follows:

Average Annual Flow foot (gpd/ft ²)	1,250 gallons per day per square
Maximum Month	1,330 gpd/ft ²
Peak Hour Flow	2,000 gpd/ft ²

These overflow rates are achieved with two clarifiers in service. It is recommended that two clarifiers be used under most conditions except for short periods during normal maintenance or when the daily flow is not expected to exceed approximately 4 to 5 mgd, such as during startup.

Non Controllable Variables

- Wastewater flow rate

Raw sewage flow from the IPS is weather- and flow- dependent and is therefore not controllable

Calculations

- Hydraulic overflow rate

The equation for calculating the clarifier overflow rate is as follows:

$$\text{SOR} = \frac{Q * 1,000,000}{N_c \times \frac{3.14 \times D_c^2}{4}}$$

Where:

SOR = Surface (hydraulic) overflow rate, gal/day/ft²

Q = Influent flow, mgd

N_c = Number of clarifiers on-line

D_c = Clarifier diameter, ft (for Spokane County RWRF = 66 ft)

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20 - Primary Clarifiers

Operating Strategies

The Primary Clarifier System is operated in one of two modes: remote manual control, or local manual control. No remote automatic mode of operation is available. Exhibit 20-2 lists the control modes for the Primary Clarifiers.

EXHIBIT 20-2
Primary Clarifiers Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Operators manually OPEN and CLOSE buried gate valves to control primary influent flow to the Primary Clarifiers.	
Manual/Local	Operators manually OPEN and CLOSE effluent gates to control effluent flow out of the Primary Clarifiers.	
Manual/Local	Operators manually OPEN and CLOSE butterfly valves to control foul air flow in and out of the Primary Clarifiers.	
Manual/Local	Operators manually OPEN and CLOSE ball valves to control plant water to the Primary Clarifier spray nozzles.	
Manual/Local	Primary Clarifier Mechanisms (60MTR00101 and 60MTR00102) can be turned ON/OFF at the LCS ON/OFF/REMOTE switch.	
Manual/Remote	Primary Clarifier Mechanisms (60MTR00101 and 60MTR00102) can be started and stopped from the HMI when the LCS is in REMOTE MODE.	
NOTES: LCS = local control station HMI = human-machine interface		

Startup Procedures

Remote-Manual Mode:

1. Select REMOTE at the LCS for the mechanisms.
2. Through the PCS, set the mechanism to MANUAL mode.
3. Open the manually operated Effluent Isolation Gate.

4. Open the manually operated foul air butterfly valve
5. Open the manually operated Influent Isolation Gate valve.
6. When wastewater is flowing into the clarifier, through the PCS, START the mechanism.
7. Open the manually operated plant water ball valve to spray bar.

Local-Manual Mode:

1. Open the manually operated Effluent Isolation Gate for the clarifier.
2. Open the manually operated foul air butterfly valve for the clarifier.
3. Open the manually operated Influent Isolation Gate valve for the clarifier.
4. When wastewater is flowing into the clarifier, switch the mechanism to ON with the ON/OFF/REMOTE switch at the LCS.
5. Open the manually operated plant water ball valve to spray bar.

Shutdown Procedures

Remote-Manual Mode:

1. Close the manually operated Influent Isolation Gate valve.
2. Close the manually operated Effluent Isolation Gate valve.
3. Close the manually operated plant water ball valve.
4. Leave the manually operated foul air butterfly valve open.
5. After pumping the sludge blanket down, through the PCS, STOP the mechanism.

Local-Manual Mode:

1. Close the manually operated Influent Isolation Gate valve.
2. Close the manually operated Effluent Isolation Gate valve.
3. Close the manually operated plant water ball valve.
4. Leave the manually operated foul air butterfly valve open.

5. After pumping the sludge blanket down, STOP the mechanism with the LCS switch.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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20 - Primary Clarifiers 1&2

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Primary Clarifier 1 Mechanism High Torque	Instrument (60NSH00201) has detected Primary Clarifier 1 Mechanism has monitored HIGH Torque	Alarm Only. Operator dispatched to area to make initial investigation.
Primary Clarifier 2 Mechanism High Torque	Instrument (60NSH00202) has detected Primary Clarifier 2 Mechanism has monitored HIGH Torque	Alarm Only. Operator dispatched to area to make initial investigation.
Primary Clarifier 1 Mechanism High-High Torque	Instrument (60NSHH00201) has detected Primary Clarifier 1 Mechanism has monitored HIGH-HIGH Torque	Alarm on SCADA. Shut down mechanism and lock out until reset locally.
Primary Clarifier 2 Mechanism High-High Torque	Instrument (60NSHH00202) has detected Primary Clarifier 2 Mechanism has monitored HIGH-HIGH Torque	Alarm on SCADA. Shut down mechanism and lock out until reset locally.

Primary Clarification UPCP

Project: Spokane, WA
Plant: Spokane County RWRf
Date: March 31, 2011, January 7, 2015, February 7, 2017
Unit process number: 60

Summary

The Primary Clarifiers allow solids to be removed in the form of sludge that has settled to the bottom of the clarifiers, and as scum that is skimmed from the surface of the clarifiers.

Process Overview

Primary Influent is conveyed by gravity to the Primary Clarifiers after undergoing preliminary treatment at the Headworks. The Primary Clarifiers remove organic and inorganic solids from the Primary Influent flowstream in order to reduce loading to the secondary treatment processes. Settleable solids are removed by the Primary Sludge Pumps and pumped to the Blended Sludge Tank and floatable solids are removed by the Primary Scum Pumps and pumped directly to the Anaerobic Digesters. Ferric chloride and anionic polymer can be added upstream of the primary clarifiers to aid in phosphorus removal. The process flowstream exits the Primary Clarifiers as Primary Effluent that flows by gravity to the Aeration Basins.

Unit Physical Information

The two Primary Clarifiers are located south of the Headworks Facility and north of the Aeration Basins. The clarifiers are constructed of concrete and include aluminum covers to contain foul air so it can be collected and conveyed to the Odor Control System. The clarifiers are 65 feet in diameter, 12 feet sidewall depth, and include spiral-type scraper mechanisms to move the settled sludge to the center of the clarifier. At the center of the clarifier is a sump to collect solids, pipes connect the sump to three primary sludge pumps located in the lower level (basement level) of the Headworks Facility. Skimmer blades on the top of the scraper mechanisms remove scum to a scum trough and then to the common scum pit. A 50 gpm progressing cavity scum pump either circulates scum back into the pit to keep it mixed or pumps scum to the anaerobic digesters.

Operational Parameters and Theory

The Primary Clarifiers slow down the velocity of the wastewater treatment stream to allow for the removal of settleable solids. The removal dually reduces the inorganic and organic solids loading to the aeration basin and transfers that loading to the anaerobic digesters. Scum is floatable solids from the influent and plant return streams that are removed to prevent nuisance accumulation downstream. Certain constituents in the scum increase gas production in the anaerobic digesters.

The addition of metal salts in the form of ferric chloride and anionic polymer can be

added upstream of the Primary Clarifiers at the Headworks. This method of Chemically Enhanced Primary Treatment (CEPT) converts soluble phosphorus and colloidal material to settleable material. The first stage flocculation process occurs at the Aerated Grit Basin. The second stage flocculation process occurs at the clarifier flocculation wells. The clarifier diameter is based on full time CEPT for a peak design flow of 13.8 MGD. The flocculate settles out and is removed from the clarifiers as sludge that is pumped to the Blended Sludge Storage Tank.

Process Monitoring and Responsibilities

The operators should check the primary clarifiers once per day for odors and unusual operating conditions. The manual torque readout from the the center drive for the spiral rake blades should be observed daily for increasing or unusually high torque readout.

On monthly or weekly basis as needed the interior of the clarifier will be inspected via inspection hatches. The launder and weir conditions are observed from the inspection hatches along with the scum trough and scum sprayers. The scum sprayers will need to be kept free of debris to ensure scum removal.

Primary Clarification

Parameter	Units	Frequency	Source
Units Online	#	Daily	SCADA
Sludge Removal	GPD	Daily	SCADA
Influent Flow	MGD	Continuous	SCADA
Sludge Blanket	Feet	Daily	Core sampler
Scum pit level	Feet	Continuous	SCADA
Ferric chloride usage	Gallons	Continuous	SCADA
Anionic polymer usage	Gallons	Continuous	SCADA
TSS removal efficiency	Percent	Weekly	Laboratory

Control Parameters

The control parameters for the primary clarifiers include the number of units in service, chemical dosage rates, sludge removal rates, and scum removal rates.

Clarifier performance is related to the hydraulic overflow rate which is the amount of flow per square foot of clarifier in service. In general, a lower hydraulic overflow rate results in better performance. The design hydraulic overflow rate for the primary clarifiers is as follows:

Average Annual Flow	1250 gpd/ft ²
Maximum Month	1330 gpd/ft ²
Peak Hour Flow	2000 gpd/ft ²

These overflow rates are achieved with two clarifiers in service. It is recommended that two clarifiers are used in most conditions except for short periods during normal maintenance or when the daily flow is not expected to exceed about 4 to 5 MGD.

Chemical dosage rates are determined by jar testing in the laboratory. A raw wastewater sample is collected and a jar testing apparatus is programmed to simulate the processes prior to primary clarification on a bench scale. Metal salts and polymer are added to the raw wastewater at varying dosages and the supernatant is tested for TSS. A TSS removal percentage is then calculated and an optimal chemical dosage rate can be selected.

Sludge removal rates are determined by the primary sludge total solids and pumping rates, any sludge not removed accumulates on the bottom of the clarifiers. The blanket level will be measured using a core sampler and will be kept to a minimum to prevent the anaerobic breakdown of organic materials and the release of soluble BOD.

While the amount of scum is not a controlled parameter adequate removal of scum from the surface of the clarifier can be influenced. The scum skimmer position can be changed so that more or less material and water is pulled up the beach plate of the scum trough. The scum spray nozzles must be kept free of debris and the flow of scum spray can be adjusted.

Calculations and Recordkeeping

The hydraulic overflow rate is calculated using the following formula:

$$SOR = (Q * 1,000,000) / (N_c * 3.14 * D_c^2 / 4)$$

SOR = Surface (hydraulic) overflow rate, gal/day/ft²

Q = Influent flow, mgd

N_C = Number of clarifiers on-line

D_C = Clarifier diameter, ft

$$\% \text{ Solids Removal} = ((\text{Influent TSS} - \text{Primary Effluent TSS}) / (\text{Influent TSS})) * 100\%$$

The number of units online will be recorded daily by the SCADA system. The volume of sludge pumped daily will be recorded. The volume of scum pumped daily can be calculated by taking the difference between total anaerobic digester influent flow (metered) and the primary sludge flow, thickened sludge flow, and centrifuge feed flow to anaerobic digesters. The percent solids removal will be calculated weekly. These are recorded in OP10.

Targets and Process Performance

Primary clarification targets are based on solids removal and controlled by the surface overflow rate.

Table 2
Targets for Primary Clarification

Parameter	Units	Minimum	Maximum
SOR	gpd/ft ²	1250	2000
Units Online	#	1	2
Sludge Removal	GPD	50,000	206,700
Scum Removal	GPD	2,000	4,000
Flow	MGD	4	13.8
Sludge Blanket	Feet	0	4
Scum pit level	Feet	1	8
% solids removal	%	60%	NA

Relationship to Other Unit Processes

Primary clarification follows screening and grit removal. A bypass or inefficiency of the grit and screening removal would lead to an increased burden on the primary clarifiers. The CEPT process directly influences solids loading. Increased metal salt and polymer feeds increase the amount of precipitate that settle in the clarifiers.

Common Problems and Troubleshooting

Clarifier Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Excess sludge blanket	<ul style="list-style-type: none"> Excess solids loading Inadequate sludge pumping 	<ul style="list-style-type: none"> Reduce loading to unit(s) Increase sludge pumping rate
Inadequate solids removal	<ul style="list-style-type: none"> High SOR Inadequate polymer feed Excessive sludge blanket 	<ul style="list-style-type: none"> Place second unit online Increase polymer dose Increase metal salts dose Increase sludge pumping rate
Excess scum accumulation	<ul style="list-style-type: none"> Skimmer not landing on beach plate Inadequate scum spray Clogged pipe from trough to scum pit 	<ul style="list-style-type: none"> Adjust skimmer position Check scum spray valve/pressure Clear pipe from trough to scum pit
Solids accumulation on weirs	<ul style="list-style-type: none"> Inadequate screening/grit removal Solids recycle 	<ul style="list-style-type: none"> Check screening/grit removal Check solids processing solids capture rates and check for abnormal solids operations
Drive torque high	<ul style="list-style-type: none"> Object on bottom of clarifier Sludge accumulation 	<ul style="list-style-type: none"> Drain and remove object Increase sludge removal rate

Alternate Modes of Operation

It is recommended to keep both units online for average annual flows to achieve the best removal. It is possible to run one unit only for short durations for maintenance procedures. While one unit is off line the Ferric Chloride dosage and anionic polymer dosage can be increased proportionately to achieve Total Phosphorus removal and efficient settling of solids. Pumping will also be increased as necessary.

22 - Sludge/Scum Pumping

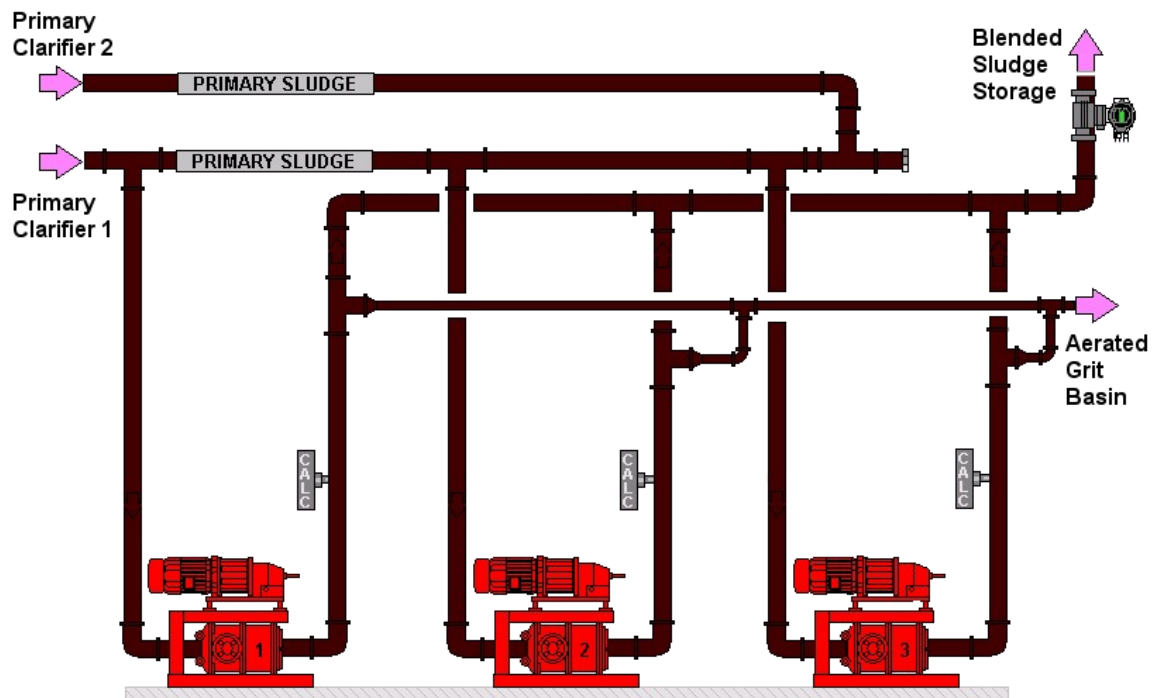
Overview

Purpose

The Primary Sludge Pumps remove settled organic material and chemically precipitated phosphorous from the Primary Clarifiers to reduce the load on secondary treatment processes. The Primary Scum Pump conveys the fat, oil, and grease (FOG) collected in the Primary Scum Wet well to the solids treatment process.

Description

Primary Sludge Pumping



Metal salts in the form of ferric chloride and polymer are added upstream of the Primary Clarifiers at the Headworks. This method of CEPT converts soluble phosphorus and colloidal material to settleable material and generally improves clarifier performance. The settled material is removed from the clarifiers as sludge and is pumped to either the Blended Sludge Tank, upstream of the

Primary Clarifiers (recycle mode), or directly to the Anaerobic Digesters.

The Primary Sludge Pumps are rotary lobe type, and located in the lower level of the Headworks Facility. A Primary Sludge Pump is dedicated to each clarifier, with a third sludge pump that can serve either clarifier in a backup mode.

Primary Scum Pumping

Primary scum is skimmed from the liquid surface of both Primary Clarifiers and collected in a common Primary Scum Wet well. The primary scum is pumped from the wet well and recirculated for a short period of time to mix the contents before transferring the material to the Anaerobic Digester feed piping.

The Primary Scum Wet well is located between the two Primary Clarifiers. The Primary Scum Pump is a vertically mounted, progressing cavity pump with the motor located above the grated opening and the pump suction extending down into the wet well. Exhibit 22-1 lists the components for the Primary Sludge and Primary Scum Pumps.

Design Criteria and Component List

EXHIBIT 22-1
Primary Sludge and Primary Scum Pumps Component List

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Primary Sludge Pump	59PMP03001, 59PMP03002, 59PMP03003	Quantity: 3 Type: Rotary Lobe, Adjustable Speed Rated Flow Capacity (gpm): 163 Rated Differential Pressure (psig): 16 Power (hp): 7.5
Primary Scum Wet well		Quantity: 1 Capacity (gal): 2900
Primary Scum Pump	60PMP00500	Quantity: 1 Type: Progressing Cavity Pump Rated Flow (gpm): 50 Power (hp): 7.5
NOTES: gpm = gallons per minute psig = pounds per square inch gauge gal = gallons		

Process Control Variables

Control Variables

- Primary sludge pumping rate

The primary sludge pumping rate significantly affects the mass and concentration of the primary sludge pumped to the solids processes. For a given mass of sludge (pounds of sludge), as flow rate decreases, the concentration will increase; as the flow rate increases, the concentration will decrease.

For the Spokane County RWRf, the goal of sludge pumping is to maintain a constant mass loading to the solids processes throughout the day. By maintaining a constant mass loading, gas production from the Anaerobic Digesters should be fairly uniform, which will allow the microturbines to operate most efficiently.

Because the mass of BOD and total suspended solids (TSS) entering the treatment plant and settled in the Primary Clarifier will vary throughout the day, the Primary Clarifiers become sludge equalization basins where sludge quantity varies throughout the day and will likely result in a varying depth of “sludge blanket.” It is expected that as the sludge blanket depth fluctuates, the concentration of the sludge will also vary; also, as the concentration varies, the sludge flow rate will need to vary in order to deliver a constant mass of solids to the solids processing process.

Non Controllable Variables

- Wastewater flow rate

Raw sewage flow from the IPS is weather- and flow- dependent and therefore is not controllable. It follows a typical municipal diurnal flow pattern.

- Influent wastewater and particle characteristics

The influent concentration of BOD, TSS, FOG, and particle sizes and shapes cannot be controlled, but these will all affect the removal efficiency of the Primary Clarifiers.

Calculations

Primary sludge flow rate:

$$\text{Primary Sludge Flow} = \text{Mass Removed} / (12.02 * \text{Sludge Conc.})$$

Where:

- Primary Sludge Flow (gallons/minute)
- Mass Removed = Operator-entered Value (lbs/day)
- Sludge Concentration (grams/liter)

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22 - Sludge/Scum Pumping

Operating Strategies

The Primary Sludge Pumping System is operated in any of the following four modes: REMOTE-AUTO (flow) control, REMOTE-AUTO (mass) control, REMOTE-MANUAL control, and LOCAL-MANUAL control. The Primary Scum Pumping System is operated in one of three modes: REMOTE-AUTO, REMOTE-MANUAL, and LOCAL-MANUAL. Exhibit 22-2 lists the control modes for sludge pumping.

EXHIBIT 22-2
Sludge Pumping Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The control mode of the sludge pumps (59PMP03001, 59PMP03002, 59PMP03003) is set locally. There are four types of primary sludge pump control: LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO-FLOW MODE, and REMOTE-AUTO-MASS MODE.	
Manual/Local	In LOCAL-MANUAL mode the operator can turn the sludge pumps ON or OFF and can adjust the speed at the LCS.	
Manual/Local	The operator must confirm in the field that the pump valve arrangement matches the selected pump control mode in SCADA.	
Manual/Remote	In REMOTE-MANUAL the operator manually turns the pumps ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	Operator selects the particular REMOTE pump control mode at SCADA. The operator also selects which pump or combination of pumps to run.	
Auto/Remote	When operating in the FLOW control mode, the speed of the Primary Sludge Pumps will adjust to maintain operator-entered FLOW setpoints. Six flow rate setpoints will be displayed on a daily basis and will be divided into 4-hour segments.	
Auto/Remote	When operating in the MASS control mode, the flow setpoint will be calculated.	
Auto/Remote	SCADA monitors and reports the following for the primary sludge pumps: LOCAL/REMOTE status, ON/OFF status, FAIL condition, motor runtime, motor voltage, motor current, power consumed, and speed.	

NOTES:

LCS = local control station

SCADA = supervisory control and data acquisition

The Primary Scum Pumping System is operated in any of the following three modes: REMOTE-AUTO control, REMOTE-MANUAL control, and LOCAL-MANUAL control. Exhibit 22-3 lists the control modes for scum pumping.

EXHIBIT 22-3**Scum Pumping Control Modes**

MODE	DESCRIPTION	REFERENCES
Manual/Local	In LOCAL-MANUAL mode the Primary Scum Pump (60PMP00500) can be controlled locally.	
Manual/Remote	In REMOTE-MANUAL mode the Primary Scum Pump (60PMP00500) can be controlled at the HMI.	
Manual/Remote	Control for OPEN-CLOSE operation of the Primary Scum Pump Recirculation Valve is provided at the PCS HMI.	
Manual/Remote	Control for OPEN-CLOSE operation of the Primary Scum Discharge Valve is provided at the PCS HMI.	
Manual/Remote	Operators set the HIGH and LOW setpoints for the Primary Scum Pit level.	
Auto/Remote	In REMOTE-AUTO mode, the Primary Scum Pump (60PMP00500) cycles ON-OFF based on liquid levels in the Primary Scum Pit and operator setpoints.	
Auto/Remote	Primary Scum Pump SHUTDOWN occurs due to pump HIGH DISCHARGE PRESSURE.	
Auto/Remote	Primary Scum Pump SHUTDOWN occurs due to pump HIGH MOTOR STATOR TEMP.	
Auto/Remote	SCADA monitors the LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO modes of operation and ON-OFF status of the pump drive.	
NOTES: HMI = human-machine interface PCS = Plant Control System SCADA = supervisory control and data acquisition		

Startup Procedures

Primary Sludge Pumping

Remote-Auto (Flow) Mode:

1. Open manual pump isolation valves.
2. At the LCS, select REMOTE.

3. Calculate the sludge flow setpoint for each of six 4-hour blocks of time based on the desired sludge mass setpoint. Enter the flow setpoints through the PCS.
4. Through the PCS, set the Primary Sludge Pump into the AUTO-FLOW mode. The pump should start operating.
5. Verify sum of individual pump flow rates is equivalent to the total sludge flow rate. NOTE: The individual pump flow rate is calculated based on the speed of the pump because it is a positive displacement pump. If the sum of the individual pump flows varies significantly from the total flow measured with the magnetic flow meter, it may mean that there is slippage within the pump, and the pump requires maintenance to tighten the tolerance between the lobes and the wall of the pump.
6. Periodically monitor sludge blanket depth to verify that calculated flow setpoints are sufficient, and monitor sludge concentration with grab samples. It is expected that during startup, this will be more frequent. However, as sludge characteristics and influent flow patterns are learned, sampling may be decreased.

Remote-Auto (Mass) Mode:

1. Open manual pump isolation valves.
2. At the LCS, select REMOTE.
3. Calculate the sludge mass setpoint based on expected flows, and trends of previous sludge production. Enter the mass setpoint through the PCS.
4. Through the PCS, set the Primary Sludge Pump into the AUTO-MASS mode. The pump should start operating.
5. The pump flow rate is calculated based on the mass setpoint and the measured concentration on the total sludge flow to solids processing.
6. Verify sum of individual pump flow rates is equivalent to the total sludge flow rate. NOTE: The individual pump flow rate is calculated based on the speed of the pump because it is a positive displacement pump. If the sum of the individual pump flows varies significantly from the total flow measured with

the magnetic flow meter, it may mean that there is slippage within the pump, and the pump requires maintenance to tighten the tolerance between the lobes and the wall of the pump.

7. Periodically monitor sludge blanket depth to verify that mass setpoints are sufficient. Monitor sludge concentration with grab samples to verify sludge density instrumentation is correlating reasonably well. It is expected that during startup, this will be more frequent. However, as sludge characteristics and influent flow patterns are learned, and as confidence in instrumentation increases, sampling may be decreased.

Remote-Manual Mode:

1. Open manual pump isolation valves.
2. At the LCS, select REMOTE.
3. Calculate the desired sludge flow.
4. Through the PCS, set the Primary Sludge Pump into the MANUAL mode and start the pump. The pump should start operating. Adjust the pump speed as required until the sludge flow is obtained. NOTE: If two primary clarifiers are in service, it is recommended that both primary sludge pumps have the same pump speed.
5. Verify sum of individual pump flow rates is equivalent to the total sludge flow rate. NOTE: The individual pump flow rate is calculated based on the speed of the pump because it is a positive displacement pump. If the sum of the individual pump flows varies significantly from the total flow measured with the magnetic flow meter, it may mean that there is slippage within the pump, and the pump requires maintenance to tighten the tolerance between the lobes and the wall of the pump.
6. Periodically monitor sludge blanket depth to verify that calculated flow setpoints are sufficient, and monitor sludge concentration with grab samples. It is expected that during startup, this will be more frequent. However, as sludge characteristics and influent flow patterns are learned, sampling may be decreased.

Local-Manual Mode:

1. Open manual pump isolation valves.
2. At the LCS, select LOCAL.
3. START the pump from the LCS.
4. Adjust the pump speed at the LCS as required until the desired sludge flow is obtained. NOTE: If two primary clarifiers are in service, it is recommended that both primary sludge pumps have the same pump speed.
5. Periodically monitor sludge blanket depth to verify that pump speed is sufficient, and monitor sludge concentration with grab samples.

Primary Scum Pumping

Remote-Auto Mode:

1. At the scum pump LCS, select REMOTE. At the scum transfer valve and scum recirculation valve, select REMOTE at the valve actuator.
2. Through the PCS, set the Primary Scum Pump, scum transfer valve, and scum recirculation valve to the AUTO-REMOTE mode.
3. Adjust the pump ON level setpoint, and recirculation time setpoint in the PCS. When level reaches the ON setpoint, the recirculation valve will open and the pump will start. After the recirculation time expires, the transfer valve will open, and the recirculation valve will close. The scum pump will continue to pump until the wet well level reaches the OFF setpoint.
4. Pump will shut off until the wet well re-fills.

Remote-Manual Mode:

1. At the scum pump LCS, select REMOTE. At the scum transfer valve and scum recirculation valve, select REMOTE at the valve actuator.
2. Through the PCS, monitor the scum wet well level.
3. Open the scum recirculation valve through the PCS.
4. When the level is at least 5 feet, the pump may be operated.
5. When the level reaches the normal ON level setpoint, open the scum transfer valve, and START the scum pump through the PCS.

Local-Manual Mode:

1. At the scum pump LCS, select LOCAL. At the scum transfer valve and scum recirculation valve, select LOCAL at the valve actuator.
2. Monitor the scum wet well level at the local level transmitter.
3. When the level is at least 5 feet, OPEN the scum recirculation valve and START the Primary Scum Pump. After approximately 3 to 5 minutes of recirculating and mixing, OPEN the scum transfer valve, and close the scum recirculation valve.
4. When level drops to 2 feet, STOP Primary Scum Pump and CLOSE scum transfer valve.

Shutdown Procedures

Remote-Automatic Mode:

1. Through the PCS, set Primary Scum Pump to REMOTE-MANUAL. In REMOTE-MANUAL, the pump will not start unless commanded to.
2. It is recommended to leave the scum recirculation valve open. If for some reason gas is generated or hot weather results in expansion, it is a good idea to allow the gas to escape and not pressurize the piping between the closed valves and the progressive cavity pump.

Remote-Manual Mode:

1. If the pump is operating and it needs to be stopped, through the PCS, initiate STOP command for the pump.
2. Close scum transfer valve at the pump.
3. It is recommended to leave the scum recirculation valve open. If for some reason gas is generated or hot weather results in expansion, it is a good idea to allow the gas to escape and not pressurize the piping between the closed valves and the progressive cavity pump.

Local-Manual Mode:

1. At the LCS, switch the Primary Sludge Pump to LOCAL, and initial STOP command for the pump.

2. Close scum transfer valve at the pump.
3. It is recommended to leave the scum recirculation valve open. If for some reason gas is generated or hot weather results in expansion, it is a good idea to allow the gas to escape and not pressurize the piping between the closed valves and the progressive cavity pump.

Abnormal Conditions

Primary Sludge Pump Out of Service

If a Primary Sludge Pump that is normally dedicated to a primary clarifier is out of service, and the standby pump is to be used, switch manual isolation valves as required to get flow into, and out of, the pump.

Blended Sludge Storage Tank Out of Service

If the Blended Sludge Storage Tank is out of service, the primary sludge pumps are designed to pump to the anaerobic digesters directly. In this scenario, the primary sludge should be thickened in the clarifier and pumped at a concentration of approximately 3 percent (30 grams/liter).

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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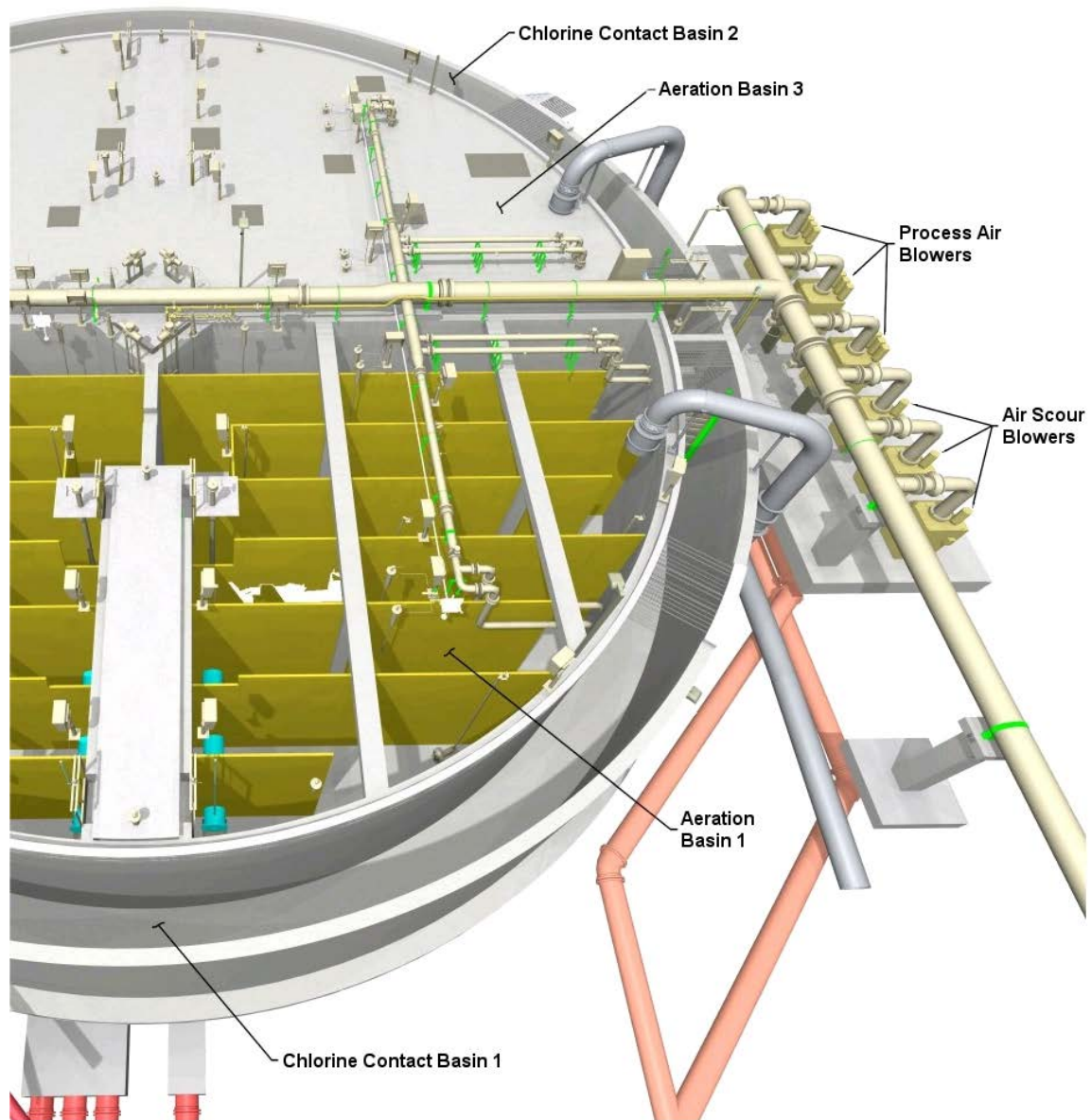
22 - Sludge/Scum Pumping

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Primary Sludge Pump 1 High Discharge Pressure	59PSH03201 detected High Discharge Pressure for Primary Sludge Pump 1 59PMP03001	Alarm shows on SCADA and stops the Primary Sludge Pump 1 until RESET locally.
Primary Sludge Pump 2 High Discharge Pressure	59PSH03201 detected High Discharge Pressure for Primary Sludge Pump 2 59PMP03002	Alarm shows on SCADA and stops the Primary Sludge Pump 2 until RESET locally.
Primary Sludge Pump 3 High Discharge Pressure	59PSH03203 detected High Discharge Pressure for Primary Sludge Pump 3 59PMP03003	Alarm shows on SCADA and stops the Primary Sludge Pump 3 until RESET locally.
Primary Scum Pump High Discharge Pressure	60PSH00800 has monitored High Discharge Pressure in the Primary Scum Pump 60PMP00500	Alarm shows on SCADA and locks out the Primary Scum Pump until RESET locally.

30 - Aeration Basins

Overview



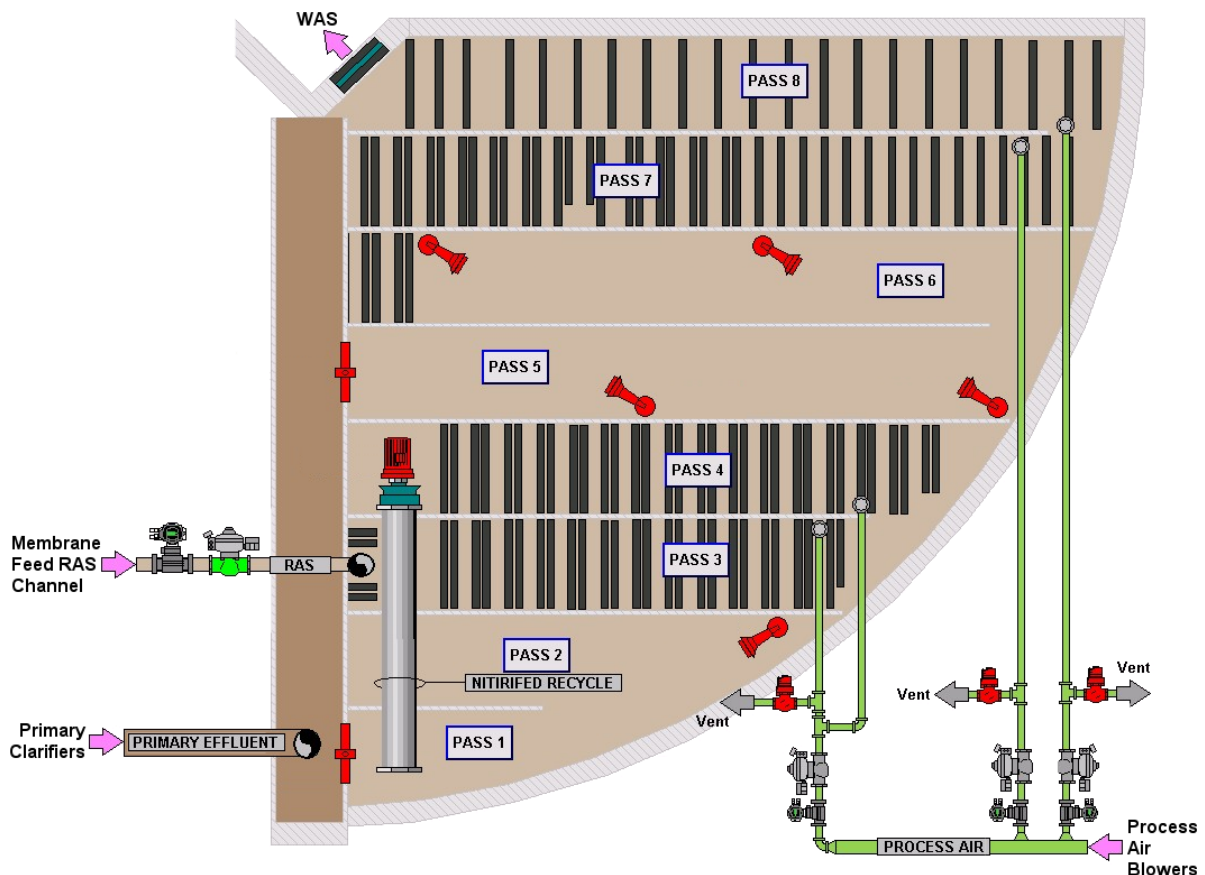
Purpose

Biological treatment removes biochemical oxygen demand (BOD), solids, and nutrients from wastewater. The biological process includes the aeration basins and membrane basins and is collectively called a membrane bioreactor (MBR). This section of the O&M Manual focuses on the aeration basins, however, the

membrane basins are an integral part of the MBR, some description is included here as well.

Description

The MBR provides conditions or environments for BOD and nutrient removal, and removal of the biomass from the effluent prior to disinfection. The aeration basins provide for BOD and nutrient removal through a series of anoxic and aerobic zones to meet the effluent limits of the plant discharge permit. The membrane tanks filter the biomass (also called activated sludge or mixed liquor) from the wastewater and sends the clean water (permeate) to the chlorine contact basin as secondary effluent. The filtered biomass becomes RAS and flows back to the aeration basins.



The four aeration basins are located at the center of the treatment plant site, just south of the Primary Clarifiers. Together they make up a circular structure where each basin is a quadrant of the circle. Baffle walls inside each basin create a serpentine flow path with a long length-to-width ratio. The basins are covered for odor control, with stair access from three locations.

The aeration basin portion of the MBR includes a step-feed (two feed points) activated sludge process that is configured as a series of anoxic and aerobic zones in each stage of the step-feed to provide nitrification and denitrification. Primary effluent flow is divided so that a portion goes to the first stage anoxic zone of each aeration basin, and the remainder goes to the second stage anoxic zone. Typically, the flow split ratio between the first feed point and the second feed point is 60 percent/40 percent.

Internal recirculation of nitrified mixed liquor returns nitrified mixed liquor from the end of the first aerobic zone to the beginning of the first anoxic zone. The Nitrified Recycle Pump is adjustable speed and can return up to 400 percent of the flow to the first stage anoxic zone, or up to 240 percent of the total primary effluent flow ($400\% \times 60\% = 240\%$).

RAS is added to the beginning of the first aerobic zone where it mixes with the mixed liquor from the end of the first anoxic zone. The mixed liquor flows through the first aerobic zone; the second anoxic zone, which is also the second primary effluent feed location; through the second aerobic zone; and exits the basin through a submerged sluice gate at the center of the aeration basin structure. The mixed liquor from all four aeration basins is combined in a submerged chamber at the center of the structure and conveyed to the membrane feed pumps in a common pipe.

Mixed liquor is pumped up to the membrane basins through the Membrane Feed Pumps. The portion of the mixed liquor that is filtered as clean water is known as permeate or secondary effluent. The filtered solids remain in the basin, flow over the basin effluent weir, and become the RAS, which flows back to the aeration basins by gravity.

Mixed liquor and surface foam is removed from the end of each aeration basin (at the center of the structure) as Waste Activated Sludge (WAS). The WAS from each basin flows over a weir gate into a common wet well. The WAS is then pumped to the blended sludge storage tank by one of two submersible WAS pumps. The WAS pumps are located in a sump at the center of the aeration basins. The four motorized slide gates are located at the end of each aeration basin. The WAS pumps will operate continuously based on an operator-entered flow setpoint, and the WAS gates will sequentially open and close based on the level in the WAS wet well.

The anoxic zones are mixed with submersible mixers that keep the mixed liquor solids in suspension and help prevent short-circuiting within the zone.

The aeration zones are aerated with ALP, which is introduced to the basin through fine-bubble membrane diffusers located on the bottom of the basin. Air flow control valves at each aerobic zone modulate to maintain dissolved oxygen

The screenshot displays a comprehensive control room interface for a wastewater treatment plant. The top status bar provides essential information including the plant name '2 BUILDING SERVICES 580000 WVN111', the current system state 'WVN111 Alarms Systems Test', and the date and time '01/26/2017 06:59:45'. The left sidebar offers a structured menu for navigating through various system components such as Overview, Alarms, Solid Handling, Maintenance, and Blowers. The central display area features a detailed process flow diagram, illustrating the movement of air and water through various basins and blowers, with real-time data points like flow rates and pressures. The bottom section is dedicated to the control of six different blowers, each equipped with a status indicator and a set of control buttons for manual operation and monitoring.

The basin drain pump is located on the perimeter of the circular structure. It is used to drain both the membrane basins and the aeration basins. The drain pump discharges to the RAS channel so that the aeration basin contents are re-distributed to the aeration basins that are still in service. Exhibit 30-1 is a partial list of example components of the Aeration Basins.

Design Criteria and Component List

EXHIBIT 30-1

Aeration Basins Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Aeration Basin		Quantity: 4 Type: Concrete Volume (gal): 330,000
Mixer	63MIX10201, 63MIX10501, 63MIX10801, 63MIX11101, 63MIX12701, 63MIX10202, 63MIX10502, 63MIX10802, 63MIX11102, 63MIX12702, 63MIX10203, 63MIX10503, 63MIX10803, 63MIX11103, 63MIX12703, 63MIX10204, 63MIX10504, 63MIX10804, 63MIX11104, 63MIX12704	Quantity: 20 Type: Submersible, Constant Speed Power (hp): 3
Nitrified Recycle Pump	63PMP11501, 63PMP11502, 63PMP11503, 63PMP11504	Quantity: 4 Type: Submersible Horizontal, Axial Flow, Adjustable Speed Flow Rate (gpm): 5,700 Power (hp): 8.3
Fine Bubble Diffusers		Quantity: Type: Polyurethane membrane, flat-panel
WAS Pump	63PMP16101, 63PMP16102	Quantity: 2 Type: Submersible, Adjustable Speed Flow Rate (gpm): 120 Power (hp): 3
WAS Gate	63GTE16001, 63GTE16002, 63GTE16003, 63GTE16004	Quantity: 4 Type: Weir/Slide Dimensions (ft): 2 X 2
Influent Gate	63GTE12101, 63GTE12102, 63GTE12103, 63GTE12104	Quantity: 8 Type: Weir Dimensions (ft): 4 X 3
Effluent Gate	63GTE12501, 63GTE12502,	Quantity: 4 Type: Sluice

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
	63GTE12503, 63GTE12504	Dimensions (ft): 4 X 4
Process Air Blower	63BLW20001, 63BLW20002, 63BLW20003	Quantity: 3 Type: Turbo, Adjustable Speed Air Flow Rate (scfm): 5,750 Pressure(psig): 10 Power (hp): 300
RAS Flowmeter	64FET02501, 64FET02502, 64FET02503, 64FET02504	Quantity: 4 Type: Magnetic Size (inches): 24
RAS Flow Control Valve	64FCV02501, 64FCV02502, 64FCV02503, 64FCV02504	Quantity: 4 Type: Butterfly Size (inches): 24
NOTES: gal = gallons hp = horsepower gpm = gallons per minute ft – feet scfm = standard cubic feet per minute psig = pound(s) per square inch gauge		

Process Control Variables

Control Variables

Proper control of the operating parameters must be maintained at all times to successfully operate an activated sludge system. To do this, a good working understanding of these parameters is essential so potential problems can be corrected prior to a process upset. The following operating parameters should be considered:

- Number of basins in service
- Solids retention time (SRT), WAS wasting rate, and solids production rate
- RAS flow rate
- Nitrified recycle flow rate
- Flow split between 1st-stage and 2nd-stage of step-feed
- Aeration process DO concentration

- Aeration header pressure setpoint

Number of Basins in Service and Mixed Liquor Concentration

The number of units in service determines the aeration volume, which is important because it is one of the parameters controlling the mixed liquor suspended solids (MLSS) concentration in the aeration system. For a given set of influent characteristic and a given SRT, the more basins in service, the lower the mixed liquor concentration.

In an MBR, the use of membranes as the liquid/solids separation mechanism eliminates the need for secondary clarifiers and the typical need to limit the solids loading rate to the clarifiers. As a consequence, MBRs can be operated at mixed liquor concentrations in the aeration basins that are approximately three times higher than conventional activated sludge processes (7,000 to 9,000 milligrams per liter [mg/L]). Spokane County RWRf was designed with a target mixed liquor concentration of 8,000 mg/L in the aeration basin.

Solids Retention Time and Sludge Wasting Rate

The SRT is the primary parameter that should be used to control the effluent quality and amount of activated sludge solids in the aeration system.

In an MBR system, it is recommended to operate the system at an SRT of at least 10 days. The reason for this is that membranes require cleaning based on organic and inorganic fouling. One aspect of organic fouling is the presence of 'biopolymers' secreted by the microorganisms. If the sludge age is sufficient, then the microorganisms degrade the biopolymer and organic fouling is minimized. Because detection of the biopolymer is difficult, manufacturers recommend a 10-day SRT as a target because it has been shown that if complete nitrification occurs, the presence of biopolymers is not likely. Therefore, nitrification becomes an indicator of sufficient sludge age, and a 10-day SRT is typically required for nitrification, especially in cool wastewater temperatures.

The SRT is controlled by the amount of sludge wasted on a daily basis, and is calculated as the amount of mixed liquor wasted per amount of mixed liquor in the system (inventory).

RAS Flow Rate

In an MBR, the RAS flow rate is closely related to membrane performance. Unlike a conventional activated sludge system with secondary clarifiers, a high RAS rate is required to prevent the mixed liquor in the membrane basins from becoming too concentrated. For the Spokane County RWRf, the target RAS rate is 300 percent of the influent flow, as explained below.

It is recommended that the mixed liquor concentration in the membrane basin not exceed approximately 12,000 mg/L for too long a period; otherwise, the membranes will become plugged and excessive pressure will be required to pull the clean water through the membrane. Consequently, more frequent cleaning may be required.

To describe how RAS flow rate is used to affect the RAS concentration, an example is used here. Membrane feed pumps pump mixed liquor from the aeration basins to the membrane basins where permeate (clean water, secondary effluent) is removed through the membrane, and the remaining solids and flow exit the membrane basin and are returned to the aeration basins as RAS. If the membrane feed pumps pump 200 percent of influent flow (2Q), and permeate is removed at 100 percent of influent flow (1Q), then the remaining flow is RAS and is 100 percent of influent flow (1Q). In this example, if the aeration basin mixed liquor concentration is 8,000 mg/L, and half the water is removed, the concentration in the membranes and RAS will double to 16,000 mg/L. Mathematically:

$$8,000 \text{ mg/L} \times (2Q/1Q) = 16,000 \text{ mg/L}$$

Similarly, if the membrane feed pump rate is 300 percent (3Q), and permeate flow is 100 percent (1Q,) then RAS is 200 percent (2Q), and the concentration in the membranes and RAS will be 12,000 mg/L. Mathematically:

$$8,000 \text{ mg/L} \times (3Q/2Q) = 12,000 \text{ mg/L}$$

The design was based on a RAS flow rate of 300 percent; therefore, following the approach above, the concentration in the membranes and RAS will be 10,700 mg/L. Mathematically:

$$8,000 \text{ mg/L} \times (4Q/3Q) = 10,700 \text{ mg/L}$$

In these examples, the aeration basin mixed liquor concentration is assumed to be 8,000 mg/L. If the basin concentration is less than 8,000 mg/L, then RAS flow rates could be less and still be below the target membrane/RAS concentration.

It is important to note that if the RAS concentration gets close to 12,000 mg/L or exceeds it for a brief period of time, the membranes will not fail or be damaged. It just means that they could require additional cleaning.

Nitrified Recycle Flow Rate

For an anoxic zone to function, nitrates need to be present. In the first anoxic zone, nitrified effluent from the first aerobic zone is recycled to the head of the first anoxic zone. For the Spokane RWRF, the design recycle flow rate is 400 percent of the basin influent flow.

Aeration Process DO Concentration and Air Header Pressure Setpoint

DO concentration in the aeration basins is another important operating parameter of the secondary system. Aeration DO is maintained by controlling the total air flow rate from the process air blowers and is typically set for 2 mg/L.

The amount of air delivered by the aeration blowers is varied to maintain the air header pressure setpoint. The goal of setting the pressure setpoint is to not have the pressure excessively high, which would result in an expensive operating system, and could limit the output of the blowers; and not set so low that air will not flow into the basin. Typically the pressure setpoint is adjusted so that the most open valve in the system is about 80 percent to 90 percent open.

Non Controllable Variables

Influent Flow Rate

The plant influent flow is dictated primarily by the flow rate into the Headworks from the IPS.

Influent Wastewater and Recycle Flow Characteristics

The influent concentrations of such constituents as BOD, TSS, ammonia and phosphorus cannot be controlled, but they will affect the oxygen demand, SRT and mixed liquor suspended solids.

Calculations

Most of the equations presented in this section are derived from a material balance around the secondary system. A material balance is an accounting method for describing the movement of a particular material (for example, BOD or TSS) through the system. The general word equation is:

$$\text{Mass added} + \text{Mass generated} = \text{Mass removed} + \text{Mass stored}$$

The destruction of mass (such as BOD oxidation and conversion) is considered as a negative generation.

Material balances can be calculated for any material. They may be calculated just for the aeration basins or Secondary Clarifiers, or they may be calculated for the entire system. The material balance can provide much useful information concerning process performance. It can be used to assess the impact of sludge waste and sludge return flows, the generation or growth of activated sludge, and quantitative changes in BOD and TSS throughout the plant.

Solids Retention Time

The solids retention time can be calculated by the following equation:

$$SRT := \left[\frac{V_{AB} \cdot MLSS \cdot N_{AB}}{(Q_{WAS} \cdot X_{WAS}) + (Q_E \cdot X_E)} \right]$$

Where:

SRT = Solids retention time, days

V_{AB} = Aeration basin volume, gallons

MLSS = Mixed liquor suspended solids, mg/L

N_{AB} = Number of aeration basins on-line

Q_{WAS} = WAS flow, gallons per day (gpd)

X_{WAS} = WAS suspended solids, mg/L

Q_E = Secondary clarifier effluent flow, gpd

X_E = Secondary effluent TSS, mg/L; typically =0 for membrane facility

WAS Wasting Rate Based on SRT

Microorganisms in the aeration basin(s) use the organic material in the wastewater for energy and reproduction. The microorganisms produced, plus the inert and non-biodegradable solids that enter the system, must be wasted from the secondary treatment process to maintain the desired sludge concentrations.

The amount of sludge to be wasted is described by the SRT equation above. For a desired SRT and measured MLSS and X_E , the WAS quantity to be wasted in one day can be determined by the following equation:

Where:

$$Q_{WAS} := \frac{\left(\frac{V_{AB} \cdot MLSS \cdot N_{AB}}{SRT} - Q_E \cdot X_E \right)}{X_{WAS}}$$

SRT = Solids retention time, days

V_{AB} = Aeration basin volume, gallons

MLSS = Mixed liquor suspended solids, mg/L

N_{AB} = Number of aeration basins on-line

Q_{WAS} = WAS flow, gpd

X_{WAS} = WAS suspended solids, mg/L

Q_E = Secondary clarifier effluent flow, gpd

X_E = Secondary effluent TSS, mg/L

An example of how to calculate the sludge waste rate by the SRT method with aeration basin 1 and secondary clarifier 1 in service and a flow of 3.0 mgd is shown below.

Given:

Aeration Basin Volume	=	900,000	Gal
Desired SRT	=	5.5	Days
Clarifier effluent TSS	=	20	mg/L
Aeration Basin MLSS	=	2700	mg/L
Waste Sludge Concentration	=	8000	mg/L
Flow	=	3,000,000	Gpd
Number of aeration basins online	=	1	

Calculate the desired waste sludge amount:

$$Q_{WAS} := \frac{\frac{900000 \cdot \text{gal} \cdot 2700 \cdot \frac{\text{mg}}{\text{L}} \cdot 1}{5.5 \cdot \text{day}} - 3000000 \cdot \frac{\text{gal}}{\text{day}} \cdot 20 \cdot \frac{\text{mg}}{\text{L}}}{8000 \frac{\text{mg}}{\text{L}}}$$

$$Q_{WAS} = 33.144 \frac{\text{gal}}{\text{min}}$$

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Operating Strategies

Mixed Liquor

Weir gates control the inflow of primary effluent to the Aeration Basins. Liquid levels are measured in the Aeration Basin influent channel by a radar level transmitter. The transmitter indicates liquid levels locally at the transmitter and remotely at SCADA. The influent weir gate position is determined by calculating flow based on liquid head over the gate with the goal of balancing the flow split to the Aeration Basins and maintaining the desired flow split between the first anoxic zone and second anoxic zone. The calculated flow rate is indicated and trended by SCADA.

The Aeration Basin liquid level is monitored by the Membrane System PLC using pressure sensors and controlled by the Membrane Permeate pumps. Because the flow into the basin and the flow out of the secondary system has some time delay, the elevation is expected to vary up to about 3 inches on either side of the level setpoint.

IMPORTANT: If the Aeration Basin liquid level rises too high, it can potentially flood the deck of the aeration basins and spill onto the ground; this would require a major failure in the system in one of two ways: 1) if the membrane feed pumps fail to pump flow up to the membranes; or 2) if the permeate pumps fail to remove water through the membranes. In either case, if more water enters the Aeration basin than what is removed, the level will rise. To protect the facility, software alarms will warn of a rising Aeration Basin level. In both cases, the offsite pump stations may be throttled (flow capacity setpoint reduced) or shut off all together until the problem is determined and corrected.

The Anoxic Zone mixers are manually started and stopped with the ON-OFF-REMOTE switch at the LCS, or remotely at the HMI when the LCS is in REMOTE.

The mixed liquor concentration at the influent of Membrane train #3 is measured daily and used for mass flow control of WAS in order to target a specific Sludge Retention Time in the Bioreactor. Exhibit 30-2 lists the control modes for the mixed liquor control process.

MODE	DESCRIPTION	REFERENCES
MANUAL/LOCAL	Each mixer is set to LOCAL-MANUAL or REMOTE-MANUAL mode at the LCP with the ON-OFF-REMOTE switch.	
MANUAL/LOCAL	In LOCAL-MANUAL the ON/OFF status of each mixer is controlled at the LCP.	
MANUAL/LOCAL	Each gate is set to LOCAL-MANUAL, REMOTE-MANUAL or REMOTE-AUTO mode at the LCP.	
MANUAL/LOCAL	In LOCAL-MANUAL the OPEN-STOP-CLOSE switch for the gates is operated locally at the LCP.	
AUTO/LOCAL	Liquid levels are measured by a radar level transmitter and indicated locally at the transmitter.	
MANUAL/REMOTE	For the aeration basin level, the plant operator inputs the HIGH level alarm setpoint (adjustable).	
MANUAL/REMOTE	In REMOTE-MANUAL the ON/OFF status of each mixer is controlled at the HMI.	
MANUAL/REMOTE	In REMOTE-MANUAL the OPEN-STOP-CLOSE switch for the gates is operated at the HMI.	
AUTO/REMOTE	In REMOTE-AUTO the influent gate position is calculated by SCADA.	
AUTO/REMOTE	Aeration basin liquid levels are measured by a radar level transmitter and indicated at SCADA.	
AUTO/REMOTE	Aeration basin HIGH level in the channel alarms to SCADA.	
AUTO/REMOTE	SCADA monitors each mixer for LOCAL/REMOTE status, ON/OFF status, FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions.	
AUTO/REMOTE	Mixer FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions alarm to SCADA.	
AUTO/REMOTE	SCADA monitors gate position and reports whether the gate is being controlled in LOCAL-MANUAL, REMOTE-MANUAL or REMOTE-AUTO mode.	
NOTES: LCP = local control panel HMI = human-machine interface SCADA = supervisory control and data acquisition		

Nitrified Recycle

Nitrified Recycle pumps are manually turned ON-OFF by a START-STOP switch controlled either by LOCAL-MANUAL mode at the LCP or REMOTE-MANUAL mode at the HMI. Pump speed is adjusted manually at the LCP, or HMI, or in REMOTE-AUTO mode by the flow setpoint, which is calculated as a ratio/percentage of influent flow rate to each basin. Exhibit 30-3 lists the control modes for the nitrified recycle control process.

EXHIBIT 30-3
Nitrified Recycle Control Modes

MODE	DESCRIPTION	REFERENCES
MANUAL/LOCAL	Each Nitrified Recycle Pump is set to LOCAL-MANUAL, REMOTE-MANUAL, or REMOTE-AUTO mode at the LCP.	
MANUAL/LOCAL	In LOCAL-MANUAL mode the Nitrified Recycle pumps are turned ON-OFF by a START-STOP switch at the LCP. Pump SPEED is also adjusted at the LCP.	
MANUAL/REMOTE	In REMOTE-MANUAL mode the Nitrified Recycle pumps are turned ON-OFF by a START-STOP switch at the HMI. Pump SPEED is also adjusted at the HMI.	
AUTO/REMOTE	In REMOTE-AUTO mode the Nitrified Recycle pumps ON-OFF status and pump SPEED are controlled by SCADA. Pump SPEED is determined by the ratio of influent flow to each basin.	
AUTO/REMOTE	SCADA monitors ON-OFF-SPEED status of the pump drive and reports whether the pump is being controlled in LOCAL-MANUAL mode at the respective LCP, REMOTE-MANUAL mode at the HMI, or REMOTE-AUTO mode by SCADA.	
AUTO/REMOTE	SCADA monitors LOCAL/REMOTE status, MANUAL/AUTO status, FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions and drive speed.	
AUTO/REMOTE	Pump FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions alarm to SCADA.	
AUTO/REMOTE	Flow rate is measured, scaled, indicated, and trend analysis done by SCADA.	
AUTO/REMOTE	SCADA monitors for FLOW and FAIL conditions.	
NOTES: LCP = local control panel HMI = human-machine interface SCADA = supervisory control and data acquisition		

Return Activated Sludge

RAS channel liquid levels are measured at the membranes by a radar level transmitter. The transmitter indicates liquid levels locally at the transmitter and remotely at SCADA. Liquid levels are reported by height or elevation in units of feet and inches.

Each RAS flow control valve has an OPEN-STOP-CLOSE switch controlled either by LOCAL-MANUAL, REMOTE-MANUAL, or REMOTE-AUTO mode. In REMOTE-AUTO mode, valve position is controlled by the desired flow split of RAS to online basins. Exhibit 30-4 lists the control modes for the RAS control process.

EXHIBIT 30-4

Return Activated Sludge Control Modes

MODE	DESCRIPTION	REFERENCES
MANUAL/LOCAL	Each RAS Flow Control Valve is set to LOCAL-MANUAL, REMOTE-MANUAL or REMOTE-AUTO mode at the LCP.	
MANUAL/LOCAL	In LOCAL-MANUAL the OPEN-STOP-CLOSE switch for each valve is controlled at the LCP.	
AUTO/LOCAL	RAS Channel liquid levels are measured at the membranes by a radar level transmitter and indicated locally at the transmitter.	
MANUAL/REMOTE	The plant operator inputs the HIGH level alarm setpoint (adjustable) for the RAS channel liquid level.	
MANUAL/REMOTE	In REMOTE-MANUAL the OPEN-STOP-CLOSE switch for each valve is operated at the HMI.	
AUTO/REMOTE	In REMOTE-AUTO the valve position is calculated by SCADA based on desired flow split of RAS to online basins.	
AUTO/REMOTE	Liquid levels are measured by a radar level transmitter and indicated at SCADA.	
AUTO/REMOTE	A HIGH level in the channel alarms to SCADA.	
AUTO/REMOTE	SCADA monitors valve position and reports whether the valve is being controlled in LOCAL-MANUAL, REMOTE-MANUAL, or REMOTE-AUTO mode.	
AUTO/REMOTE	Flow rate is measured, scaled, indicated, and trend analysis done by SCADA.	
AUTO/REMOTE	SCADA monitors for FLOW and FAIL conditions.	
NOTES: LCP = local control panel RAS = return activated sludge HMI = human-machine interface SCADA = supervisory control and data acquisition		

Process Air

There are three process blowers: two duty that operate in a lead-lag configuration based on lowest run time, and one redundant standby blower. Blower speeds modulate to maintain a header pressure. Dissolved oxygen setpoints (adjustable) are maintained in each aeration control zone by modulating the air flow control valve and maintaining the air pressure setpoint of the main ALP header. Two blowers (a LEAD and a LAG) are automatically controlled to maintain the proper air flow and pressure. The LAG blower is turned on automatically only if Influent plant flow is within a range set by the operator on the Process Blower Sequence page and the pressure set point is not being met by the LEAD blower. If the pressure sensor FAILS, the blowers maintain the last output pressure. Exhibit 30-5 lists the control modes for process

air control.

EXHIBIT 30-5
Process Air Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Operator selects LOCAL-MANUAL, REMOTE-MANUAL, or REMOTE-MANUAL control mode at the LCP.	
Manual/Local	In LOCAL-MANUAL mode blowers are turned ON-OFF by a START-STOP switch at the LCP. Also in LOCAL-MANUAL mode, blower SPEED is adjusted at the LCP to maintain header pressure.	
Manual/Remote	In REMOTE-MANUAL mode blowers are turned ON-OFF by a START-STOP switch at the HMI. Also in LOCAL-MANUAL Blower SPEED is adjusted at the HMI to maintain header pressure.	
Manual/Remote	Operator inputs DO setpoints at the HMI.	
Manual/Remote	Operator inputs header pressure setpoints at the HMI.	
Auto/Remote	In REMOTE-AUTO mode the ON-OFF status and SPEED of the blowers are adjusted by SCADA to maintain the header pressure setpoint.	
Auto/Remote	SCADA monitors LOCAL/REMOTE status, MANUAL/AUTO status, alarm conditions and drive speed of the blowers.	
Auto Remote	Blower conditions that alarm to SCADA include FAIL/HIGH FILTER HEADLOSS/HIGH SUCTION TEMP/HIGH DISCHARGE PRESSURE/HIGH MOTOR TEMP/HIGH BEARING TEMP/HIGH ROTOR VIBRATION.	
Auto/Remote	ALP airflow rate is measured, scaled, indicated, and trend analysis done by SCADA.	
Auto/Remote	SCADA monitors for FLOW and FAIL conditions.	
Auto/Remote	Blowers maintain the last output pressure if the pressure sensor FAILS.	
NOTES: LCP = local control panel HMI = human-machine interface DO = dissolved oxygen SCADA = supervisory control and data acquisition ALP = low-pressure air		

Startup Procedures

Remote Automatic Mode:

1. Determine the number of aeration basins to be put in service.
2. Open the Aeration Basin effluent gate from the HMI or local gate actuator at the center of the structure.

3. Switch the RAS flow control valve from REMOTE-MANUAL to REMOTE-AUTOMATIC. Flood the basin with mixed liquor and RAS to approximately 3 feet.
4. Switch the influent weir gates from REMOTE-MANUAL to REMOTE-AUTOMATIC. The gates should lower and begin controlling influent flow.
5. Switch aeration air flow control valves from REMOTE-MANUAL to REMOTE-AUTOMATIC. Adjust the dissolved oxygen (DO) setpoints as required.
6. Manually start the anoxic zone mixers through the PCS.
7. Switch the Nitrified Recycle Pump from REMOTE-MANUAL to REMOTE-AUTOMATIC. Adjust the recycle ratio as required.
8. Once the Aeration Basin level has risen to normal water level, switch the WAS control gate from REMOTE-MANUAL to REMOTE-AUTOMATIC so that it becomes part of the WAS wasting sequence.
9. Switch the WAS pump from REMOTE-MANUAL to REMOTE-AUTOMATIC. Adjust the desired amount of sludge to waste.

Note: Alternatively, the RAS flow control valve, the influent weir gates, and the air flow control valves can be left in MANUAL and manually controlled until the basin reaches a stable operation, when the valves/gates can be switched to REMOTE-AUTOMATIC mode.

Remote Manual Mode:

1. Determine the number of aeration basins to be put in service.
2. Manually open the Aeration Basin effluent gate from the HMI or local gate actuator at the center of the structure
3. Open the RAS flow control valve from REMOTE-MANUAL on the PCS by giving it a valve position. It is recommended to position the valve to a mostly closed position (10-20 percent open) so that not all of the RAS goes to the Aeration Basin being filled, and then gradually open it as the basin fills. Monitor the RAS flow rate and adjust as required to balance the flow split.
4. Open the influent weir gates from REMOTE-MANUAL on the PCS. Adjust the position as required to obtain desired flow over the gates.
5. Open the aeration air flow control valves from REMOTE-MANUAL on the PCS. Adjust the valve position as required to obtain the desired DO.
6. Start the Nitrified Recycle Pump from the PCS. Adjust the pump speed as required to obtain the desired flow rate.
7. Start the anoxic zone mixers through the PCS.

8. It is not necessary to adjust the WAS gate if other aeration basins are in service. The biomass is common to all basins, so wasting can occur from any of the basins. However, if the Aeration Basin is left in the REMOTE-MANUAL mode, periodically raising and lowering the WAS gate will remove any scum that accumulates at the end of the basin.
9. Start the WAS Pump from REMOTE-MANUAL. Adjust the pump speed until the desired flow rate is obtained. Note: As the level in the wet well decreases, the flow rate will decrease because the hydraulic head will increase. It is recommended to set the pump speed when the level in the wet well is at the approximate mid-depth.

Local Manual Mode:

1. Determine the number of aeration basins to be put in service.
2. Open the Aeration Basin effluent gate from the local gate actuator at the center of the structure.
3. Open the RAS flow control valve from the valve's LCS. It is recommended to position the valve to a mostly closed position (10-20 percent open) so that not all of the RAS goes to the aeration basin being filled, and then gradually open it as the basin fills. Monitor the RAS flow rate and adjust as required to balance the flow split.
4. Open the influent weir gates from the gate's LCS. Adjust the position as required to obtain the desired flow over the gates. Monitor the flow rate over the gate from local displays.
5. Open the aeration air flow control valves from the valves' LCS. Adjust as required to obtain the desired DO.
6. Start the Nitrified Recycle Pump from the LCS. Monitor the recycle flow rate and adjust the pump speed as required.
7. Manually start the anoxic zone mixers through the LCS.
8. It is not necessary to adjust the WAS gate if other aeration basins are in service. The biomass is common to all basins, so wasting can occur from any of the basins. However, if the aeration basin is left in the REMOTE-MANUAL mode, periodically raising and lowering the WAS gate will remove any scum that accumulates at the end of the basin.

Shutdown Procedures

Remote Automatic Mode:

1. Close the influent weir gates by switching from REMOTE-AUTOMATIC to REMOTE-MANUAL, then close the gates. The gates should lower and begin controlling influent flow
2. Close the RAS flow control valve by switching from REMOTE-AUTOMATIC to REMOTE-MANUAL, then close the valve.
3. Close the aeration basin effluent gate from the HMI or local gate actuator at the center of the structure.
4. Close the WAS control gate by switching from REMOTE-AUTOMATIC to REMOTE-MANUAL, then close the gate.
5. Stop the anoxic zone mixers through the PCS.
6. Stop the Nitrified Recycle Pump by switching from REMOTE-AUTOMATIC to REMOTE-MANUAL, and then stop the pump.
7. Switch the aeration air flow control valves from REMOTE-AUTOMATIC to REMOTE-MANUAL, and then close the valve. If the basin will be left full of mixed liquor, it is recommended to continue aerating the basin.

Abnormal Conditions

Aeration Basin Draining:

1. Shut down the basin to be drained as described above.
2. Verify drain pump will not be used by Membrane System.
3. Open the basin drain valve located near the Nitrified Recycle Pump. It is recommended to slowly open the valve until there is approximately 10 feet of mixed liquor in the drain pump station.
4. If the drain pump is in LOCAL, start the pump from the LCS. If the Drain Pump is in REMOTE-MANUAL, start the pump through the PCS. If the Drain Pump is in REMOTE-AUTOMATIC, the pump will start automatically.
5. Monitor the level in the drain pump pump station. This is an indication of the level in the Aeration Basin. As the level is drawn down, the pump will stop automatically if the pump is in REMOTE-AUTOMATIC. If the pump is in LOCAL or REMOTE-MANUAL, the pump will need to be stopped by the operator.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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30 - Aeration Basins

Alarm List

This section includes both the Aeration Basins alarm list and the Process Air Blowers alarm list.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 1 Mixer 1 FAIL-TO-START	Aeration Basin1Mixer 1 (63MIX10201) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 1 Mixer 2 FAIL-TO-START	Aeration Basin1Mixer 2 (63MIX10501) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 1 Mixer 3 FAIL-TO-START	Aeration Basin1Mixer 3 (63MIX10801) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 1 Mixer 4 FAIL-TO-START	Aeration Basin1Mixer 4 (63MIX11101) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 1 Mixer 5 FAIL-TO-START	Aeration Basin1Mixer 5 (63MIX12701) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 1 Mixer 1 FAIL-TO-STOP	Aeration Basin1Mixer 1 (63MIX10201) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 1 Mixer 2 FAIL-TO- STOP	Aeration Basin1Mixer 2 (63MIX10501) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 1 Mixer 3 FAIL-TO- STOP	Aeration Basin1Mixer 3 (63MIX10801) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 1 Mixer 4 FAIL-TO- STOP	Aeration Basin1Mixer 4 (63MIX11101) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 1 Mixer 5 FAIL-TO- STOP	Aeration Basin1Mixer 5 (63MIX12701) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 1 Mixer 1 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10401) has detected a High Temperature in Aeration Basin 1 Mixer 1 (63MIX10201)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 2 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10601) has detected a High Temperature in Aeration Basin1Mixer 2 (63MIX10501).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 1 Mixer 3 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10901) has detected a High Temperature in Aeration Basin1Mixer 3 (63MIX10801)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 4 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH11201) has detected a High Temperature in Aeration Basin1Mixer 4 (63MIX11101).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 5 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH12801) has detected a High Temperature in Aeration Basin1Mixer 5 (63MIX12701).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 1 MOTOR-LEAK-DETECTED	Sensor (63XSH10401) has detected a Motor Leak in Aeration Basin1Mixer Motor 1 (63MIX10201).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 2 MOTOR-LEAK-DETECTED	Sensor (63XSH10701) has detected a Motor Leak in Aeration Basin1Mixer Motor 2 (63MIX10501).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 3 MOTOR-LEAK-DETECTED	Sensor (63XSH11001) has detected a Motor Leak in Aeration Basin1Mixer Motor 3 (63MIX10801).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 4 MOTOR-LEAK-DETECTED	Sensor (63XSH11301) has detected a Motor Leak in Aeration Basin1Mixer Motor 4 (63MIX11101).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 1 Mixer 5 MOTOR-LEAK-DETECTED	Sensor (63XSH12901) has detected a Motor Leak in Aeration Basin1Mixer Motor 5 (63MIX12701).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 1 FAIL-TO-START	Aeration Basin 2 Mixer 1 (63MIX10202) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 2 Mixer 2 FAIL-TO-START	Aeration Basin 2 Mixer 2 (63MIX10502) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 2 Mixer 3 FAIL-TO-START	Aeration Basin 2 Mixer 3 (63MIX10802) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 2 Mixer 4 FAIL-TO-START	Aeration Basin 2 Mixer 4 (63MIX11102) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 2 Mixer 5 FAIL-TO-START	Aeration Basin 2 Mixer 5 (63MIX12702) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 2 Mixer 1 FAIL-TO-STOP	Aeration Basin 2 Mixer 1 (63MIX10202) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 2 Mixer 2 FAIL-TO- STOP	Aeration Basin 2 Mixer 2 (63MIX10502) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 2 Mixer 3 FAIL-TO- STOP	Aeration Basin 2 Mixer 3 (63MIX10802) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 2 Mixer 4 FAIL-TO- STOP	Aeration Basin 2 Mixer 4 (63MIX11102) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 2 Mixer 5 FAIL-TO- STOP	Aeration Basin 2 Mixer 5 (63MIX12702) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 2 Mixer 1 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10402) has detected a High Temperature in Aeration Basin 2 Mixer 1 (63MIX10201)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 2 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10602) has detected a High Temperature in Aeration Basin 2 Mixer 2 (63MIX10502).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 3 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10902) has detected a High Temperature in Aeration Basin 2 Mixer 3 (63MIX10802)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 4 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH11202) has detected a High Temperature in Aeration Basin 2 Mixer 4 (63MIX11102).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 5 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH12802) has detected a High Temperature in Aeration Basin 2 Mixer 5 (63MIX12702).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 1 MOTOR-LEAK-DETECTED	Sensor (63XSH10402) has detected a Motor Leak in Aeration Basin 2 Mixer Motor 1 (63MIX10201).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 2 MOTOR-LEAK-DETECTED	Sensor (63XSH10702) has detected a Motor Leak in Aeration Basin 2 Mixer Motor 2 (63MIX10502).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 3 MOTOR-LEAK-DETECTED	Sensor (63XSH11002) has detected a Motor Leak in Aeration Basin 2 Mixer Motor 3 (63MIX10802).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 4 MOTOR-LEAK-DETECTED	Sensor (63XSH11302) has detected a Motor Leak in Aeration Basin 2 Mixer Motor 4 (63MIX11102).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 2 Mixer 5 MOTOR-LEAK-DETECTED	Sensor (63XSH12902) has detected a Motor Leak in Aeration Basin 2 Mixer Motor 5 (63MIX12702).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 1 FAIL-TO-START	Aeration Basin 3 Mixer 1 (63MIX10203) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor and Breaker.
Aeration Basin 3 Mixer 2 FAIL-TO-START	Aeration Basin 3 Mixer 2 (63MIX10503) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 3 Mixer 3 FAIL-TO-START	Aeration Basin 3 Mixer 3 (63MIX10803) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 3 Mixer 4 FAIL-TO-START	Aeration Basin 3 Mixer 4 (63MIX11103) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 3 Mixer 5 FAIL-TO-START	Aeration Basin 3 Mixer 5 (63MIX12703) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 3 Mixer 1 FAIL-TO-STOP	Aeration Basin 3 Mixer 1 (63MIX10203) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 3 Mixer 2 FAIL-TO- STOP	Aeration Basin 3 Mixer 2 (63MIX10503) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 3 Mixer 3 FAIL-TO- STOP	Aeration Basin 3 Mixer 3 (63MIX10803) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 3 Mixer 4 FAIL-TO- STOP	Aeration Basin 3 Mixer 4 (63MIX11103) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 3 Mixer 5 FAIL-TO- STOP	Aeration Basin 3 Mixer 5 (63MIX12703) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 3 Mixer 1 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10303) has detected a High Temperature in Aeration Basin 3 Mixer 1 (63MIX10203)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 2 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10603) has detected a High Temperature in Aeration Basin 3 Mixer 2 (63MIX10503).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 3 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10903) has detected a High Temperature in Aeration Basin 3 Mixer 3 (63MIX10803)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 4 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH11203) has detected a High Temperature in Aeration Basin 3 Mixer 4 (63MIX11103).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 5 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH12803) has detected a High Temperature in Aeration Basin 3 Mixer 5 (63MIX12703).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 1 MOTOR-LEAK-DETECTED	Sensor (63XSH10403) has detected a Motor Leak in Aeration Basin 3 Mixer Motor 1 (63MIX10203).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 2 MOTOR-LEAK-DETECTED	Sensor (63XSH10703) has detected a Motor Leak in Aeration Basin 3 Mixer Motor 2 (63MIX10503).	Alarm shows on SCADA. Inspect the Mixer Motor.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 3 Mixer 3 MOTOR-LEAK-DETECTED	Sensor (63XSH11003) has detected a Motor Leak in Aeration Basin 3 Mixer Motor 3 (63MIX10803).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 4 MOTOR-LEAK-DETECTED	Sensor (63XSH11303) has detected a Motor Leak in Aeration Basin 3 Mixer Motor 4 (63MIX11103).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 3 Mixer 5 MOTOR-LEAK-DETECTED	Sensor (63XSH12903) has detected a Motor Leak in Aeration Basin 3 Mixer Motor 5 (63MIX12703).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 1 FAIL-TO-START	Aeration Basin 4 Mixer 1 (63MIX10204) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 4 Mixer 2 FAIL-TO-START	Aeration Basin 4 Mixer 2 (63MIX10504) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 4 Mixer 3 FAIL-TO-START	Aeration Basin 4 Mixer 3 (63MIX10804) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 4 Mixer 4 FAIL-TO-START	Aeration Basin 4 Mixer 4 (63MIX11104) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 4 Mixer 5 FAIL-TO-START	Aeration Basin 4 Mixer 5 (63MIX12704) has Failed to Start.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor, and Breaker.
Aeration Basin 4 Mixer 1 FAIL-TO-STOP	Aeration Basin 4 Mixer 1 (63MIX10204) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 4 Mixer 2 FAIL-TO- STOP	Aeration Basin 4 Mixer 2 (63MIX10504) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 4 Mixer 3 FAIL-TO- STOP	Aeration Basin 4 Mixer 3 (63MIX10804) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 4 Mixer 4 FAIL-TO- STOP	Aeration Basin 4 Mixer 4 (63MIX11104) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 4 Mixer 5 FAIL-TO- STOP	Aeration Basin 4 Mixer 5 (63MIX12704) has Failed to Stop.	Alarm shows on SCADA. Inspect the Mixer Motor, Motor Contactor.
Aeration Basin 4 Mixer 1 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10304) has detected a High Temperature in Aeration Basin 4 Mixer 1 (63MIX10204)	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 2 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10604) has detected a High Temperature in Aeration Basin 4 Mixer 2 (63MIX10504).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 4 Mixer 3 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH10903) has detected a High Temperature in Aeration Basin 4 Mixer 3 (63MIX10804).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 4 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH11204) has detected a High Temperature in Aeration Basin 4 Mixer 4 (63MIX11104).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 5 HIGH-MOTOR-TEMPERATURE	Sensor (63TSH12904) has detected a High Temperature in Aeration Basin 4 Mixer 5 (63MIX12704).	Alarm shows on SCADA. Shuts down and locks the Mixer Motor until RESET locally. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 1 MOTOR-LEAK-DETECTED	Sensor (63XSH10404) has detected a Motor Leak in Aeration Basin 4 Mixer Motor 1 (63MIX10204).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 2 MOTOR-LEAK-DETECTED	Sensor (63XSH10704) has detected a Motor Leak in Aeration Basin 4 Mixer Motor 2 (63MIX10504).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 3 MOTOR-LEAK-DETECTED	Sensor (63XSH11004) has detected a Motor Leak in Aeration Basin 4 Mixer Motor 3 (63MIX10804).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 4 MOTOR-LEAK-DETECTED	Sensor (63XSH11304) has detected a Motor Leak in Aeration Basin 4 Mixer Motor 4 (63MIX11104).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 4 Mixer 5 MOTOR-LEAK-DETECTED	Sensor (63XSH12904) has detected a Motor Leak in Aeration Basin 4 Mixer Motor 5 (63MIX12704).	Alarm shows on SCADA. Inspect the Mixer Motor.
Aeration Basin 1&2-Pass 1 Influent Channel HIGH LEVEL	Instrument (63LET12001) detected HIGH LEVEL in Aeration Basin 1&2-Pass 1 Influent Channel.	Alarm shows on SCADA.
Aeration Basin 1&2-Pass 5 Influent Channel HIGH LEVEL	Instrument (63LET12002) detected HIGH LEVEL in Aeration Basin 1&2-Pass 5 Influent Channel.	Alarm shows on SCADA.
Aeration Basin 3&4-Pass 1 Influent Channel HIGH LEVEL	Instrument (63LET12003) detected HIGH LEVEL in Aeration Basin 3&4-Pass 1 Influent Channel.	Alarm shows on SCADA.
Aeration Basin 3&4-Pass 5 Influent Channel HIGH LEVEL	Instrument (63LET12004) detected HIGH LEVEL in Aeration Basin 3&4-Pass 5 Influent Channel.	Alarm shows on SCADA.
Aeration Basin 1 HIGH DELTA	Instrument (63LET12601) has detected a HIGH DELTA in Aeration Basin 1.	Alarm shows on SCADA.
Aeration Basin 2 HIGH DELTA	Instrument (63LET12602) has detected a HIGH DELTA in an Aeration Basin 2.	Alarm shows on SCADA.
Aeration Basin 3 HIGH DELTA	Instrument (63LET12603) has detected a HIGH DELTA in an Aeration Basin 3.	Alarm shows on SCADA.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 4 HIGH DELTA	Instrument (63LET12604) has detected a HIGH DELTA in an Aeration Basin 4.	Alarm shows on SCADA.
Aeration Basin 1 HIGH LEVEL	Instrument (63LET12601) has detected a HIGH LEVEL in Aeration Basin 1.	Alarm shows on SCADA. Ensure membranes are keeping up with plant influent flow.
Aeration Basin 2 HIGH LEVEL	Instrument (63LET12602)) has detected a HIGH LEVEL in an Aeration Basin 2.	Alarm shows on SCADA. Ensure membranes are keeping up with plant influent flow.
Aeration Basin 3 HIGH LEVEL	Instrument (63LET12603) has detected a HIGH LEVEL in an Aeration Basin 3.	Alarm shows on SCADA. Ensure membranes are keeping up with plant influent flow.
Aeration Basin 4 HIGH LEVEL	Instrument (63LET12604) has detected a HIGH LEVEL in an Aeration Basin 4.	Alarm shows on SCADA. Ensure membranes are keeping up with plant influent flow.
Aeration Basin 1 Pump (63PMP11501) Fault	Pump (63PMP11501) in Aeration Basin 1 has Faulted.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 1 Pump (63PMP11501) FAIL-TO-START	Pump (63PMP11501) in Aeration Basin 1 has Failed to Start.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 1 Pump (63PMP11501) FAIL-TO-STOP	Pump (63PMP11501) in Aeration Basin 1 has Failed to Stop.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 1 Pump (63PMP11501) HIGH MOTOR TEMPERATURE	Sensor (63TSH11601) has detected a HIGH MOTOR TEMPERATURE in pump (63PMP11501)	Alarm shows on SCADA. The pump shuts down and locks out until RESET locally. Inspect the pump.
Aeration Basin 1 Pump (63PMP11501) MOTOR LEAK DETECTED	Sensor (63XSH11701) has detected a LEAK in pump (63PMP11501).	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 2 Pump (63PMP11502) Fault	Pump (63PMP11502) in Aeration Basin 2 has Faulted.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 2 Pump (63PMP11502) FAIL-TO-START	Pump (63PMP11502) in Aeration Basin 2 has Failed to Start.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 2 Pump (63PMP11502) FAIL-TO-STOP	Pump (63PMP11502) in Aeration Basin 2 has Failed to Stop.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 2 Pump (63PMP11502) HIGH MOTOR TEMPERATURE	Sensor (63TSH11602) has detected a HIGH MOTOR TEMPERATURE in pump (63PMP11502)	Alarm shows on SCADA. The pump shuts down and locks out until RESET locally. Inspect the pump.
Aeration Basin 2 Pump (63PMP11502) MOTOR LEAK DETECTED	Sensor (63XSH11702) has detected a LEAK in pump (63PMP11502).	Alarm shows on SCADA. Inspect the pump.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 3 Pump (63PMP11503) Fault	Pump (63PMP11503) in Aeration Basin 3 has Faulted.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 3 Pump (63PMP11503) FAIL-TO-START	Pump (63PMP11503) in Aeration Basin 3 has failed to start.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 3 Pump (63PMP11503) FAIL-TO-STOP	Pump (63PMP11503) in Aeration Basin 3 has failed to stop.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 3 Pump (63PMP11503) HIGH MOTOR TEMPERATURE	Sensor (63TSH11603) has detected a HIGH MOTOR TEMPERATURE in pump (63PMP11503)	Alarm shows on SCADA. The pump shuts down and locks out until RESET locally. Inspect the pump.
Aeration Basin 3 Pump (63PMP11503) MOTOR LEAK DETECTED	Sensor (63XSH11703) has detected a LEAK in pump (63PMP11503).	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 4 Pump (63PMP11504) Fault	Pump (63PMP11504) in Aeration Basin 4 has Faulted.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 4 Pump (63PMP11504) FAIL-TO-START	Pump (63PMP11504) in Aeration Basin 4 has failed to start.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 4 Pump (63PMP11504) FAIL-TO-STOP	Pump (63PMP11504) in Aeration Basin 4 has failed to stop.	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 4 Pump (63PMP11504) HIGH MOTOR TEMPERATURE	Sensor (63TSH11604) has detected a HIGH MOTOR TEMPERATURE in pump (63PMP11504)	Alarm shows on SCADA. The pump shuts down and locks out until RESET locally. Inspect the pump.
Aeration Basin 4 Pump (63PMP11504) MOTOR LEAK DETECTED	Sensor (63XSH11704) has detected a LEAK in pump (63PMP11504).	Alarm shows on SCADA. Inspect the pump.
Aeration Basin 1 LOW FLOW	Instrument (63FE11801) detected LOW FLOW in Aeration Basin 1.	Alarm shows on SCADA. Inspect the Basin Influent gates.
Aeration Basin 2 LOW FLOW	Instrument (63FE11802) detected LOW FLOW in Aeration Basin 2.	Alarm shows on SCADA. Inspect the Basin Influent gates.
Aeration Basin 3 LOW FLOW	Instrument (63FE11803) detected LOW FLOW in Aeration Basin 3.	Alarm shows on SCADA. Inspect the Basin Influent gates.
Aeration Basin 4 LOW FLOW	Instrument (63FE11804) detected LOW FLOW in Aeration Basin 4.	Alarm shows on SCADA. Inspect the Basin Influent gates.
Aeration Basin RAS Channel HIGH LEVEL	Instrument (64LET00500) has detected High Level in the Aeration Basin RAS Channel.	Alarm shows on SCADA. Inspect RAS flow control valves for proper function.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin RAS Channel LOW LEVEL	Instrument (64LET00500) has detected Low Level in the Aeration Basin RAS Channel.	Alarm shows on SCADA. Inspect the membrane feed pumps for proper function.

Process Air Alarms

ALARM	MEANING	RESPONSE OR ACTION
Process Air Blower 1 (63BLW20001) HIGH DISCHARGE PRESSURE	Process Air Blower 1 (63BLW20001) has detected HIGH DISCHARGE PRESSURE	Alarm shows on SCADA. Ensure the Process Air Header Pressure set point is adjusted properly. The second blower start point on the blower SEQ page may need adjusted to allow for a delayed start based on Oxygen demand.
Process Air Blower 2 (63BLW20002) HIGH DISCHARGE PRESSURE	Process Air Blower 2 (63BLW20002) has detected HIGH DISCHARGE PRESSURE	Alarm shows on SCADA. Ensure the Process Air Header Pressure set point is adjusted properly. The second blower start point on the blower SEQ page may need adjusted to allow for a delayed start based on Oxygen demand.
Process Air Blower 3 (63BLW20003) HIGH DISCHARGE PRESSURE	Process Air Blower 3 (63BLW20003) has detected HIGH DISCHARGE PRESSURE	Alarm shows on SCADA. Ensure the Process Air Header Pressure set point is adjusted properly. The second blower start point on the blower SEQ page may need adjusted to allow for a delayed start based on Oxygen demand.
Process Air Blower 1 (63BLW20001) HIGH HEADLOSS	Process Air Blower 1 (63BLW20001) has detected HIGH HEADLOSS	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 2 (63BLW20002) HIGH HEADLOSS	Process Air Blower 2 (63BLW20002) has detected HIGH HEADLOSS	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 3 (63BLW20003) HIGH HEADLOSS	Process Air Blower 3 (63BLW20003) has detected HIGH HEADLOSS	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 1 (63BLW20001) HIGH SUCTION TEMPERATURE	Process Air Blower 1 (63BLW20001) has detected HIGH SUCTION TEMPERATURE.	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 2 (63BLW20002) HIGH SUCTION TEMPERATURE	Process Air Blower 2 (63BLW20002) has detected HIGH SUCTION TEMPERATURE.	Alarm shows on SCADA. Inspect blower filters.

ALARM	MEANING	RESPONSE OR ACTION
Process Air Blower 3 (63BLW20003) HIGH SUCTION TEMPERATURE	Process Air Blower 3 (63BLW20003) has detected HIGH SUCTION TEMPERATURE.	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 1 (63BLW20001) HIGH DISCHARGE TEMPERATURE	Process Air Blower 1 (63BLW20001) has detected HIGH DISCHARGE TEMPERATURE.	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 2 (63BLW20002) HIGH DISCHARGE TEMPERATURE	Process Air Blower 2 (63BLW20002) has detected HIGH DISCHARGE TEMPERATURE.	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 3 (63BLW20003) HIGH DISCHARGE TEMPERATURE	Process Air Blower 3 (63BLW20003) has detected HIGH DISCHARGE TEMPERATURE.	Alarm shows on SCADA. Inspect blower filters.
Process Air Blower 1 (63BLW20001) HIGH MOTOR TEMPERATURE	Process Air Blower 1 (63BLW20001) has detected HIGH MOTOR TEMPERATURE.	Alarm shows on SCADA. Inspect blower coolant level.
Process Air Blower 2 (63BLW20002) HIGH MOTOR TEMPERATURE	Process Air Blower 2 (63BLW20002) has detected HIGH MOTOR TEMPERATURE.	Alarm shows on SCADA. Inspect blower coolant level.
Process Air Blower 3 (63BLW20003) HIGH MOTOR TEMPERATURE	Process Air Blower 3 (63BLW20003) has detected HIGH MOTOR TEMPERATURE.	Alarm shows on SCADA. Inspect blower coolant level.
Process Air Blower 1 (63BLW20001) HIGH BEARING TEMPERATURE	Process Air Blower 1 (63BLW20001) has detected HIGH BEARING TEMPERATURE.	Alarm shows on SCADA. Ensure blow off valves are closed to prevent excess vibration.
Process Air Blower 2 (63BLW20002) HIGH BEARING TEMPERATURE	Process Air Blower 2 (63BLW20002) has detected HIGH BEARING TEMPERATURE.	Alarm shows on SCADA. Ensure blow off valves are closed to prevent excess vibration.
Process Air Blower 3 (63BLW20003) HIGH BEARING TEMPERATURE	Process Air Blower 3 (63BLW20003) has detected HIGH BEARING TEMPERATURE.	Alarm shows on SCADA. Ensure blow off valves are closed to prevent excess vibration.
Process Air Blower 1 (63BLW20001) HIGH ROTOR VIBRATION	Process Air Blower 1 (63BLW20001) has detected HIGH ROTOR VIBRATION.	Alarm shows on SCADA. Ensure blow off valves are closed to prevent excess vibration.
Process Air Blower 2 (63BLW20002) HIGH ROTOR VIBRATION	Process Air Blower 2 (63BLW20002) has detected HIGH ROTOR VIBRATION.	Alarm shows on SCADA. Ensure blow off valves are closed to prevent excess vibration.
Process Air Blower 3 (63BLW20003) HIGH ROTOR VIBRATION	Process Air Blower 3 (63BLW20003) has detected HIGH ROTOR VIBRATION.	Alarm shows on SCADA. Ensure blow off valves are closed to prevent excess vibration.
Process Air Header LOW PRESSURE	Instrument (63PIT40500) has detected LOW PRESSURE in the Process Air Header.	Alarm shows on SCADA. Ensure both blowers are running. Inspect basins for broken air diffusers.
Process Air Header HIGH PRESSURE	Instrument (63PIT40500) has detected HIGH PRESSURE in the Process Air Header.	Alarm shows on SCADA. Ensure basin air flow control valves are opening and there is a demand for oxygen.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 1 Pass 3 HIGH DISSOLVED OXYGEN	Instrument (63AE14011) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 3 LOW DISSOLVED OXYGEN	Instrument (63AE14011) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 4 HIGH DISSOLVED OXYGEN	Instrument (63AE14012) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 4 LOW DISSOLVED OXYGEN	Instrument (63AE14012) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 7 HIGH DISSOLVED OXYGEN	Instrument (63AE14111) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 7 LOW DISSOLVED OXYGEN	Instrument (63AE14111) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 8 HIGH DISSOLVED OXYGEN	Instrument (63AE14112) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 1 Pass 8 LOW DISSOLVED OXYGEN	Instrument (63AE14112) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 1 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 3 HIGH DISSOLVED OXYGEN	Instrument (63AE14021) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 3 LOW DISSOLVED OXYGEN	Instrument (63AE14021) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 4 HIGH DISSOLVED OXYGEN	Instrument (63AE14022) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 4 LOW DISSOLVED OXYGEN	Instrument (63AE14022) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 7 HIGH DISSOLVED OXYGEN	Instrument (63AE14121) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 7 LOW DISSOLVED OXYGEN	Instrument (63AE14121) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 2 Pass 8 HIGH DISSOLVED OXYGEN	Instrument (63AE14122) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 2 Pass 8 LOW DISSOLVED OXYGEN	Instrument (63AE14122) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 2 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 3 HIGH DISSOLVED OXYGEN	Instrument (63AE14031) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 3 LOW DISSOLVED OXYGEN	Instrument (63AE14031) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 4 HIGH DISSOLVED OXYGEN	Instrument (63AE14032) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 4 LOW DISSOLVED OXYGEN	Instrument (63AE14032) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 7 HIGH DISSOLVED OXYGEN	Instrument (63AE14131) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 7 LOW DISSOLVED OXYGEN	Instrument (63AE14131) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 8 HIGH DISSOLVED OXYGEN	Instrument (63AE14132) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 3 Pass 8 LOW DISSOLVED OXYGEN	Instrument (63AE14132) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 3 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 3 HIGH DISSOLVED OXYGEN	Instrument (63AE14041) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 3 LOW DISSOLVED OXYGEN	Instrument (63AE14041) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 3.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 4 HIGH DISSOLVED OXYGEN	Instrument (63AE14042) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 4 LOW DISSOLVED OXYGEN	Instrument (63AE14042) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 4.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 7 HIGH DISSOLVED OXYGEN	Instrument (63AE14141) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 7 LOW DISSOLVED OXYGEN	Instrument (63AE14141) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 7.	Alarm shows on SCADA. Inspect Air Flow Control Valves.

ALARM	MEANING	RESPONSE OR ACTION
Aeration Basin 4 Pass 8 HIGH DISSOLVED OXYGEN	Instrument (63AE14142) has detected a HIGH DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.
Aeration Basin 4 Pass 8 LOW DISSOLVED OXYGEN	Instrument (63AE14142) has detected a LOW DISSOLVED OXYGEN condition in Aeration Basin 4 Pass 8.	Alarm shows on SCADA. Inspect Air Flow Control Valves.

Aeration Basin UPCP

Project: Spokane, WA
Plant: Spokane County RWRf
Date: April 11, 2011, January 31, 2017
Unit process number: 63

Summary

Biological treatment removes biochemical oxygen demand (BOD), solids, and nutrients from wastewater. The biological process includes the aeration basins and membrane basins and is collectively called a membrane bioreactor (MBR).

Process Overview

The MBR provides conditions or environments for BOD and nutrient removal, and removal of the biomass from the effluent prior to disinfection. The aeration basins provide for BOD and nutrient removal through a series of anoxic and aerobic zones to meet the effluent limits of the plant discharge permit. The membrane tanks filter the biomass (also called activated sludge or mixed liquor) from the wastewater and sends the clean water (permeate) to the chlorine contact basin as secondary effluent. The filtered biomass becomes RAS and flows back to the aeration basins. A small portion of the biomass is wasted to solids processing continuously to maintain a desired solids concentration in the MBR.

Unit Physical Information

The four aeration basins are located at the center of the treatment plant site, just south of the Primary Clarifiers. Together they make up a circular structure where each basin is a quadrant of the circle at 330,000 gallons. Baffle walls inside each basin create a serpentine flow path with a long length-to-width ratio. The basins are covered for odor control and foul air is removed by fans located at the odor control scrubbers. Low pressure atmospheric air for dissolved oxygen control is supplied by turbo blowers adjacent to the basin. Each quadrant includes one nitrified recycle pump, five anoxic mixers, and fine bubble air diffusers along the bottom of the aerobic zones.

Operational Parameters and Theory

The aeration basin portion of the MBR includes a step-feed (two feed points) activated sludge process that is configured as a series of anoxic and aerobic zones in each stage of the step-feed to provide nitrification and denitrification. Primary effluent flow is divided so that a portion goes to the first anoxic zone of each aeration basin, and the remainder

goes to the second anoxic zone. Typically, the flow split ratio between the first feed point and the second feed point is 60 percent and 40 percent, respectively. The flow split distributes loading in the basin and also ensures adequate carbonaceous substrate for denitrification in both anoxic zones.

Internal recirculation of nitrified mixed liquor from the first aerobic zone to the beginning of the first anoxic zone is facilitated by the nitrified recycle pump. The Nitrified Recycle Pump speed is variably controlled and can return up to 400 percent of the flow to the first stage anoxic zone, or up to 240 percent of the total primary effluent flow ($400\% \times 60\% = 240\%$). This return functions to enhance denitrification by combining mixed liquor high in nitrates with primary clarifier effluent under anoxic conditions.

RAS is added to the beginning of the first aerobic zone where it mixes with the mixed liquor from the end of the first anoxic zone. The mixed liquor and RAS flows through the first aerobic zone, then the second anoxic zone, and lastly through the second aerobic zone where it exits the basin through a submerged sluice gate at the bottom center of the aeration basin structure. The mixed liquor from all four aeration basins is combined in a submerged chamber at the bottom center of the structure and conveyed to the membrane feed pumps in a common pipe. The anoxic zones are mixed with submersible mixers that keep the mixed liquor solids in suspension and help prevent short-circuiting within the zone.

Mixed liquor is pumped up to the membrane basins by the Membrane Feed Pumps. The portion of the mixed liquor that is filtered as clean water is known as permeate or secondary effluent. The filtered solids remaining in the membrane basins flow over the basin effluent weirs and become the RAS, which is returned to the aeration basins by gravity.

Mixed liquor and surface foam are removed as waste activated sludge (WAS) from the end of each aeration basin at a higher elevation than the mixed liquor removal. The WAS from each basin flows over a motorized weir gate (one per basin) into a common wetwell. The WAS is then pumped to the blended sludge storage tank by one of two submersible WAS pumps. The WAS pumps are located at the bottom of the common WAS wetwell. The WAS pumps will operate continuously based on an operator-entered flow setpoint, and the WAS gates will sequentially open and close based on the level in the WAS sump. WAS removal serves to remove excess biological growth in order to maintain the MLSS concentration and the mean cell residence time.

The aeration zones are aerated with ALP, which is introduced to the basin through fine-bubble membrane diffusers located on the bottom of the basin. Air flow control valves at each aerobic zone modulate to maintain dissolved oxygen (DO) setpoints. The amount of air delivered to the aeration basins through the fine bubble diffusers is directly proportional to the DO measurements from within the liquids process flow stream.

Process Monitoring and Responsibilities

Because of the covers in place for odor control the aeration basin is primarily monitored remotely via the SCADA system. Each of the four basins can be operated and monitored independently.

Aeration Basins

Parameter	Units	Frequency	Source
Units Online	#	Daily	SCADA
Dissolved Oxygen	mg/L	Continuous	SCADA
Influent Flow	MGD	Continuous	SCADA
RAS Flow	GPM	Continuous	SCADA
WAS Flow	GPD	Daily	SCADA
Air Flow	SCFM	Daily	Meter
SRT	Days	Daily	Calculation
MLSS	mg/L	Daily	Handheld Meter
MLVSS	mg/L	Weekly	Lab
Nitrified Recycle Rate	MGD	Continuous	Calculation
Ammonia	mg/L	Continuous	SCADA
Nitrate	mg/L	Continuous	SCADA
Total phosphorus	mg/L	Daily	Lab
Orthophosphorus	mg/L	Continuous	SCADA
TKN	mg/L	Weekly	Lab
Biological Assesment	NA	Quarterly	Lab
Alkalinity	mg/L	Weekly	Lab
pH	SU	Continuous	SCADA

Control Parameters

Proper control of the operating parameters must be maintained at all times to successfully operate an activated sludge system. To do this, a good working understanding of these parameters is essential to maintain removal efficiency. The following operating parameters should be considered:

- Number of basins in service
- Mixed Liquor concentration

- Solids retention time (SRT), WAS wasting rate, and solids production rate
- RAS flow rate
- Nitrified recycle flow rate
- Flow split between 1st-stage and 2nd-stage of step-feed
- Aeration process DO concentration
- Aeration header pressure setpoint
- MBR pH

Number of Basins in Service

The number of units in service determines the aeration volume, which is important because it is one of the parameters controlling the treatment capacity. Given a constant MLSS concentration, increasing the number of basins online increases the treatment capacity on a loading basis. Increasing the number of basins online also increases the hydraulic retention time, essentially the contact time between activated sludge and pollutants.

Mixed Liquor Concentration

In an MBR, the use of membranes as the liquid/solids separation mechanism eliminates the need for secondary clarifiers and the typical need to limit the solids loading rate to the clarifiers. As a consequence, MBRs can be operated at mixed liquor concentrations in the aeration basins that are approximately three times higher than conventional activated sludge processes (7,000 to 9,000 milligrams per liter [mg/L]). Spokane County RWRf was designed with a target mixed liquor concentration of 8,000 mg/L in the aeration basin. In general increasing the MLSS concentration increases the treatment capacity due to increasing the biomass. Too low of a MLSS concentration will result in inadequate pollutant removal.

Solids Retention Time and Sludge Wasting Rate

In an MBR system, it is recommended to operate the system at an SRT of at least 10 days. The reason for this is that membranes require cleaning based on organic and inorganic fouling. One aspect of organic fouling is the presence of ‘biopolymers’ secreted by the microorganisms. If the sludge age is sufficient, then the microorganisms degrade the biopolymer and organic fouling is minimized. Because detection of the biopolymer is difficult, manufacturers recommend a 10-day SRT as a target because it has been shown that if complete nitrification occurs, the presence of biopolymers is not likely. Therefore, nitrification becomes an indicator of sufficient sludge age, and a 10-day SRT is typically required for nitrification, especially in cool wastewater temperatures.

The SRT is controlled by the amount of sludge wasted on a daily basis. Increasing wasting decreases SRT and vice versa. The SRT influences nitrification, microbial communities (mainly bacteria and protozoans), and floc structure.

RAS Flow Rate

In an MBR, the RAS flow rate is closely related to membrane performance. Unlike a conventional activated sludge system with secondary clarifiers, a high RAS rate is

required to prevent the mixed liquor in the membrane basins from becoming too concentrated. For the Spokane County RWRf, the target RAS rate is 300 percent of the influent flow, as explained below.

It is recommended that the mixed liquor concentration in the membrane basin not exceed approximately 12,000 mg/L for too long a period; otherwise, the membranes will become plugged and excessive pressure will be required to pull the clean water through the membrane. Consequently, more frequent cleaning may be required.

To describe how RAS flow rate is used to affect the RAS concentration, an example is used here. Membrane feed pumps pump mixed liquor from the aeration basins to the membrane basins where permeate (clean water, secondary effluent) is removed through the membrane, and the remaining solids and flow exit the membrane basin and are returned to the aeration basins as RAS. If the membrane feed pumps pump 200 percent of influent flow (2Q), and permeate is removed at 100 percent of influent flow (1Q), then the remaining flow is RAS and is 100 percent of influent flow (1Q). In this example, if the aeration basin mixed liquor concentration is 8,000 mg/L, and half the water is removed, the concentration in the membranes and RAS will double to 16,000 mg/L. Mathematically:

$$8,000 \text{ mg/L} \times (2Q/1Q) = 16,000 \text{ mg/L}$$

Similarly, if the membrane feed pump rate is 300 percent (3Q), and permeate flow is 100 percent (1Q,) then RAS is 200 percent (2Q), and the concentration in the membranes and RAS will be 12,000 mg/L. Mathematically:

$$8,000 \text{ mg/L} \times (3Q/2Q) = 12,000 \text{ mg/L}$$

The design was based on a RAS flow rate of 300 percent; therefore, following the approach above, the concentration in the membranes and RAS will be 10,700 mg/L. Mathematically:

$$8,000 \text{ mg/L} \times (4Q/3Q) = 10,700 \text{ mg/L}$$

In these examples, the aeration basin mixed liquor concentration is assumed to be 8,000 mg/L. If the basin concentration is less than 8,000 mg/L, then RAS flow rates could be less and still be below the target membrane/RAS concentration.

It is important to note that if the RAS concentration gets close to 12,000 mg/L or exceeds it for a brief period of time, the membranes will not fail or be damaged. It just means that they could require additional cleaning.

Nitrified Recycle Flow Rate

The function of the anoxic zones in the basins is to allow for denitrification which can reduce the total nitrogen content by reducing nitrate to nitrogen gas. For an anoxic zone to function, nitrates need to be present. In the first anoxic zone, nitrified effluent from

the first aerobic zone is recycled to the head of the first anoxic zone. For the Spokane RWRF, the design recycle flow rate is 400 percent of the influent flow.

Aeration Process DO Concentration and Air Header Pressure Setpoint

DO concentration in the aeration basins is another important operating parameter of the secondary system. Aeration DO is maintained by controlling the total air flow rate from the process air blowers and is typically set for 2 mg/L in the aerobic zones of the basins.

The amount of air delivered by the aeration blowers is varied to maintain the air header pressure setpoint. The goal of setting the pressure setpoint is to not have the pressure excessively high, which would result in an expensive operating system, and could limit the output of the blowers; and not set so low that air will not flow into the basin. Typically the pressure setpoint is adjusted so that the most open valve in the system is about 80 percent to 90 percent open.

The air header pressure is also affected greatly by the number of blowers online. During periods of high air demand the lag blower will turn on and during low demand periods only the lead blower will run. Plant influent flow determines when the lag blower is activated. The lag blower flow set point trigger is operator defined and can be adjusted depending on oxygen demand and header pressure.

MBR pH

The pH of the bioreactor can influence the rate of nitrification in the aerobic zones. If the pH is too low the biomass is less efficient at nitrification. pH is monitored at the effluent of the secondary system prior to disinfection. Adjustment of the pH is done by dosing 25% NaOH into the RAS channel.

Calculations and Recordkeeping

Most of the equations presented in this section are derived from a material balance around the secondary system. A material balance is an accounting method for describing the movement of a particular material (for example, BOD or TSS) through the system. The general word equation is:

$$\text{Mass added} + \text{Mass generated} = \text{Mass removed} + \text{Mass stored}$$

The destruction of mass (such as BOD oxidation and conversion) is considered as a negative generation.

Material balances can be calculated for any material. They may be calculated just for the aeration basins or they may be calculated for the entire system. The material balance can provide much useful information concerning process performance. It can be used to assess the impact of sludge waste and sludge return flows, the generation or growth of activated sludge, and quantitative changes in BOD and TSS throughout the plant.

Solids Retention Time

The solids retention time can be calculated by the following equation:

$$SRT = (V_{AB} * MLSS * N_{AB}) / [(Q_{WAS} * X_{WAS}) + (Q_E * X_E)]$$

Where:

SRT = Solids retention time, days

V_{AB} = Aeration basin volume, gallons

MLSS = Mixed liquor suspended solids, mg/L

N_{AB} = Number of aeration basins on-line

Q_{WAS} = WAS flow, gallons per day (gpd)

X_{WAS} = WAS suspended solids, mg/L

Q_E = Permeate flow, gpd

X_E = Permeate TSS, mg/L; typically =0 for membrane facility

WAS Wasting Rate Based on SRT

Microorganisms in the aeration basin(s) use the organic material in the wastewater for energy and reproduction. The microorganisms produced, plus the inert and nonbiodegradable solids that enter the system, must be wasted from the secondary treatment process to maintain the desired sludge concentrations and ages.

The amount of sludge to be wasted is described by the SRT equation above. For a desired SRT and measured MLSS and X_E , the WAS quantity to be wasted in one day can be determined by the following equation:

$$Q_{WAS} = [(V_{AB} * MLSS * N_{AB}) / SRT - Q_E * X_E] / X_{WAS}$$

Where:

SRT = Solids retention time, days

V_{AB} = Aeration basin volume, gallons

MLSS = Mixed liquor suspended solids, mg/L

N_{AB} = Number of aeration basins on-line

Q_{WAS} = WAS flow, gpd

X_{WAS} = WAS suspended solids, mg/L

Q_E = Permeate flow, gpd

X_E = Secondary effluent TSS, mg/L

Targets and Process Performance

Targets are based on achieving the design removal efficiencies and maintaining the health of the activated sludge.

Table 2
Targets for Aeration Basin

Parameter	Units	Minimum	Maximum
Units Online	#	1	4
Dissolved Oxygen	mg/L	1	3
Influent Flow	MGD	2	8
RAS Flow	GPM	3 Q*	4 Q*
WAS Flow	GPD	NA	NA
SRT	Days	10	20
MLSS	mg/L	7,000	12,000
Nitrified Recycle Rate	GPM	2.4 Q*	4.0 Q*
pH	Standard units	5.5	7.5

***Q represents the influent flow rate**

Relationship to Other Unit Processes

Loading to the Aeration Basins is directly influenced by removal efficiencies of the screening, grit, and CEPT systems. Higher removal efficiencies of any of those three processes will decrease loading in the Aeration Basins.

The aeration basin effluent characteristics influence the performance of the membranes. Higher portions of undesirable organic constituents can lead to organic fouling. Inadequate breakdown of inorganic constituents can lead to inorganic fouling of the membranes.

Waste activated sludge rates influences the anaerobic digester performance. Increased loading rates to the solids side will result in an increase in sludge production.

Common Problems and Troubleshooting

Aeration Basin Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Effluent Ammonia High	<ul style="list-style-type: none">• Low SRT• Low DO• Biological inhibition	<ul style="list-style-type: none">• Increase MLSS/Decrease WAS Rate• Increase diffused air• Eliminate toxicity
Effluent Nitrate High	<ul style="list-style-type: none">• Low carbon availability• High anoxic DO	<ul style="list-style-type: none">• Optimize influent flow split• Decrease PC removal

Condition	Possible Cause	Possible Solutions
High CBOD	<ul style="list-style-type: none"> Low DO 	<ul style="list-style-type: none"> Increase aerobic DO
Low Aerobic DO	<ul style="list-style-type: none"> Uneven air distribution Excess loading 	<ul style="list-style-type: none"> Check air delivery system Increase basins online Increase PC removal rates
High Anoxic DO	<ul style="list-style-type: none"> Excess aerobic DO Intermingling with aerobic zone 	<ul style="list-style-type: none"> Decrease Aerobic DO Inspect zone separation
Excess Foam (filamentous)	<ul style="list-style-type: none"> High SRT Nutrient deficiency High/Low DO 	<ul style="list-style-type: none"> Decrease SRT Adjust CEPT Adjust DO
High MLSS	<ul style="list-style-type: none"> High RAS return Low wasting rate 	<ul style="list-style-type: none"> Decrease RAS return Increase wasting rate
Low MLSS	<ul style="list-style-type: none"> Low RAS return High wasting rate 	<ul style="list-style-type: none"> Increase RAS return Decrease wasting rate
Low SRT	<ul style="list-style-type: none"> High WAS rate 	<ul style="list-style-type: none"> Decrease WAS rate
High SRT	<ul style="list-style-type: none"> Low WAS rate 	<ul style="list-style-type: none"> Increase WAS rate
High Level	<ul style="list-style-type: none"> Loss of MLSS pumping MLSS Q<Influent Q 	<ul style="list-style-type: none"> See pump failure Check programming
Low Level	<ul style="list-style-type: none"> MLSS Q>Influent Q 	<ul style="list-style-type: none"> Check programming
Mixer Failure	<ul style="list-style-type: none"> Breaker failure Contactator failure Motor failure High Temperature Moisture intrusion 	<ul style="list-style-type: none"> Inspect breaker Inspect motor contactor Inspect motor Inspect motor Inspect the mixer motor
Pump Failure	<ul style="list-style-type: none"> Motor/pump failure Motor Leak Fail to stop Fail to start High Temperature 	<ul style="list-style-type: none"> Inspect pump/motor Inspect motor Inspect pump Inspect pump Inspect motor
RAS Low Level	<ul style="list-style-type: none"> High flow 	<ul style="list-style-type: none"> Check RAS flows
RAS High Level	<ul style="list-style-type: none"> Low RAS flow 	<ul style="list-style-type: none"> Check RAS flows

Alternate Modes of Operation

The basins are designed around an average influent flow of 8 MGD with a constituent composition as listed in the Service Contract. If the influent loading is less than design it may be necessary to reduce the number of basins in service. Each basin can handle approximately (2) two MGD, so for each decrease of 2 MGD an additional basin can be

taken offline.

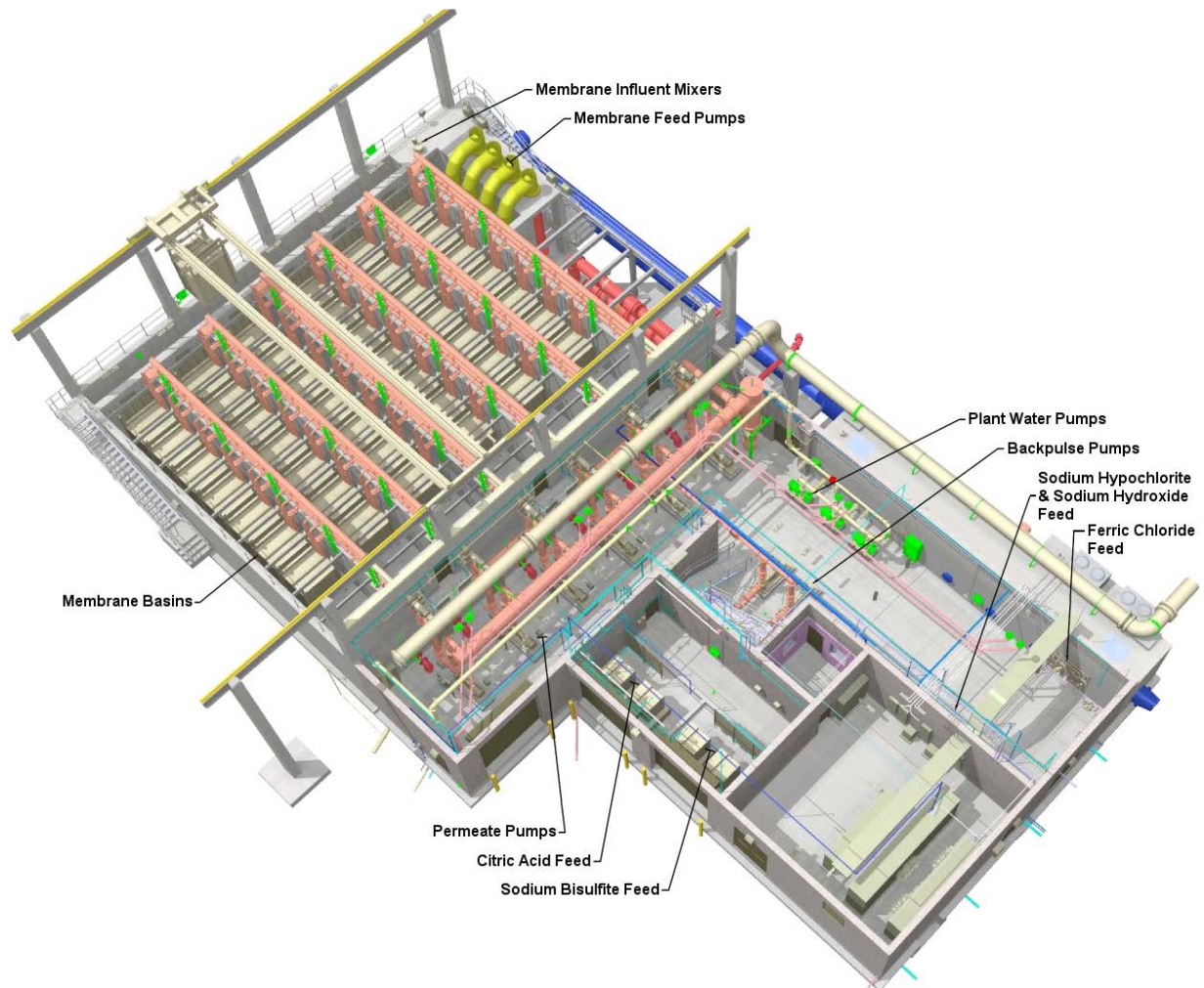
Another alternative mode of operation would be to increase or decrease the MLSS concentration to compensate for changes in loading or if maintenance is necessary for that basin. Limits on MLSS concentration are determined by the design and operational limits of the membranes.

The first anoxic zone can be operated as an influent fermentation tank by turning off the denitrification return pump. This would stop the flow of mixed liquor activated sludge to the zone and influent only would pass through the zone with a detention time proportionate to flow.

If less than all four aeration basins are needed in regular operation the offline basins can be stored either wet or dry. The basin(s) can be filled with clean water or left empty. In either situation any remaining head space in the basin up to maximum water elevation level can be utilized as emergency or temporary storage of mixed liquor, RAS, or influent.

For short periods of time a basin can be isolated with mixed liquor present in the basin. This mode would involve shutting the influent, RAS, effluent, waste, and drain gates and or valves. In this manner an extended treatment or contact time could be applied until conditions allow a return to normal operation.

Overview



Purpose

The membrane basins contain membrane filters that separate the biomass (also called activated sludge or mixed liquor) from the wastewater and transfers the clean water (permeate) to the Chlorine Contact Basin as secondary effluent. The filtered biomass becomes RAS and flows back to the aeration basins.

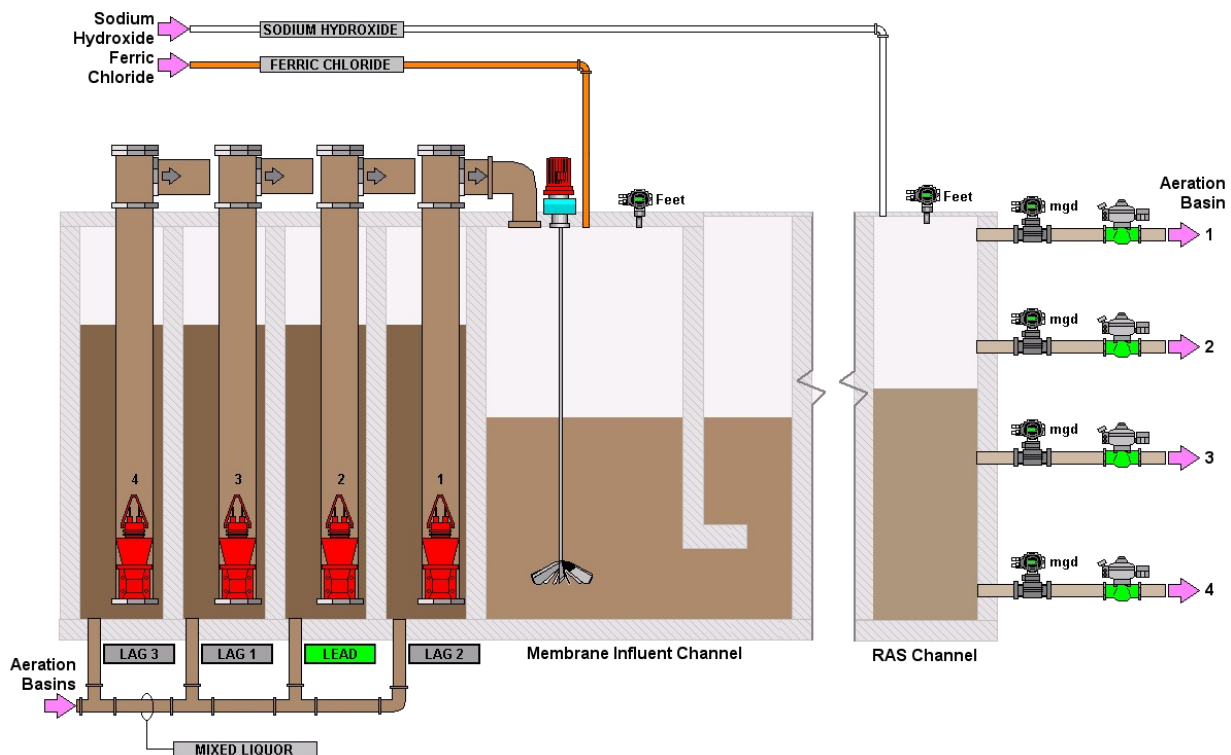
The membrane basins are part of the secondary process, which also includes the aeration basins, and is collectively called a MBR. This section of the O&M Manual focuses on the membrane basins, but because the aeration basins are

an integral part of the MBR, refer also to the Aeration Basins process control narrative.

Much of the equipment associated with the membrane process is provided and controlled by the membrane system supplier GE Water Technologies (formerly known as Zenon). Refer to the GE W&PT Spokane County RWRf Control Narrative for a complete process control description of the Membrane System Package.

Description

The membrane process is located south of the aeration basins and includes the membrane feed pumps, the membrane package, the membrane air scour blowers, and the membrane cleaning chemicals.



Mixed liquor from the aeration basins is pumped up to the membrane basin feed channel by the Membrane Feed Pumps. Four variable-speed submersible membrane feed pumps are located on the north side of the membrane basins between the membranes and the aeration basins.

Mixed liquor in the membrane feed channel is dosed and mixed with ferric chloride to precipitate remaining phosphorus from the process flowstream. The vertical shaft mixer is located at the north end of the feed channel near the

pumps, and the ferric addition point is near the mixer. Refer to the Ferric Chloride process control narrative for further details. The mixed liquor is evenly distributed to the membrane basins across Membrane Influent Gates into the membrane trains.

In each membrane train, secondary effluent (membrane permeate) is pulled through the membranes and pumped via the permeate pumps to the disinfection system at the Chlorine Contact Basins. The filtered solids remaining in the basin flow over the basin effluent weir and become the RAS, which flows back to the aeration basins by gravity.

Air is added to the membrane basins to help clean the membranes and prevent them from becoming “blinded” by the mixed liquor solids. The amount of air is determined by the Membrane Control System and is generally based on the number of membrane trains in service. The scour air is supplied to the membrane by Air Scour Blowers located on the east side of the aeration basins near the Process Air Blowers. The Air Scour Blowers are turbo air-bearing type, and are directly driven by an adjustable speed drive. Backup air for membrane air scour is provided by the process blowers serving the Aeration Basins.

As described above, much of the equipment associated with the membrane process is provided and controlled by the membrane system supplier. The Packaged Membrane System includes:

- Membranes provided by GE Water (formerly known as Zenon)
- Six hollow-fiber membrane trains (basins)
- Five trains of 340 square foot modules wherein eight membrane cassettes are installed per train consisting of: seven cassettes populated with 48 modules, and one cassette populated with 38 or 39 modules
- One train of 370 square foot modules wherein eight membrane cassettes are installed consisting of: six cassette populated with 48 modules and two cassettes populated with 28 modules
- Six permeate pumps for transferring membrane-filtered secondary effluent over to disinfection
- Two backpulse pumps and chemical feed pumps that clean the membranes using sodium hypochlorite and citric acid

The two backpulse pumps use secondary effluent from the permeate pump header to supply backwash water to the membrane in a reverse-flow direction. Sodium hypochlorite or citric acid is injected into the backwash water to clean the membranes from the inside out.

The membranes are periodically cleaned to remove fouling that may have accumulated on the membranes. A drain system is in place to dewater the membrane tanks and clean the membranes. When a membrane basin is taken out of service, its respective Membrane Influent Gate is closed, the Membrane Drain Valve is opened, and the Membrane Drain Pump discharges flow from the tank back to the RAS channel. Exhibit 40-1 is a partial example components list for the Membrane System.

Design Criteria and Component List

EXHIBIT 40-1

Membrane System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Membrane Feed Pump	64PMP00101, 64PMP00102, 64PMP00103, 64PMP00104	Quantity: 4 Type: Vertical, Axial Flow, Adjustable Speed Flow Rate (gpm): 9250 Pressure (TDH/ft): 10 Power (hp): 44
Mixer	64MXR02200	Quantity: 1 Type: Vertical Power (hp): 2
Gate	64GTE52001, 64GTE52002, 64GTE52003, 64GTE52004, 64GTE52005, 64GTE52006	Quantity: 6 Type: Weir Width (ft): 3
Permeate Pump	Packaged Equipment	Quantity: 6 Type: Horizontal, End Suction, Centrifugal Flow Rate (gpm): 1970 Power (hp): 30
Air Scour Blower	63BLW30001, 63BLW30002, 63BLW30003	Quantity: 3 Type: Turbo, Adjustable Speed Airflow Rate (scfm): 5700 Pressure (psig): 5.4 Power (hp): 200
Membrane Drain Pump	63PMP00700	Quantity: 1 Type: Submersible, Constant Speed Flow Rate (gpm): 2100 Pressure (TDH/ft): 12 Power (hp): 15
NOTES: gpm = gallons per minute TDH/ft = total dynamic head per foot		

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
scfm = standard cubic feet per minute psig = pounds per square inch gauge		

Process Control Variables

Control Variables

The membrane process is generally a self-controlled system as required/determined by the system supplier, GE Water Technologies (formerly Zenon).

Non Controllable Variables

Influent Flow Rate

The MBR influent flow is dictated primarily by the flow rate into the treatment plant, and is weather-dependent.

Influent Wastewater and Recycle Flow Characteristics

These include such influent concentrations as BOD, TSS, ammonia and phosphorus to the MBR system.

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Operating Strategies

Membrane Feed Pumps

Membrane Feed Pumps are controlled to maintain a RAS flow. The flow that they pump is distributed to the membranes in a passive flow split over opened-closed weir gates. Liquid levels are measured in the Membrane Influent Channel by a pressure level transmitter. The transmitter indicates liquid levels remotely at SCADA. Liquid levels are reported by height or elevation in units of feet and tenths. A HIGH level in the channel alarms to SCADA and shuts down the Membrane Feed Pumps. The plant operator inputs the HIGH level alarm setpoint (adjustable).

Permeate Pumps

Membrane Permeate Pumps are flow-controlled by the Membrane System master PLC. Flow rate setpoints are set to match plant influent flows and adjusted by the liquid level in the Aeration Basins.

The Membrane System master PLC calculates the overall total secondary effluent flow rate and communicates that value to the PCS.

Air Scour Blowers

ALP is delivered to the membranes by Air Scour Blowers. Each blower is directly driven by an adjustable speed drive that provides high efficiency without the need for any gear box or inlet/outlet guide vanes. The aeration scheme is designed to provide an airflow setpoint as required based on number of membrane trains in service combined with process air demands, with the position of the membrane flow control valves determined by the membrane control system. This arrangement reduces overall energy consumption while maintaining membrane air scour requirements. Backup air for membrane air scour is provided by the process blowers serving the Aeration Basins.

Membrane Drain Pump

The Membrane Drain Pump is automatically controlled based on the liquid level in the wet well. Exhibit 40-2 lists some example control modes for the Membrane Feed Pumps, Air Scour Blowers, and Membrane Drain Pump.

EXHIBIT 40-2

Membrane Feed Pumps, Air Scour Blowers, and Membrane Drain Pump Example Control Modes

MODE	DESCRIPTION	REFERENCES
Membrane Feed Pumps		
Manual/Local	Membrane Feed Pumps are provided with ON-OFF-SPEED control by LOCAL-MANUAL mode at each respective LCP.	
Manual/Remote	Membrane Feed Pumps are provided with ON-OFF-SPEED control by REMOTE-MANUAL mode at the HMI.	
Auto/Remote	Membrane Feed Pumps are provided with ON-OFF-SPEED control by REMOTE-AUTO mode by SCADA. In REMOTE-AUTO mode, pump speed is adjusted to maintain total RAS flow rate at approximately 300 percent of the influent flow rate.	
Auto/Remote	SCADA monitors LOCAL/REMOTE status; MANUAL/AUTO status, FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions, and drive speed. Pump FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions alarm to SCADA.	
Manual/Local	Each weir gate has an OPEN-STOP-CLOSE switch controlled at the gate actuator in LOCAL-MANUAL mode.	
Manual/Remote	Each weir gate has an OPEN-STOP-CLOSE switch controlled at the HMI in REMOTE-MANUAL mode.	
Auto/Remote	In REMOTE-AUTO mode, gate position is set to the CLOSED position for membrane basin recovery cleans controlled by the membrane basin drain sequence of operation.	
Auto/Remote	SCADA monitors gate position and reports whether the gate is being controlled in LOCAL-MANUAL mode at the gate actuator, REMOTE-MANUAL mode at the HMI, or REMOTE-AUTO mode by SCADA for membrane basin recovery cleaning.	
Air Scour Blowers		
Manual/Local	In LOCAL-MANUAL mode the air scour blowers are turned ON-OFF by a START-STOP switch and blower speed is adjusted manually at the LCP.	
Manual/Remote	In REMOTE-MANUAL mode the air scour blowers are turned ON-OFF by a START-STOP switch and blower speed is adjusted manually at the HMI.	
Auto/Remote	In REMOTE-AUTO mode the air scour blowers speed is adjusted by the PCS based on a flow setpoint as determined by the GE Membrane Control System.	
Auto/Remote	SCADA monitors ON-OFF-SPEED status of the blower drive and reports whether the blower is being controlled in LOCAL-MANUAL mode at the respective LCP, REMOTE-MANUAL mode at the HMI, or REMOTE-AUTO mode by SCADA.	

Auto/Remote	SCADA monitors LOCAL/REMOTE status, MANUAL/AUTO status, alarm conditions and drive speed of the blowers.	
Auto/Remote	ALP airflow rate is measured, scaled, indicated and trend analysis done by SCADA. SCADA monitors for FLOW and FAIL conditions.	
Membrane Drain Pump		
Manual/Local	In LOCAL-MANUAL mode the Membrane Drain Pump is controlled by an ON-OFF switch at the LCP.	
Manual/Remote	In REMOTE-MANUAL mode the Membrane Drain Pump is controlled by an ON-OFF switch at the HMI.	
Auto/Remote	In REMOTE-AUTO mode, the ON-OFF switch of the Membrane Drain Pump is controlled automatically by turning the pump ON upon a HIGH level detection and turning the pump OFF upon a LOW level detection.	
Auto/Remote	SCADA monitors LOCAL/REMOTE status, ON/OFF status, and FAIL/HIGH MOTOR TEMP/MOTOR LEAK conditions. Alarm conditions to SCADA include pump FAIL/HIGH MOTOR TEMP/MOTOR LEAK.	
NOTES: LCP = local control panel HMI = human-machine interface SCADA = supervisory control and data acquisition RAS = return activated sludge PCS = Plant Control System		

Startup Procedures

Remote Automatic Mode:

1. Verify the Aeration Basins are full of mixed liquor.
2. Verify the Membrane System is operational, and in AUTOMATIC mode.
3. Verify the membrane basin influent gates are in REMOTE at the LCS, and OPEN.
4. Verify the Air Scour Blowers are in REMOTE at the LCP, and ready to function.
5. Enter a RAS flow setpoint at the HMI to the PCS.
6. Verify the RAS flow control valves are in REMOTE at the LCS, and OPEN.
7. Verify the Membrane Feed Pumps are in REMOTE at the LCS, and in AUTOMATIC at the HMI. The pumps should start and begin pumping.
8. The Membrane System master PLC will not start the Permeate Pumps until either flow is entering the treatment plant, or the level in the aeration basin is above setpoint. If the Permeate Pumps do not start pumping, the mixed

liquor pumped to the membrane basins will pass through the membrane basin and become RAS, and will return to the aeration basin by gravity.

9. When influent wastewater does start entering the treatment plant, the Permeate Pumps will start operating, the blowers will operate to maintain the flow setpoint, and the Membrane Feed Pumps will increase speed to maintain the RAS flow ratio.
10. Start the mixer and begin adding ferric chloride.

Remote Manual Mode:

1. IT IS NOT RECOMMENDED TO OPERATE THE MEMBRANE SYSTEM IN MANUAL. This includes the Membrane System, the Air Scour Blowers, and the Backpulse Pumps.
2. Verify the Membrane Feed Pumps are in REMOTE at the LCS, and in MANUAL at the HMI. Start the pumps and adjust the speed to obtain the desired RAS flow.
3. Verify the membrane mixer is in REMOTE at the LCS, and in MANUAL at the HMI. Start the mixer and begin adding ferric chloride.

Local Manual Mode:

1. IT IS NOT RECOMMENDED TO OPERATE THE MEMBRANE SYSTEM IN MANUAL. This includes the Membrane System, the Air Scour Blowers, and the Backpulse Pumps.
2. Verify the Membrane Feed Pumps are in LOCAL at the LCS. Start the pump and adjust speed at the LCS to obtain the desired RAS flow.
3. Verify the membrane mixer is in LOCAL at the LCS. Start the mixer.

Shutdown Procedures

Remote Automatic Mode:

1. Verify the Aeration Basins are not receiving wastewater.
2. With the system components in AUTOMATIC, as the flows to the MBR decrease to zero, the Membrane System master control system will automatically shut down the membrane trains.
3. After treatment plant flow has been reduced to zero for a period of time, switch the Membrane Feed Pumps to MANUAL at the LCS, and STOP the pumps.

4. Verify the RAS flow control valves are in REMOTE at the LCS, and OPEN.
5. Stop the membrane channel mixer and begin adding ferric chloride.

Remote Manual Mode:

1. Verify the Aeration Basins are not receiving wastewater.
2. With the system components in AUTOMATIC, as the flows to the MBR decrease to zero, the Membrane System master control system will automatically shut down the membrane trains.
3. After treatment plant flow has been reduced to zero for a period of time, switch the Membrane Feed Pumps to MANUAL at the LCS, and STOP the pumps.
4. Verify the RAS flow control valves are in REMOTE at the LCS, and OPEN.
5. Stop the membrane channel mixer and begin adding ferric chloride.

Additional Control Features

See GE Water Technologies' Process Control and Operation manuals.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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40 - Membrane System

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Membrane Feed Pump 1 FAIL-TO-START	Membrane Feed Pump 1 (64PMP00101) has Failed to Start.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 2 FAIL-TO-START	Membrane Feed Pump 2 (64PMP00102) has Failed to Start.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 3 FAIL-TO-START	Membrane Feed Pump 3 (64PMP00103) has Failed to Start.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 4 FAIL-TO-START	Membrane Feed Pump 4 (64PMP00104) has Failed to Start.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 1 FAIL-TO-STOP	Membrane Feed Pump 1 (64PMP00101) has Failed to Stop.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 2 FAIL-TO-STOP	Membrane Feed Pump 2 (64PMP00102) has Failed to Stop.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 3 FAIL-TO-STOP	Membrane Feed Pump 3 (64PMP00103) has Failed to Stop.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 4 FAIL-TO-STOP	Membrane Feed Pump 4 (64PMP00104) has Failed to Stop.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 1 FAULT	Membrane Feed Pump 1 (64PMP00101) has a drive Fault.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 2 FAULT	Membrane Feed Pump 2 (64PMP00102) has a drive Fault.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 3 FAULT	Membrane Feed Pump 3 (64PMP00103) has a drive Fault.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 4 FAULT	Membrane Feed Pump 4 (64PMP00104) has a drive Fault.	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor equipment.

ALARM	MEANING	RESPONSE OR ACTION
Membrane Feed Pump 1 HIGH MOTOR TEMPERATURE	Instrument (64TSH00201) has detected High Motor Temperature condition in Membrane Feed Pump 1 (64PMP00101)	Alarm shows on SCADA. Confirm that the pump is shut down and locked out until RESET locally. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 2 HIGH MOTOR TEMPERATURE	Instrument (64TSH00202) has detected High Motor Temperature condition in Membrane Feed Pump 2 (64PMP00102)	Alarm shows on SCADA. Confirm that the pump is shut down and locked out until RESET locally. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 3 HIGH MOTOR TEMPERATURE	Instrument (64TSH00203) has detected High Motor Temperature condition in Membrane Feed Pump 3 (64PMP00103)	Alarm shows on SCADA. Confirm that the pump is shut down and locked out until RESET locally. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 4 HIGH MOTOR TEMPERATURE	Instrument (64TSH00204) has detected High Motor Temperature condition in Membrane Feed Pump 4 (64PMP00104)	Alarm shows on SCADA. Confirm that the pump is shut down and locked out until RESET locally. Inspect Membrane Feed Pump Motor equipment.
Membrane Feed Pump 1 MOTOR LEAK DETECTED	Instrument (64XSH00301) has detected High Motor Temperature condition in Membrane Feed Pump 1 (64PMP00101)	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor 1 equipment.
Membrane Feed Pump 2 MOTOR LEAK DETECTED	Instrument (64XSH00302) has detected High Motor Temperature condition in Membrane Feed Pump 2 (64PMP00102)	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor 2 equipment.
Membrane Feed Pump 3 MOTOR LEAK DETECTED	Instrument (64XSH00303) has detected High Motor Temperature condition in Membrane Feed Pump 3 (64PMP00103)	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor 3 equipment.
Membrane Feed Pump 4 MOTOR LEAK DETECTED	Instrument (64XSH00304) has detected High Motor Temperature condition in Membrane Feed Pump 4 (64PMP00104)	Alarm shows on SCADA. Inspect Membrane Feed Pump Motor 4 equipment.
Membrane Mixer Motor FAIL-TO-START	Membrane Mixer Motor (64MXR02200) has failed to start.	Alarm shows on SCADA. Inspect Membrane Mixer Motor 1 equipment
Membrane Mixer Motor FAIL-TO-STOP	Membrane Mixer Motor (64MXR02200) has failed to stop.	Alarm shows on SCADA. Inspect Membrane Mixer Motor 1 equipment
Membrane Mixer Motor FAULT	Membrane Mixer Motor (64MXR02200) has a drive Fault.	Alarm shows on SCADA. Inspect Membrane Mixer Motor 1 equipment
Membrane Influent Channel LOW LEVEL	Instrument (64LET00400) has detected Low Level condition in the Membrane Influent Channel.	Alarm shows on SCADA.
Membrane Influent Channel HIGH LEVEL	Instrument (64LSH00400) has detected High Level condition in the Membrane Influent Channel.	Alarm shows on SCADA.
Membrane Influent Channel HIGH-HIGH LEVEL	Instrument (64LET00400) has detected High-High Level condition in the Membrane Influent Channel.	Alarm shows on SCADA.

Membrane Filtration UPCP

Project: Spokane, WA
Plant: Spokane County RWRf
Date reviewed: April 18, 2011, March 8, 2017
Unit process number: 64

Summary

The membranes filter the Mixed Liquor Suspended Solids (MLSS) effluent from the Aeration Basins, the removed Permeate proceeds to the Disinfection process and the concentrated Activated Sludge is returned to the Aeration basins as Return Activated Sludge (RAS).

Process Overview

The membrane basins contain membrane filters that separate the biomass (also called activated sludge or mixed liquor) from the wastewater and transfers the clean water (permeate) to the Chlorine Contact Basin as secondary effluent. The unfiltered biomass becomes RAS and flows back to the aeration basins. The membrane basins are part of the secondary process, which also includes the aeration basins, and is collectively called a Membrane BioReactor (MBR).

Mixed liquor from the aeration basins is pumped up to the membrane basin feed channel through the Membrane Feed Pumps. Four variable-speed submersible membrane feed pumps are located on the north side of the membrane basins between the membranes and the aeration basins.

Mixed liquor in the membrane feed channel is dosed and mixed with ferric chloride to precipitate the remaining phosphorus from the process flow stream. The vertical shaft mixer is located at the north end of the feed channel near the pumps, and the ferric addition point is near the mixer. The mixed liquor is evenly distributed to the membrane basins across Membrane Influent Gates into the membrane trains.

In each membrane train, secondary effluent (membrane permeate) is pulled through the membranes and pumped via the permeate pumps to the disinfection system at the Chlorine Contact Basins. The concentrated solids remaining in each train flow over the train effluent weir and becomes RAS which flows back to the aeration basins by gravity. The equal distribution of RAS flow to the four aeration basins is controlled by actuated butterfly valves.

Air at low pressure is introduced to the membrane basins through coarse bubble diffusers. The low pressure air helps clean the membranes and prevent them from becoming fouled by the mixed liquor suspended solids. The amount of air is determined by the Membrane Control System and is based on the number of membrane trains in service. The scour air

is supplied to the membrane basins by Air Scour Blowers located on the east side of the aeration basins near the Process Air Blowers. The Air Scour Blowers are turbo air-bearing type, and are directly driven by an adjustable speed drive. Backup air for membrane air scour can be provided by a process blower serving the Aeration Basins by means of isolation valves.

The two back pulse pumps use secondary effluent from the permeate pump header to supply backwash water to the membrane in a reverse-flow direction. Sodium hypochlorite or citric acid can be injected into the backwash water to clean the membranes during a maintenance clean or recovery clean.

The membranes are periodically cleaned to remove fouling that may have accumulated on the membranes. Shorter maintenance cleans are done with the existing mixed liquor in place. Longer recovery cleans require draining the basin and filling in order to reach the respective pH or chlorine concentration. A drain system is in place to dewater the membrane tanks and clean the membranes.

Unit Physical Information

The membrane process is located south of the aeration basins and includes the membrane feed pumps, the membrane package, the membrane air scour blowers, and the membrane cleaning chemicals. The Packaged Membrane System includes:

- Membranes provided by GE Water (formerly known as Zenon).
- Six hollow-fiber membrane trains (basins). Each basin is 56.5' long, 10' wide, 12' side water depth, and holds 42,300 gallons.
- Train 1 contains eight membrane cassettes populated with 370 square foot modules: six cassettes populated with 48 modules, and two cassettes populated with 28 modules. This train has 127,280 square feet of filtration surface area.
- Trains 2-4 contain eight membrane cassettes populated with 340 square foot modules: seven cassettes populated with 48 modules and one cassette populated with 38 modules. These trains have 127,160 square feet of filtration surface area each.
- Trains 5-6 contain eight membrane cassettes populated with 340 square foot modules: seven cassettes populated with 48 modules and one cassette populated with 39 modules. These trains have 127,500 square feet of filtration surface area each.
- Four submersible, vertical, axial-flow membrane feed pumps.
- Six horizontal centrifugal permeate pumps for transferring membrane-filtered secondary effluent over to disinfection.

- Two horizontal centrifugal back pulse pumps for back pulsing and clean in place procedures.
- Two pneumatic diaphragm sodium hypochlorite feed pumps and two pneumatic diaphragm citric acid feed pumps.

Operational Parameters and Theory

The membranes are a physical barrier and separate solids and liquids by applying suction pressure with the permeate pumps on the downstream side of the membranes. The hollow fibers deploy an “outside in” filtration where liquid is pulled from the area surrounding the membranes and into the middle and then transported to a common header. The suction of liquid through the membranes attracts solids larger than the membrane pore size to the surface of the membranes, which over time will plug the filter pores. To counteract plugging there are three methods of self cleaning: an air scour system to dislodge particles from the surface, a back pulsing system where filtered water is pushed in the opposite direction of filtration to relieve plugging, and two chemical cleaning methods, sodium hypochlorite to remove organic fouling and citric acid to remove inorganic fouling.

Process Monitoring and Responsibilities

The bulk of monitoring for membranes is conducted via instrumentation that reads out to the operator accessible SCADA system. Some manual checks will be conducted daily.

Membrane Filtration

Parameter	Units	Frequency	Source
Units Online	#	Daily	SCADA
TMP (trans membrane pressure)	PSI	Continuous	SCADA
Influent Flow	MGD	Continuous	SCADA
RAS Flow	GPM	Continuous	SCADA
Air Flow	SCFM	Continuous	SCADA
Permeate Flow	GPD	Continuous	SCADA
Backpulse Flow	GPD	Continuous	SCADA
Temperature	°C	Continuous	SCADA
Permeate Turbidity	NTUs	Continuous	SCADA
pH	SU	Continuous	SCADA
Permeability	GFD/PSI	Continuous	Calculated
Flux	GFD	Continuous	Calculated
Fecal Coliforms	Colonies/ 100mL	Weekly	Lab

Control Parameters

The membranes are controlled based on the number of units in service, flow, and pressure. Up to the maximum design capacity the number of units in service must be adequate to process the incoming flow from the aeration basins. Secondly, the vacuum pressure applied by the permeate pumps can be increased, increasing the flux rates. Increasing the flux also increases the amount of fouling. RAS flow rates will regulate the membrane basin level (in addition to permeate flow).

Calculations and Recordkeeping

Monitoring trends in membrane performance requires calculating efficiencies and normalizing for changes in extraneous parameters such as flows and temperatures.

Trans-membrane Pressure

Trans-membrane pressure is essential to evaluating membrane performance. The calculation will be done by the control system as follows:

$$\text{TMP} = \text{Header Pressure} + A \times C - (\text{Membrane Tank Level} - B) \times C$$

A=Height in inches of the pressure transmitter above the top of the membranes

B=Height in inches to the top of membranes in the membrane tank

C=Conversion factor (length to pressure), during production the value is negative and during back pulses it is positive.

Flux

Flux is defined as the permeate flow rate per unit of membrane surface area. It is reported as gallons per square foot per day.

$$\text{Flux} = \text{Flow} / \text{Membrane Surface Area}$$

Permeability

Permeability is flux normalized against TMP. The amount of permeate per unit of membrane in relation to 1 unit of vacuum required and is reported as gallons per foot per day per PSI (gfd/psi).

$$\text{Permeability} = \text{Flux} / \text{TMP}$$

Targets and Process Performance

Targets are based on achieving the design removal efficiencies and maintaining the health of the activated sludge.

Table 2

Targets for Membrane Filtration

Parameter	Units	Minimum	Maximum
Units Online	#	1	6
TMP (trans membrane pressure)	PSI	-8	8
Influent Flow	MGD	x	13.8
RAS Flow	MGD	x	4Q
Air Flow	SCFM	x	12,600
Permeate Flow (max monthly)	MGD	x	10.0
Backpulse Flow	GPD	x	x
Temperature	°C	11	30
Permeate TSS	mg/L	0	1.0
pH (operating)	SU	5.0	9.5
pH (cleaning)	SU	2.0	10.5
Permeability	GFD/PSI	x	x
Flux	GFD	x	x
Fecal Coliforms	CFU/100mL	0	100
Chlorine (cleaning)	mg/L	0	1000

*Q represents the influent flow rate

Relationship to Other Unit Processes

The membrane filtration is most dependent on the aeration basin. The composition of the activated sludge including sludge age and mixed liquor concentration can have a large impact on filtration efficiency. Because the membranes can be damaged by the presence of abrasive solids or debris it is important that the fine screen and grit removal processes are effective and all larger solids and debris are removed by the end of primary clarification. The chemical phosphorus removal process may increase fouling rates of the membranes through the addition of polymer, and to a lesser extent ferric chloride. Lower solids removal efficiencies due to membrane damage may increase chlorine demand or increase fecal coliform presence in the chlorine contact basin influent.

Common Problems and Troubleshooting

Membrane Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Fouling (High TMP)	<ul style="list-style-type: none"> Organic Inorganic 	<ul style="list-style-type: none"> Sodium hypochlorite CIP Citric acid CIP
Membrane Damage	<ul style="list-style-type: none"> Foreign debris 	<ul style="list-style-type: none"> Housecleaning above membranes Optimize screening/grit removal

Condition	Possible Cause	Possible Solutions
		<ul style="list-style-type: none"> • Drain and clean basin
Air leak	<ul style="list-style-type: none"> • Wear and tear 	<ul style="list-style-type: none"> • Repair broken fibers
High MLSS	<ul style="list-style-type: none"> • High RAS return • Low wasting rate 	<ul style="list-style-type: none"> • Decrease RAS return • Increase wasting rate
Low MLSS	<ul style="list-style-type: none"> • Low RAS return • High wasting rate 	<ul style="list-style-type: none"> • Increase RAS return • Decrease wasting
Low permeability	<ul style="list-style-type: none"> • Long term fouling 	<ul style="list-style-type: none"> • Recovery clean
Sludge Caking	<ul style="list-style-type: none"> • Young sludge age (bio-fouling) 	<ul style="list-style-type: none"> • Increase sludge age
Low pH	<ul style="list-style-type: none"> • Increased ferric dose 	<ul style="list-style-type: none"> • Increase caustic feed to RAS

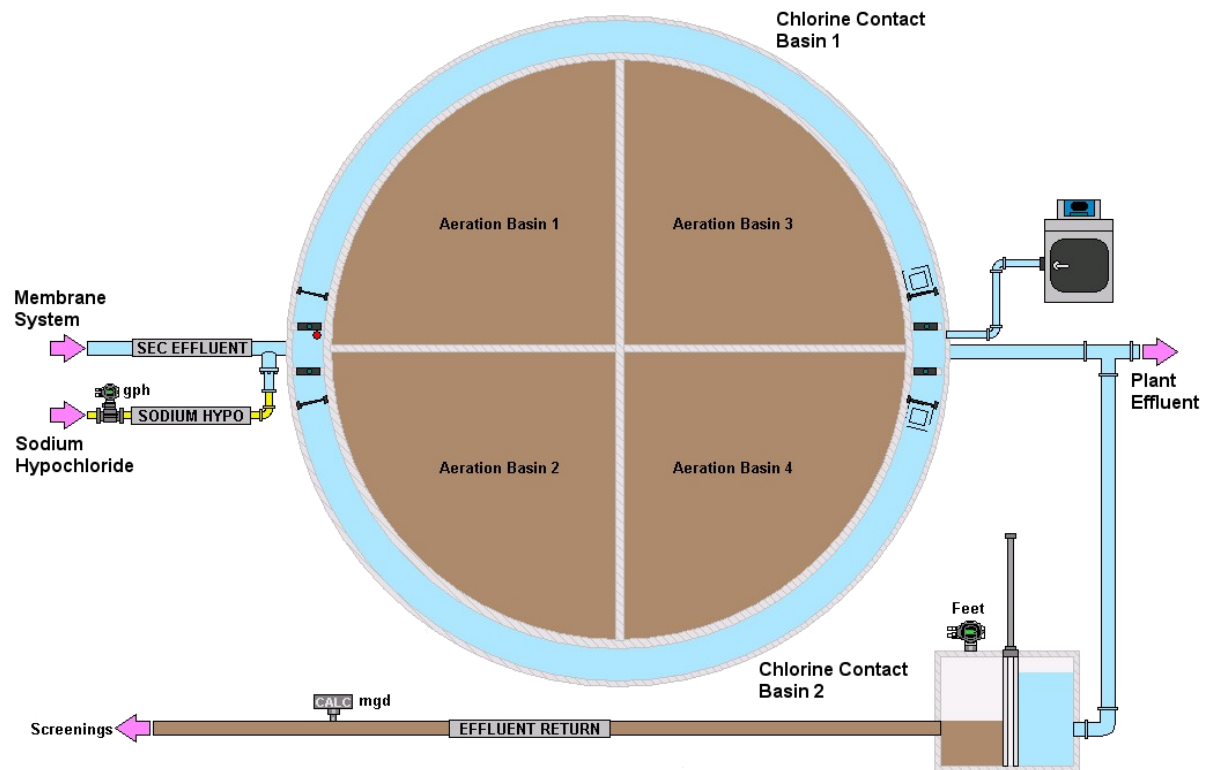
Alternate Modes of Operation

The operation of membranes within each train has to follow a relatively narrow range of operating parameters in order to protect the membranes. The operation of the entire membrane facility, on the other hand, allows for more flexibility because all six trains offer redundancy. Under normal operations the majority of trains will be online and the train(s) offline will be rotated into service or through various operating parameters.

During a maintenance event if one or more trains are offline the flux rates of the remaining trains can be increased to produce more permeate, up to a maximum flux rate. Conversely if needed all six trains can be run at the same time at lower flux rates, such as to prevent freezing during periods of cold weather. The operating parameters allow for a wide range of operating conditions from low flow to normal. The membranes should always be submerged and kept wet so rotating each train through the operating range works best when running at lower than design loading or flow conditions.

45 - Chlorine Contact

Overview



Purpose

To ensure the effluent is safe for use and of acceptable quality to be sent to the river outfall or used as W3 water. Sodium Hypochlorite is used to disinfect the water and Sodium Bisulfite is used to dechlorinate any water that is sent to the outfall. Sampling of the effluent is done to check the residual chlorine levels in the Chlorine Contact basin, the W3 water, and the effluent sent to the outfall.

Description

The Disinfection process takes place at the two Chlorine Contact Basins and uses Sodium Hypochlorite to kill pathogens in the Secondary Effluent flow stream. Plant Effluent is conveyed from the Chlorine Contact Basins to the Reclaimed Water Wet well for W3 Plant Water and Irrigation water distribution systems. Any excess flow is treated with Sodium Bisulfite for dechlorination before it is discharged to the river outfall. Refer to the Sodium Hypochlorite and Sodium Bisulfite Process Control Narratives for chemical storage and dosing requirements.

In the future, a portion of the effluent flow can be diverted offsite for reuse applications as Reclaimed Water. Future Reclaimed Water distribution will require additional pumps. Dechlorination will not be applied to Reclaimed Water. This practice will meet the Class A requirements for fecal coliform counts and will maintain a disinfectant residual in the public distribution system. The Reclaimed Water Wet well high water level transmitter measures water level in the wet well and could be used to assist in controlling future pumps if they are installed.

Water level at the Effluent Diversion Structure is also measured. A high level alarm at the Effluent Diversion Structure indicates an improperly positioned plant effluent valve. A magnetic flowmeter is provided on the Plant Effluent line downstream of the Reclaimed Water Wet well to measure effluent flow discharged to the river outfall. The meter provides a flow signal that controls the Sodium Bisulfite dechlorination feed rate.

For Plant Effluent flow control to the Plant Water and Irrigation systems, refer to the W3 Plant Water Process Control Narrative.

Design Criteria and Component List

EXHIBIT 45-1
Secondary Effluent Disinfection Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Chlorine Contact Basin		Quantity: 2 Type: Concrete Volume (GAL): 168000
Secondary Effluent Chlorine Analyzer	63AET43200	Quantity: 1 Type: Colorimetric Analyzer Range (mg/L): 0.00 – 5.00

EXHIBIT 1-3
Plant Effluent Distribution Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Plant Effluent Flow Meter	64FET20700	Quantity: 1 Type: Magnetic Diameter (INCHES): 24
W3 Chlorine Analyzer	64AIT21100	Quantity: 1 Type: Colorimetric Analyzer Range (mg/L): 0.00 – 5.00

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45 - Chlorine Contact

Operating Strategies

Disinfection of Secondary Plant Effluent

Reclaimed water wetwell liquid levels are measured by a radar level transmitter that indicates liquid levels in both the chlorine contact basin and the reclaimed water wetwell locally at the transmitter and remotely at SCADA. Liquid levels are reported by height or elevation in units of feet and inches.

EXHIBIT 45-2
Effluent Sampler Control Mode Table

MODE	DESCRIPTION	REFERENCES
Auto/Remote	The Effluent Sampler is time based-. The Effluent Sampler is monitored for a FAIL condition.	

EXHIBIT 45-3
Secondary Effluent Testing Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The plant operator selects the LOW and HIGH level set point for Chlorine Residual Concentration, Nitrate, Ammonia and Phosphate Levels at SCADA.	
Manual/Remote	The plant operator selects the CALIBRATION MODE at SCADA for the Chlorine Residual, Nitrate, Ammonia and Phosphate tests.	
Auto/Remote	Secondary Effluent Chlorine Residual Concentration is measured, scaled, indicated, and trend analysis done at SCADA and displayed on the HMI.	
Auto/Remote	Secondary Effluent Nitrate Levels are measured, scaled, indicated, and trend analysis done at SCADA and displayed on the HMI.	
Auto/Remote	Secondary Effluent Ammonia Levels are measured, scaled, indicated, and trend analysis done at SCADA and displayed on the HMI.	
Auto/Remote	Secondary Effluent Phosphate Levels are measured, scaled, indicated, and trend analysis done at SCADA and displayed on the HMI.	
Auto/Remote	Secondary Effluent Turbidity is measured by GE Membrane System and used for process monitoring.	

Distribution of Plant Effluent

EXHIBIT 45-4

Plant Effluent Sample Pump Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Local	Plant Effluent Sample Pump is controlled by an ON-OFF switch in LOCAL-MANUAL Mode at the LCP.	
Manual/Remote	Plant Effluent Sample Pump is controlled by an ON-OFF switch in REMOTE-MANUAL Mode at the HMI.	
Auto/Remote	In REMOTE-AUTO Mode, the ON-OFF switch is controlled automatically by SCADA turning the pump ON to collect samples for calculating chlorine residual and determining dosing rate of Sodium Bisulfite for dechlorination.	
Auto/Remote	SCADA monitors LOCAL/REMOTE status, ON/OFF status, FAIL condition and discharge pressure. Alarm conditions to SCADA include PUMP FAIL or HIGH PRESSURE.	

EXHIBIT 45-5

Plant Effluent Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The Plant Operator inputs HIGH and LOW level alarm setpoints for the Plant Effluent Channel at SCADA.	
Manual/Remote	The plant operator inputs HIGH and LOW set points for Chlorine Residual and pH levels at SCADA.	
Auto/Remote	Plant Effluent Flow Rate is measured, scaled, indicated, and trend analysis done by SCADA. SCADA provides revolving seven-day flow totalizer displayed on the HMI. SCADA monitors for FLOW and FAIL conditions.	
Auto/Remote	Plant Effluent pH Levels are measured, scaled, indicated, and trend analysis done at SCADA and displayed on the HMI.	
Auto/Remote	Plant Effluent Chlorine Residual Concentration (downstream of Plant Water Pumps) is measured, scaled, indicated, and trend analysis done at SCADA and displayed on the HMI.	

Startup Procedures

1. Verify CCB influent and effluent gates are open.

2. Verify sodium hypochlorite pump to secondary effluent is on-line and dose is set.
3. Verify chlorine residual analyzer is cleaned, calibrated and on-line.
4. Secondary effluent flow from the membrane system initiates sodium hypochlorite pump operation.
5. Verify effluent sampler is on-line.
6. When effluent flow is measured, turn effluent sample pump ON from Local Control Switch at analyzer panel.
7. Verify pH analyzer is installed, calibrated and on-line.

Shutdown Procedures

1. Once flow from membranes has ceased, turn effluent sample pump OFF from Local Control Switch at analyzer panel.
2. If shutdown will be for a prolonged period, take pH analyzer off-line and store electrode per manufacturer's directions.
3. Turn effluent sampler OFF.
4. If shutdown will be for a prolonged period, take chlorine residual analyzer off-line.
5. Close chlorine contact basin influent and effluent gates.

Abnormal Conditions

Effluent Sampler Failure – See Effluent Sampler O&M for troubleshooting

Safety

All safety related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan or the hard copy in the Operations Building.

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Disinfection UPCP

Project: Spokane, WA
Plant: Spokane County RWRF
Date: April 18, 2011, April 19, 2011, March 3, 2015, April 13, 2016
Unit process number: 45

Summary

Effluent is disinfected to prevent transmission of infectious diseases and to ensure that water is safe for human contact and the environment. Effluent is dechlorinated prior to discharge to minimize the effect of chlorination on aquatic life and the environment.

Process Overview

Secondary effluent is conveyed by six permeate pumps located in the membrane facility to the chlorine contact chamber. Chlorine is added to the secondary effluent in the form of sodium hypochlorite and injected into the permeate discharge header prior to the chlorine contact chamber. The chlorine contact chamber allows sufficient time for disinfection to occur. The disinfected effluent flows by gravity to the Reclaimed Water Wetwell for W3 Plant Water and Irrigation water distribution systems. Any excess flow is treated with Sodium Bisulfite for dechlorination and sodium hydroxide for pH adjustment before it is discharged to the river outfall.

Unit Physical Information

The two chlorine contact chambers are located on the outer perimeter of the aeration basin south of the primary clarifiers and north of the membrane facility. The effluent wetwell is located on the north side of the membrane facility. Both the chlorine contact chambers and the effluent wetwell are constructed of concrete. The two chlorine contact chambers are 198 feet long, 6.33 feet wide, and 18 feet deep with an effective capacity of 168,000 gallons each. The effluent wetwell is 56 feet long, 8 feet wide and 7.83 feet deep. It has a 10 foot by 8 foot section that is 6.5 feet deeper than the rest of the wetwell. This gives the wetwell a total capacity of 30,000 gallons. There are two 5.3 gph chemical feed pumps for sodium hypochlorite injection located on the south wall of the pump room in the membrane facility. There are two 4400 gallon bulk storage tanks for sodium hypochlorite located on the east side of the membrane facility outside. There are two 14 gph chemical feed pumps for sodium bisulfite injection located in the chemical room of the membrane facility. Two 300 gallon totes of sodium bisulfite are located in the chemical room of the membrane facility. There are two 30 gph chemical feed pumps for sodium hydroxide injection located on the south wall of the pump room in the membrane facility. There are two 8800 gallon bulk storage tanks for sodium hydroxide located on the east side of the membrane facility outside. There are two chlorine analyzers, one at the head of the chlorine contact chamber, and one sampling the discharge of the

reclaimed water pumps. There are three 700 gpm Horizontal Split Case, Adjustable Speed pumps to distribute plant water from the effluent wetwell throughout the facility.

Operational Parameters and Theory

Sodium hypochlorite is injected into the permeate flowstream just prior to the chlorine contact chamber. Once the chlorinated flow reaches the chlorine contact chamber it is slowed to increase the contact time. A chlorine analyzer will test the chlorine residual at the head of the chlorine contact chamber. Operators will input a setpoint into SCADA and it will use the data from the analyzer to meter the sodium hypochlorite feed. After sufficient contact time the flow will continue on to the effluent wetwell. From here it is distributed throughout the plant via the plant water pumps. A second chlorine analyzer measures the total residual chlorine from the plant water line. Effluent that is not used will flow over a weir inside the effluent wetwell into a sodium bisulfite contact chamber and then out to the outfall. Sodium bisulfite is used for dechlorination. A flow meter ensures that sufficient sodium bisulfite is delivered to the contact chamber prior to the outfall. Sodium hydroxide is added at the sodium bisulfite contact chamber for pH adjustment. A pH probe communicates the pH to SCADA which uses that data to meter the sodium hydroxide feed for pH adjustment.

The chlorine contact chamber volume is based on full time disinfection for a peak design flow of 13.8 MGD. The effluent should be sufficiently disinfected of pathogens and bacterial contamination in the detention time given with a sufficient chlorine residual.

Process Monitoring and Responsibilities

Operators should check the chlorine contact chamber on a daily basis for unusual odors, water clarity, foaming, scum buildup, and other unsanitary conditions. The two chlorine analyzers should be inspected daily for sufficient volume of reagent, leakage in the sampling lines, or other unusual operating conditions. An inspection of sodium hypochlorite and sodium bisulfite storage and pumping systems should also be performed on a daily basis. These inspections will include: checking for leaks, unusual drops in the volume of the storage tanks, high or low pressure on the discharge lines, and other unusual operating conditions.

A drawdown test will be performed as needed on the chemical feed pumps to ensure they are pumping the volume reported to SCADA.

On a semi-annual basis if needed the interior of the effluent wetwell will be inspected. The sidewall and weir conditions are observed from the inspection hatches along the top of the effluent wetwell. The sodium bisulfite injection point must be kept clean of buildup.

Chlorine analyzers will require calibration every 6 months.

Parameter	Units	Frequency	Source
Contact Chambers Online	#	Daily	SCADA
Chlorine Residual, pre contact chamber	mg/L	Continuous	Chlorine analyzer
Fecal Coliforms	#/100ml	3/week	Laboratory analysis
Effluent Flow	MGD	Continuous	SCADA
Chlorine residual, post contact chamber	mg/L	Continuous	Chlorine analyzer
Wetwell level	Feet	Continuous	SCADA

Control Parameters

The control parameters for the chlorine contact chambers include the number of units in service, detention time, and chlorine residual.

Disinfection performance is related to detention time which is the amount of time the effluent remains in the chamber. In general, a higher detention time results in better performance. The design detention time for the chlorine contact chamber is as follows:

Average Annual Flow	60 minutes
Maximum Month Flow	57 minutes
Peak Hour Flow	35 minutes

These detention times are achieved with two chlorine contact chambers in service. It is recommended that two chlorine contact chambers are used in most conditions except for short periods during normal maintenance, or when the daily flow is not expected to exceed about 4 to 5 MGD such as during startup.

Chlorine analyzers sample and monitor the chlorine residual of the effluent in two places. The chlorine residual is the amount of chlorine left in the effluent after the chlorine demand has been met. Mathematically:

Chlorine residual remaining = chlorine dosage – effluent demand

A chlorine residual of 0.01 to 1.0 mg/l should be maintained in the effluent wetwell.

Calculations and Recordkeeping

The chlorine contact chamber detention time is calculated using the following formula:

$$DT = (V * N_C) / (Q * 92.4 \text{ ft}^3/\text{min}/\text{MGD})$$

DT = Detention time, minutes

Q = Effluent flow, MGD

N_C = Number of chambers on-line

V = Chamber volume, ft³

The number of units online will be recorded daily by the SCADA system and detention times will be calculated daily in OP10. The volume of sodium hypochlorite and sodium bisulfite pumped daily will be recorded by SCADA as well as calculated by subtracting the volume of the storage tanks that day from the volume of the tanks the previous day.

Targets and Process Performance

Disinfection targets are based on detention time, chlorine residual both in the chlorine contact chamber and in the discharge, and the presence of indicator bacteria (total coliform, fecal coliform, E. coli).

Table 2
Targets for Disinfection

Parameter	Units	Minimum	Maximum
Detention Time	Minutes	15	NA
Contact Chambers Online	#	1	2
Sodium hypochlorite pumped	GPD	10	297
Sodium bisulfite pumped	GPD	10	88
Effluent flow	MGD	4	13.8
Residual chlorine (contact chamber)	mg/L	0.2	5.6
Residual chlorine (effluent wetwell)	mg/L	0.01	5.6
Residual chlorine (discharge)	mg/L	NA	0.0336
Coliform count	Organisms/100ml	NA	400

Relationship to Other Unit Processes

Disinfection follows membrane filtration. Degradation in the quality of the filtration will increase the amount of solids that pass through to the chlorine contact chamber. Higher solids concentrations increase the chlorine demand and therefore reduce the efficiency of the disinfection process.

The effluent wetwell supplies the plant water pumps that distribute non potable water throughout the plant for wash down, pump seals, spray water, dilution water, etc. A loss of disinfection would result in potentially harmful bacteria and pathogens being distributed throughout the plant water system, as well as NPDES permit violations.

Common Problems and Troubleshooting

Disinfection Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Low chlorine residual in the chlorine contact chamber or effluent wetwell	<ul style="list-style-type: none">• Increased chlorine demand• Loss of hypochlorite feed	<ul style="list-style-type: none">• Troubleshoot membrane system• Switch to redundant chemical feed pump• Ensure adequate sodium hypochlorite supply in storage tanks
High chlorine residual in the discharge line	<ul style="list-style-type: none">• Low bisulfite dose• Loss of bisulfite feed	<ul style="list-style-type: none">• Increase bisulfite feed• Switch to redundant chemical feed pump• Ensure adequate sodium bisulfite supply in storage tanks
High coliform counts	<ul style="list-style-type: none">• Loss of disinfection• High solids content• Contamination in chlorine contact chamber	<ul style="list-style-type: none">• Check hypochlorite storage and feed system, switch to redundant feed pump if necessary• Troubleshoot membrane system• Inspect chlorine contact chamber for source of contamination and remove

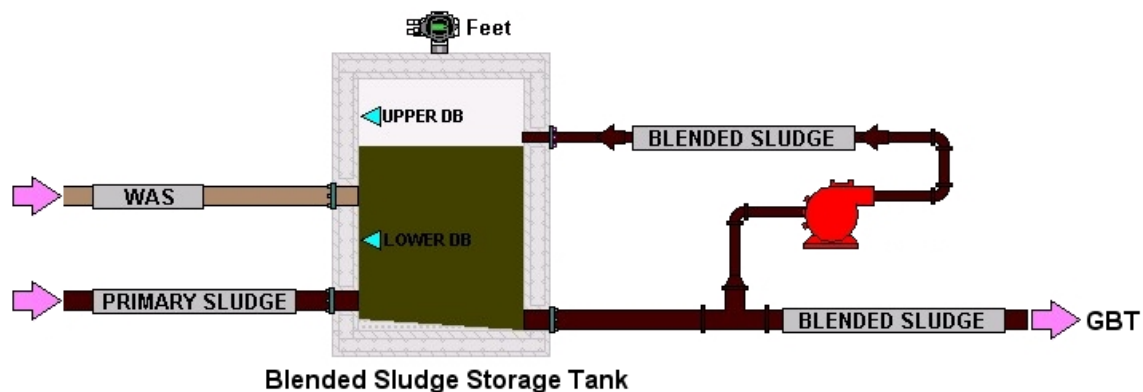
Alternate Modes of Operation

It is recommended to keep both contact chambers online for average annual flows to achieve the best disinfection. It is possible to run one contact chamber only for short durations for maintenance procedures or during flows of 5 MGD or less. While one contact chamber is off line the sodium hypochlorite dosage will be increased to achieve equivalent disinfection with a lower detention time and the sodium bisulfite dosage will be increased for total dechlorination at the discharge. Maintenance will be accomplished during low flow conditions to achieve most efficient operation and disinfection rates.

Should a catastrophic failure occur at one of the chlorine contact chambers, adequate disinfection can be achieved using just one contact chamber. Chlorine feed will be increased and detention time at peak hourly flow will remain above 15 minutes.

50 - Blended Storage/Pumping

Overview



Purpose

Primary sludge (PS) and Waste Activated Sludge (WAS) are pumped to a Blended Storage Tank where the two are mixed into a homogenous sludge that is thickened by the gravity belt thickeners (GBTs) and then sent to the Anaerobic Digesters.

Description

Primary Sludge Pumping

The Primary Sludge Pumping System pumps primary sludge from the bottom of the Primary Clarifiers to the Blended Sludge Storage Tank. See the Primary Clarifiers process control narrative for a description of the Primary Sludge Pumping System.

WAS Pumping

The WAS Pumping System pumps WAS from the WAS sump (common to all four aeration basins) located at the Aeration Basins to the Blended Sludge

Storage Tank. See the Aeration Basins process control narrative for a description of the WAS Pumping System.

Blended Sludge Storage

The Blended Sludge Storage System consists of components that provide a homogeneous blending of primary sludge and WAS prior to thickening by the GBTs. Components of the Blended Sludge Storage System include the Blended Sludge Storage Tank, the Blended Sludge Storage Tank Mixing Pump, and support appurtenances (such as valves and flushing connections).

The Blended Sludge Storage Tank is located to the east of the Solids Facility on an at-grade concrete pad. The Blended Sludge Storage Tank is provided with a foul air connection to the Odor Control System.

The Blended Sludge Storage Tank Mixing Pump is located in the northeast corner of the Solids Facility. It is designed to mix the primary sludge and WAS to a homogeneous sludge for thickening. The pump is designed to mix the contents of the tank by recirculation. The turnover time for the tank is 30 minutes. Exhibit 50-1 lists the components for blended storage.

Design Criteria and Component List

EXHIBIT 50-1

Blended Storage Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Blended Sludge Storage Tank	78TNK00100	Quantity: 1 Type: Concrete Volume (gal): 12,000
Blended Sludge Storage Tank Mixing Pump	78PMP00500	Quantity: 1 Type: Screw Induced, Centrifugal, Constant Speed Rated Flow Capacity (gpm): 400 Rated Differential Pressure (TDH/ft): 15 Power (hp): 5
NOTES: gal = gallons gpm = gallons per minute TDH/ft = total dynamic head per foot		

Process Control Variables

Control Variables

- WAS and PS Feed Rates

WAS and PS feed rates are set at the Aeration Basins and Primary Clarifiers systems. See the Aeration Basins process control narrative for a description of the WAS Pumping System. See the Primary Clarifiers process control narrative for a description of the PS Pumping System.

- Blended Sludge Removal Rate

Although it is not typical for the GBT Feed Pumps speed to be controlled manually, the option exists for the operators to manually adjust the GBT Feed Pumps speed which in turn controls the Blended Sludge removal rate from the Blended Sludge Storage Tank.

Non Controllable Variables

- Blended Sludge Removal Rate

Blended Sludge removal rate is set by the automatic operation of the GBT Feed Pumps. The GBT Feed Pumps speed will be automatically controlled to maintain the Blended Sludge Storage Tank level within a normal operating band by increasing or decreasing the GBT feed rate.

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Operating Strategies

Blended Storage Tank

There are two control modes for the operation of the Blended Sludge Storage Tank Mixing Pump: LOCAL-MANUAL, and REMOTE-MANUAL. The Blended Sludge Storage System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

The pump system includes a LCP, pressure gauge, check valve, isolation valves, and flushing and sampling connections. The tank is equipped with three inlet connections, an overflow/drain connection, a foul air connection, a vent, an outlet connection, and a manway.

The Blended Sludge Storage Tank Mixing Pump blends the primary sludge and WAS in the Blended Sludge Storage Tank into a homogeneous mixture. The liquid level in the Blended Sludge Storage Tank is monitored by a radar level transmitter mounted on top of the tank. The sensor indicates liquid level in feet. A level switch is set for HIGH level in the tank. Exhibit 50-2 list some example control modes for the Blended Storage Tank.

EXHIBIT 50-2
Blended Storage Tank Example Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Local	The LOCAL or REMOTE control mode for the Blended Sludge Storage Tank Mixing Pump	
Manual/Local	When operating in the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON or OFF at the LCS.	
Manual/Remote	When operating in the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON or OFF at SCADA.	
Auto/Remote	SCADA monitors and reports the following for the Blended Sludge Storage Tank Mixing Pump: LOCAL/REMOTE, ON/OFF status, and motor runtime.	

NOTES:

LCS = local control station

SCADA = supervisory control and data acquisition

Startup Procedures

Local-Manual Mode:

1. Position the blended sludge suction and discharge piping isolation valves for the Blended Sludge Storage Tank Mixing Pump to the OPEN position.
2. At the LCS for each piece of equipment, select LOCAL operation for the Blended Sludge Storage Tank Mixing Pump.
3. From the LCS select Blended Sludge Storage Tank Mixing Pump ON.

Remote-Manual Mode:

1. At the LCS for each piece of equipment, select REMOTE operation for the Blended Sludge Storage Tank Mixing Pump.
2. From SCADA select Blended Sludge Storage Tank Mixing Pump ON.

Shutdown Procedures

Local-Manual Mode:

1. From the LCS, with the REMOTE-LOCAL switch in LOCAL, select Blended Sludge Storage Tank Mixing Pump OFF.

Remote-Manual Mode:

1. From SCADA select Blended Sludge Storage Tank Mixing Pump OFF.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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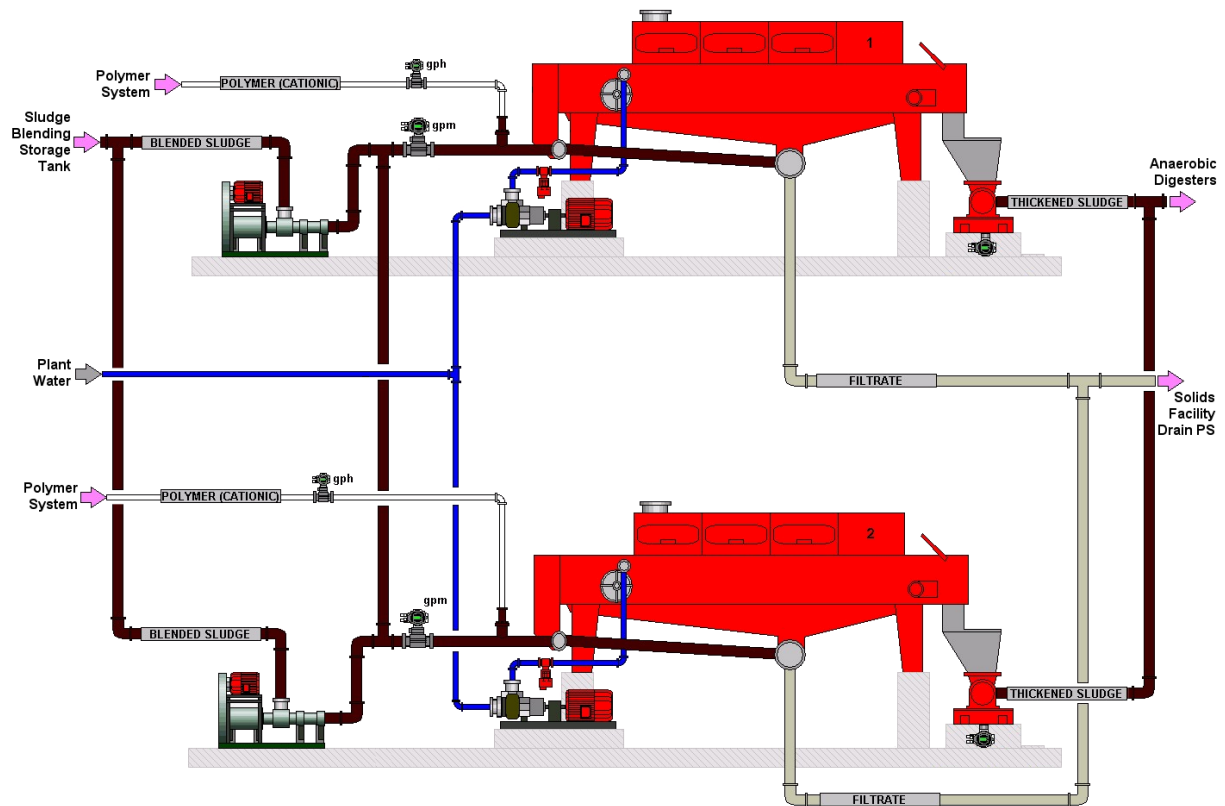
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Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Primary Sludge Pump 1 HIGH DISCHARGE PRESSURE	Instrument (59PSH03201) has detected High Discharge Pressure for Primary Sludge Pump 1	Alarm shows on SCADA. Primary Sludge Pump 1 stops until RESET locally. Inspect Primary Sludge Pump 1 equipment.
Primary Sludge Pump 2 HIGH DISCHARGE PRESSURE	Instrument (59PSH03202) has detected High Discharge Pressure for Primary Sludge Pump 2	Alarm shows on SCADA. Primary Sludge Pump 2 stops until RESET locally. Inspect Primary Sludge Pump 2 equipment.
Primary Sludge Pump 3 HIGH DISCHARGE PRESSURE	Instrument (59PSH03203) has detected High Discharge Pressure for Primary Sludge Pump 3	Alarm shows on SCADA. Primary Sludge Pump 3 stops until RESET locally. Inspect Primary Sludge Pump 3 equipment.

52 - Gravity Belt Thickeners

Overview



Purpose

The Gravity Belt Thickener (GBT) System consists of components that thicken the blended sludge and pump the blended sludge to the anaerobic digesters. The main components of the GBT System include two GBT Feed Pumps, two GBTs, two Thickened Sludge Pumps and two GBT Wash Water Pumps. The GBT Feed Pumps are located along the north wall of the Solids Handling Room in the Solids Facility. The GBTs are located on the northeast wall in the Solids Handling Room.

Primary sludge from the primary clarifiers and Waste Activated Sludge (WAS) from the Aeration Basins are combined in the Blended Sludge Storage Tank. Blended sludge from the Blended Sludge Storage Tank is pumped to the GBTs by the GBT Feed Pumps for thickening before being sent to the Anaerobic Digesters. GBT Wash Water Pumps boost W3 water pressure suitable for the

GBT belt wash water system. Thickened sludge is pumped from the GBT discharge hoppers to the Anaerobic Digesters by the Thickened Sludge Pumps.

Description

Two progressive cavity GBT Feed Pumps (one duty, one standby) feed the GBTs sludge from the Blended Sludge Storage Tank. The GBTs are one duty, one standby for normal operations. A constant, 24/7 thickening operation evens out the load to the Anaerobic Digesters and improves gas recovery. The piping is also configured to allow primary sludge to be sent directly to digestion to allow use of the GBTs for waste activated sludge (WAS) only.

A cationic polymer system will serve as a thickening aid for the blended sludge to assist with solids capture and concentration (see the Cationic Polymer Storage and Feed process control narrative for reference). A polymer injector/mixer is provided with each GBT. Each thickener can process approximately 18,000 lbs/day of residuals with filtrate pumped from the thickeners back to the Headworks. The GBTs are designed to produce a residual concentration of 5 percent solids.

The GBTs are plumbed up to allow separate operation of the units. This will allow one to operate in its normal thickening mode on WAS and primary sludge, while the other can perform recuperative thickening of the Anaerobic Digester contents if needed. During recuperative thickening, the hydraulic loading capacity of the GBT will be reduced due to the higher feed sludge solids concentration range of 2 to 3 percent. Typical solids concentration for the blended primary and secondary sludge is 0.5 to 1 percent.

Thickened sludge from the GBTs falls into hoppers that feed two two-stage rotary lobe Thickened Sludge Pumps. The Thickened Sludge Hoppers are mounted on load cells that control the operation of the Thickened Sludge Pump based on sludge weight in the hopper. Each GBT has a dedicated Thickened Sludge Pump for transferring thickened sludge to the Anaerobic Digesters.

A belt washing system for each GBT consists of an end suction centrifugal booster pump and a strategically placed spray header with nozzles located throughout the width of the belt. The power and control of the belt washing system is through the GBT control panel.

The GBTs are equipped with a belt-tracking and tensioning system. The automatic belt tracking system continuously aligns and maintains proper belt position on rollers during operation. The belt tensioning system allows the

operator to make manual adjustments to the belt tension while the belt is operating.

The GBTs are each provided with a full enclosure to contain odors. The enclosures are equipped with a foul air connection to the Odor Control System. Filtrate from the GBTs flows by gravity to the Solids Facility Drain Pump Station.

The GBT System is intended to operate remotely through supervisory control and data acquisition (SCADA) but can also be operated in the LOCAL MANUAL mode. Exhibit 52-1 is a partial list of components for the GBT System.

Design Criteria and Component List

EXHIBIT 52-1
GBT System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Gravity Belt Thickener	78GBT02401, 78GBT02402	Quantity: 2 Type: Adjustable Speed, 1.5-meter belt Rated Flow Capacity (gpm): 450 Power (hp): 3
Thickened Sludge Pump	78PMP02601, 78PMP02602	Quantity: 2 Type: Two-stage Rotary Lobe, Adjustable Speed Rated Flow Capacity (gpm): 100 Rated Differential Pressure (psig): 120 Power (hp): 10
GBT Wash Water Pump	78PMP02001, 78PMP02002	Quantity: 2 Type: Horizontal End Suction Centrifugal, Constant Speed Rated Flow Capacity (gpm): 20 Rated Differential Pressure (TDH/ft): 140 Power (hp): 5
GBT Feed Pump	78PMP00801, 78PMP00802	Quantity: 2 Type: Progressing Cavity, Adjustable Speed Rated Flow Capacity (gpm): 450 Rated Differential Pressure (psig): 13 Power (hp): 25
NOTES: gpm = gallons per minute hp = horsepower psig = pounds per square inch gauge TDH/ft = total dynamic head per foot		

Process Control Variables

Control Variables

1. Polymer Dosage – See Cationic Polymer Section.
2. Belt Pressure (Tension) – Belt Pressure can be adjusted at the GBT local control panel but, is typically automatically adjusted
3. Sludge Feed Rate – Sludge feed rate can be manually adjusted at the GBT Feed Pumps, but the normal mode of operation is automatic control.
4. Belt Speed – Belt speed can be manually adjusted at the GBT local control panel but, is typically controlled remotely.
5. Number of plows furrowing – Number of plows furrowing is manually controlled at the GBT by the operator based on visual inspection of the belt performance.
6. Sludge Dam Height – Sludge dam height is manually controlled at the GBT by the operator based on visual inspection of the belt performance.
7. Belt Wash Water Sprays – Sprays can be manually adjusted at the GBT by the operator.

Non-controllable Variables

1. Primary solids concentration coming into the Blended Sludge Storage Tank can vary depending on plant influent. These variations can require more or less polymer dosing.

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52 - Gravity Belt Thickeners

Operating Strategies

Gravity Belt Thickener

Blended sludge from the Blended Sludge Storage Tank is pumped to the GBTs by the GBT Feed Pumps for thickening at the GBTs before being sent to the Anaerobic Digesters. Blended sludge flow to the GBTs is monitored.

Three GBT control modes control the operation of the GBTs: LOCAL-MANUAL, REMOTE-MANUAL, and REMOTE-AUTO. When operating in REMOTE, the operator selects the particular REMOTE GBT control mode at SCADA.

When operating the GBTs in the REMOTE-AUTO control mode, the GBTs will adjust based on the sludge feed flow rate to the GBTs. For the GBT to START after receiving a command to do so, the GBT must be in a SYSTEM READY state. The GBT is in a SYSTEM READY state when the belt drive is ON, the wash water pump is ON, the wash water valve is OPEN, and no alarms are present. Exhibit 52-2 lists the control modes for the GBTs.

EXHIBIT 52-2
Gravity Belt Thickener Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	LOCAL/REMOTE mode of the GBTs is selected at the LCP.	
Manual/Local	When operating the GBTs in the LOCAL-MANUAL control mode, the operator manually turns the GBT(s) ON and OFF and inputs belt speed at the LCP.	
Manual/Remote	When operating in REMOTE, the operator selects the particular REMOTE GBT control mode at SCADA.	
Manual/Remote	When operating the GBTs in the REMOTE-MANUAL control mode, the operator manually turns the GBT(s) ON and OFF and inputs belt speed at SCADA.	
Auto/Remote	When operating the GBTs in the REMOTE-AUTO control mode, after initiating a START command to the GBTs and their successful start, the operating speed of the belts on the GBTs will adjust based on the sludge feed flow rate to the GBTs. For the GBT to START after receiving a command to do so, the GBT must be in a SYSTEM READY state.	
Auto/Remote	The GBT is in a SYSTEM READY state when the belt drive is ON, the wash water pump is ON, the wash water valve is OPEN, and no alarms are present.	

Auto/Remote	SCADA monitors and reports the LOCAL/REMOTE, SYSTEM READY, belt drive FORWARD-REVERSE, belt drive SPEED, wash water valve OPEN/CLOSED, and discharge hopper weight for the GBTs.	
Auto/Remote	Blended sludge flow to the GBTs is monitored at the SCADA workstation.	
NOTES: GBT = gravity belt thickener LCP = local control panel SCADA = supervisory control and data acquisition		

GBT Feed Pump

Four GBT Feed Pump control modes control the operation of the pumps: LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO-FLOW MODE and REMOTE-AUTO-LEVEL MODE. When operating in REMOTE, the operator selects the particular REMOTE pump control mode at SCADA. Exhibit 52-3 lists the control modes for the GBT Feed Pumps.

EXHIBIT 52-3
GBT Feed Pump Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	LOCAL/REMOTE mode of the GBT Feed Pumps is selected at the LCS.	
Manual/Local	When operating the GBT Feed Pumps in the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs pump speed at the LCS.	
Manual/Remote	When the GBT Feed Pumps are operating in REMOTE, the operator selects REMOTE-MANUAL, REMOTE-AUTO-FLOW MODE, or REMOTE-AUTO-LEVEL MODE at SCADA.	
Manual/Remote	When operating the GBT Feed Pumps in the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs pump speed at SCADA.	
Auto/Remote	For both LOCAL-MANUAL and REMOTE-MANUAL, GBT Feed Pump output will occur when the GBT Feed Pump START control function is activated. GBT SYSTEM READY condition is present (see below for requirements on GBT SYSTEM READY status).	
Auto/Remote	When operating in the FLOW control mode, the speed of the GBT Feed Pumps will adjust to maintain an operator-selected FLOW setpoint. Loops 7800801: provide AUTO-MANUAL and START-STOP control of the GBT and drive speed adjustment through the HMI. Provide	

	ON-OFF and LOCAL REMOTE status indication of the drive on the HMI.	
Auto/Remote	When operating in the LEVEL control mode, the speed of the GBT Feed Pumps will adjust to maintain a predetermined level in the Blended Sludge Storage Tank.	
Auto/Remote	SCADA monitors and reports the following for the GBT Feed Pumps: LOCAL/REMOTE status, ON/OFF, FAIL condition, speed, motor runtime, motor voltage, motor current, power consumed, and stator temperature.	
NOTES: GBT = gravity belt thickener LCS = local control station SCADA = supervisory control and data acquisition HMI = human-machine interface		

Thickened Sludge Pump

Thickened sludge is pumped from the GBT discharge hoppers to the Anaerobic Digesters by the Thickened Sludge Pumps.

Three Thickened Sludge Pump control modes control the operation of the pumps: LOCAL, REMOTE-MANUAL, and REMOTE-AUTO. When operating in REMOTE, the operator selects the particular REMOTE pump control mode at SCADA.

When operating the Thickened Sludge Pumps in the REMOTE-AUTO control mode, the speed of the pumps will adjust to maintain a predetermined weight in the GBT discharge hopper. The speed command for the pumps will be overridden if the Anaerobic Digester feed valves are CLOSED or a LOW WEIGHT in the Discharge Hopper is met. Exhibit 52-4 lists the control modes for the Thickened Sludge Pump.

EXHIBIT 52-4
Thickened Sludge Pump Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	LOCAL/REMOTE control mode of the Thickened Sludge Pumps is selected at the LCS.	
Auto/Remote	When operating the Thickened Sludge Pumps in the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs pump speed at the LCS.	

Manual/Remote	When operating in REMOTE, the operator selects the particular REMOTE pump control mode at SCADA.	
Manual/Remote	When operating the Thickened Sludge Pumps in the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs pump speed at SCADA.	
Auto/Remote	When operating the Thickened Sludge Pumps in the REMOTE-AUTO control mode, the speed of the pumps will adjust to maintain a predetermined weight in the GBT discharge hopper.	
Auto/Remote	When operating in the REMOTE-AUTO control modes, the speed command for the pumps will be overridden if the Anaerobic Digester feed valves are CLOSED or a LOW WEIGHT in the discharge hopper is met. [HIGH WEIGHT is 1,475]	
Auto/Remote	SCADA monitors and reports the LOCAL/REMOTE status, ON/OFF, FAIL condition, speed, motor runtime, motor voltage, motor current, power consumed, and stator temperature for the Thickened Sludge Pumps	
NOTES: GBT = gravity belt thickener LCS = local control station SCADA = supervisory control and data acquisition		

GBT Wash Water

GBT Wash Water Pumps boost W3 water pressure suitable for the GBT belt wash water system. The control logic for the GBT Wash Water Pumps is by the GBT supplier. Exhibit 52-5 lists the control modes for the GBT Wash Water Pumps.

EXHIBIT 52-5
Wash Water Control Modes

MODE	DESCRIPTION	REFERENCES
Auto/Remote	The control logic for the GBT Wash Water Pumps is by the GBT supplier, located in the supplier's O&M Manual.	
Auto/Remote	SCADA monitors and reports the ON/OFF status for the GBT Wash Water Pumps.	
Auto/Remote	SCADA monitors and reports the OPENED/CLOSED status for the GBT Wash Water Pump discharge valves.	
NOTES: GBT = gravity belt thickener		

O&M = operations and maintenance
SCADA = supervisory control and data acquisition

Startup Procedures

Verify that the Solids Facility air at high pressure (AHP) is operational and supplying air to the GBT pneumatic control panels.

Remote-Auto Mode:

1. Open required manual isolation valves for required system operation, including valves for the GBT Feed Pumps, Polymer Feed Pumps, and the Thickened Sludge Pumps.
2. At the LCS for each piece of equipment, select REMOTE operation for the GBT Feed Pumps, Polymer Feed Pumps, GBT Wash Water pumps and the Thickened Sludge Pumps.
3. At the GBT LCP for the GBT in operation, select the REMOTE operation.
4. At the PCS select the GBT Feed Pump REMOTE control mode (FLOW or LEVEL).
5. At the PCS initiate the GBT START command.

Remote-Manual Mode:

Note: Remote-Manual Mode operation is not recommended.

1. Open required manual isolation valves for required system operation including valves for the GBT Feed Pumps, Polymer Feed Pumps, and the Thickened Sludge Pumps.
2. At the LCS for each piece of equipment, select REMOTE operation for the GBT Feed Pumps, Polymer Feed Pumps, GBT Wash Water pumps and the Thickened Sludge Pumps.
3. At the GBT LCP for the GBT in operation, select the REMOTE operation.
4. From the PCS, initiate the GBT START command and select the GBT belt direction to FORWARD and set the GBT belt speed.
5. At the PCS set the GBT Feed Pump rate, Polymer Feed Rate, GBT Belt Speed and Thickened Sludge Pump rate.

Local-Manual Mode:

Note: Local-Manual operation is not recommended.

1. Open required manual isolation valves for required system operation including valves for the GBT Feed Pumps, Polymer Feed Pumps, and the Thickened Sludge Pumps.
2. At the LCS for each piece of equipment, select LOCAL operation for the GBT Feed Pumps, Polymer Feed Pumps, GBT Wash Water pumps and the Thickened Sludge Pumps.
3. At the GBT LCP for the GBT in operation, select the LOCAL operation.
4. At the GBT LCP set the belt speed.
5. At the GBT Feed Pumps, Polymer Feed Pumps, pumps and the Thickened Sludge Pumps, set the pump speed.

Shutdown Procedures

Remote-Auto Mode:

1. From the GBT LCP, Initiate the GBT STOP command.

Remote-Manual Mode:

1. From the PCS, set the speed to zero for the GBT Feed Pumps and Polymer Feed Pumps, and initiate the GBT STOP command.
2. From the PCS, STOP the Thickened Sludge Pumps.

Local-Manual Mode:

1. At the LCS for the GBT Feed Pumps and Polymer Feed Pumps set the pump speed to zero.
2. From the GBT LCP select the GBT STOP command.
3. At the Thickened Sludge Pump LCS set the pump speed to zero.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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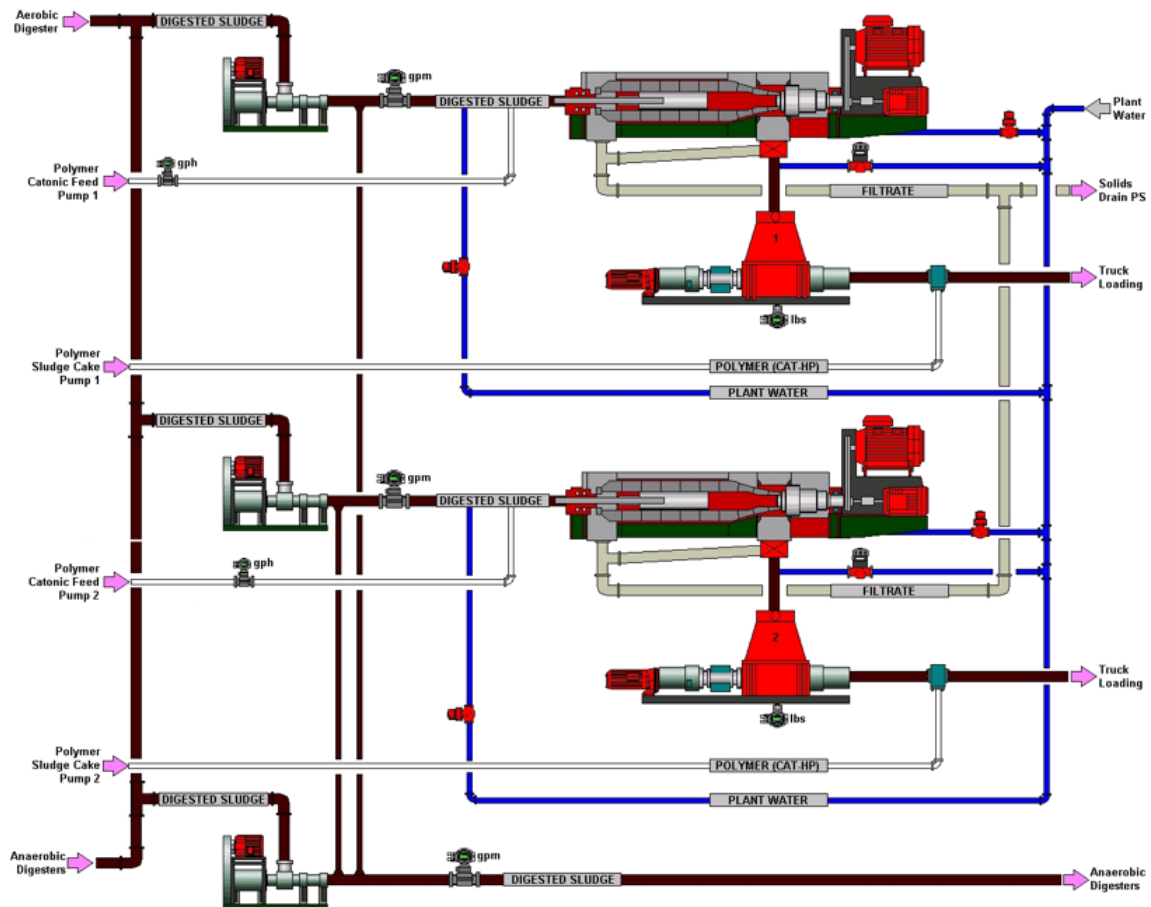
52 - Gravity Belt Thickeners

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Gravity Belt Feed Pump 1 FAIL-TO-START	Gravity Belt Feed Pump 1 (78PMP00801) has Failed to Start.	Alarm on SCADA. Inspect Gravity Belt Feed Pump 1 Equipment.
Gravity Belt Feed Pump 2 FAIL-TO-START	Gravity Belt Feed Pump 2 (78PMP00802) has Failed to Start.	Alarm on SCADA. Inspect Gravity Belt Feed Pump 2 Equipment.
Gravity Belt Feed Pump 1 FAIL-TO-STOP	Gravity Belt Feed Pump 1 (78PMP00801) has Failed to Stop.	Alarm on SCADA. Inspect Gravity Belt Feed Pump 1 Equipment.
Gravity Belt Feed Pump 2 FAIL-TO-STOP	Gravity Belt Feed Pump 2 (78PMP00802) has Failed to Stop.	Alarm on SCADA. Inspect Gravity Belt Feed Pump 2 Equipment.
Gravity Belt Feed Pump 1 HIGH DISCHARGE PRESSURE	Instrument (78PSH00901) has detected High Discharge Pressure in Gravity Belt Feed Pump 1 (78PMP00801).	Alarm on SCADA. Inspect Gravity Belt Feed Pump 1 Equipment.
Gravity Belt Feed Pump 2 HIGH DISCHARGE PRESSURE	Instrument (78PSH00902) has detected High Discharge Pressure in Gravity Belt Feed Pump 2 (78PMP00802).	Alarm on SCADA. Inspect Gravity Belt Feed Pump 2 Equipment.
Gravity Belt Feed Pump 1 HIGH STATOR TEMPERATURE	Instrument (78TSH01101) has detected High Stator Temperature in Gravity Belt Feed Pump 1 (78PMP00801).	Alarm on SCADA. Inspect Gravity Belt Feed Pump 1 Equipment.
Gravity Belt Feed Pump 2 HIGH STATOR TEMPERATURE	Instrument (78TSH01102) has detected High Stator Temperature in Gravity Belt Feed Pump 2 (78PMP00802).	Alarm on SCADA. Inspect Gravity Belt Feed Pump 2 Equipment.
Thickened Sludge Pump 1 FAIL-TO-START	Thickened Sludge Pump 1 (78PMP02601) has Failed to Start.	Alarm on SCADA. Inspect Thickened Sludge Pump 1
Thickened Sludge Pump 2 FAIL-TO-START	Thickened Sludge Pump 2 (78PMP02602) has Failed to Start.	Alarm on SCADA. Inspect Thickened Sludge Pump 2
Thickened Sludge Pump 1 FAIL-TO-STOP	Thickened Sludge Pump 1 (78PMP02601) has Failed to Stop.	Alarm on SCADA. Inspect Thickened Sludge Pump 1
Thickened Sludge Pump 2 FAIL-TO-STOP	Thickened Sludge Pump 2 (78PMP02602) has Failed to Stop.	Alarm on SCADA. Inspect Thickened Sludge Pump 2

ALARM	MEANING	RESPONSE OR ACTION
Thickened Sludge Pump 1 HIGH DISCHARGE PRESSURE	Instrument (78PSH02701) has detected High Discharge Pressure in Thickened Sludge Pump 1 (78PMP00801).	Alarm on SCADA. Confirm the pump shuts down. Inspect Thickened Sludge Pump 1 Equipment. If Thickened Sludge is more than 6% solids, polymer dose may need to be reduced.
Thickened Sludge Pump 2 HIGH DISCHARGE PRESSURE	Instrument (78PSH02702) has detected High Discharge Pressure in Thickened Sludge Pump 2 (78PMP00802).	Alarm on SCADA. Confirm the pump shuts down. Inspect Thickened Sludge Pump 2 Equipment. If Thickened Sludge is more than 6% solids, polymer dose may need to be reduced.
Thickened Sludge Pump 1 HIGH WEIGHT	Instrument (78WIT02501) has detected High Weight in the GBT 1 discharge Hopper.	Alarm on SCADA. Inspect Thickened Sludge Pump 1 Equipment. Polymer dose may need to be adjusted and/or dams/plows need adjustment.
Thickened Sludge Pump 2 HIGH WEIGHT	Instrument (78WIT02502) has detected High Weight in the GBT 2 discharge Hopper.	Alarm on SCADA. Inspect Thickened Sludge Pump 2 Equipment. Polymer dose may need to be adjusted and/or dams/plows need adjustment.
GBT 1 Discharge Hopper LOW WEIGHT	Instrument (78WIT02501) has detected Low Weight in the GBT 1 discharge Hopper.	Alarm on SCADA. Check GBT feed pump system for proper operation.
GBT 2 Discharge Hopper LOW WEIGHT	Instrument (78WIT02502) has detected Low Weight in the GBT 2 discharge Hopper.	Alarm on SCADA. Check GBT feed pump system for proper operation.
GBT 1 Belt Misalignment	GBT belt has misaligned and triggered the sensor on one of the two sides.	Alarm on SCADA. Start the standby GBT and inspect the failed unit.
GBT 2 Belt Misalignment	GBT belt has misaligned and triggered the sensor on one of the two sides.	Alarm on SCADA. Start the standby GBT and inspect the failed unit.

Overview



Purpose

The primary purpose of the solids dewatering process is to efficiently remove water from the biosolids and reduce the volume for cost-effective hauling to a Beneficial Use Facility (BUF).

Digested sludge from the Aerobic Digester is pumped to the centrifuge units by the Centrifuge Feed Pumps for dewatering by the centrifuge units before being pumped by the Dewatered Sludge Pumps to the truck loadout area. The water that is removed from the digested sludge, centrate, is then conveyed via the solids drain pump station to the liquids treatment processes. The major components of the Sludge Dewatering System consist of the Centrifuge Feed

Pumps, Centrifuges, and Dewatered Sludge Pumps. This equipment, along with support appurtenances, are located in the Solids Facility.

Description

Three progressive cavity Centrifuge Feed Pumps with adjustable frequency drives (AFDs), two duty and one standby, pump digested sludge from the Aerobic Digester to the centrifuge units.

The Centrifuge Feed Pumps can be used to do the following:

- Transfer digested sludge between Anaerobic Digesters.

- Re-circulate a portion of the aerobically digested solids back into the Anaerobic Digesters.

- Pump sludge from the aerobic digester to the Centrifuge units

- Pump sludge from the anaerobic digesters to the Centrifuge units

- Pump blended sludge from the sludge blend tank to the centrifuge units

Two Dewatering Centrifuge Units are sized to meet the design digested solids flows. The sizing of the centrifuges enables the combined capacity of the two units to meet the peak loading rates but does not allow a DUTY-STANDBY configuration. Each centrifuge can dewater 50 percent of the maximum week solids load 8 hours per day, 5 days per week. Should one unit be out of service, the remaining unit will be operated longer to achieve the needed dewatering quantities. The Dewatering Centrifuge Units also allow recuperative thickening of the Aerobic Digester contents, which may be implemented if the dewatered sludge cannot be land- applied. When the Dewatering Centrifuge Units are used for recuperative thickening, the operator will need to make significant adjustments to the settings on the centrifuge units and to polymer addition.

Dewatered sludge (DWS) from the centrifuge units falls into hoppers that feed two open-throat progressive cavity Dewatered Sludge Pumps. The Dewatered Sludge Pumps are located on load cells that control the operation of the pump based on sludge weight in the associated hopper.

The Dewatered Sludge Pumps transfer solids for loading into trucks for offsite disposal. Knife gates in the truck loading area are strategically located to accommodate three truck configurations: semi-truck with a trailer, dump truck, and a dump truck with a pump. The Dewatered Sludge Pumps can also be used in conjunction with the Dewatering Centrifuge Units for recuperative thickening of the Aerobic Digester. Centrate drawn from the centrifuges will flow to the Solids Facility Drain Pump Station and return to the Headworks for processing.

A polymer feed system provides flocculation of the digested sludge as it enters the Centrifuge and for aiding in pumping DWS after it leaves the Dewatered Sludge Pumps. The following injection locations have been provided upstream of the centrifuge units: at the centrifuge feed tube, 25 feet prior to the centrifuges on the sludge feed piping, and 50 feet prior to the centrifuges on the sludge feed piping. An injection ring supplied by the Dewatered Sludge Pump manufacturer provides the mechanism for injecting polymer for dewatered sludge pumping. See the process control narrative for the Cationic Polymer Storage and Feed process for reference.

Non potable water has been routed upstream and downstream of the centrifuge units and is used for cleaning the DWS line upstream of the Dewatered Sludge Pumps, the Dewatered Sludge Pumps themselves, and the DWS piping to the truck loading area. In addition, non-potable water is available downstream of the truck loading area to help direct light solids into the Solids Facility Drain Pump Station, which may be required under certain cleaning and maintenance events. All wash water from the centrifuge units is diverted into the Solids Facility Drain Pump Station where it is eventually returned into the liquid treatment process.

A compressed air system located in the Solids Facility Mechanical Room provides compressed air for the miscellaneous air demands (actuators on the knife gates located on the dewatered sludge piping, solenoid valves on the W3 piping) associated with the sludge dewatering equipment. In addition, the compressed air is also used to help aid in transport of DWS in the DWS piping downstream of the Dewatered Sludge Pumps. The Compressed Air System includes a reciprocating compressor, regenerative heatless air dryer, coalescing prefilter, particulate after filter, pressure regulating valve, and isolation solenoid valves.

Foul air connections on the centrate discharge and cake discharge prevent odors from infiltrating the Solids Handling Room. Exhibit 54-1 is a partial list of components for the centrifuge units.

Design Criteria and Component List

EXHIBIT 54-1
Centrifuge Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Centrifuge	78CEN10701, 78CEN10702	Quantity: 2 Type: Adjustable Speed Hydraulic Loading (gpm): 125 Power (hp): 60
Centrifuge Feed Pump	78PMP26001, 78PMP26002, 78PMP26003	Quantity: 3 Type Progressive Cavity, Adjustable Speed Rated Flow Capacity (gpm): 125 Rated Differential Pressure (psig): 35 Power (hp): 1.5
Dewatered Sludge Pump	78PMP12901, 78PMP12902	Quantity: 2 Type: Adjustable Speed Rated Flow Capacity (gpm): 15 Rated Differential Pressure (psi): 300 Solids Throughput (lbs/hr): 1560 Power (hp): 15
NOTES: gpm = gallons per minute psig = pounds per square inch gauge lbs/hr = pounds per hour		

Process Control Variables

Control Variables

1. Polymer Dosage - See Cationic Polymer Section.
2. Sludge Feed Rate – Sludge Feed Rate is controlled by adjusting the Centrifuge Feed Pump speed.
3. Centrifuge Torque – Operator enters a Torque set point at the Centrifuge local control panel or thru the PCS.
4. Dewatered Sludge Discharge location – The Dewatered Sludge pumps, associated with each centrifuge can discharge sludge to multiple locations

including truck load out, aerobic digester and Solids Facility Drain Pump station. Depending upon the mode of operation, the operator must choose which location the dewatered sludge is pumped to by properly positioning the discharge valves open or closed.

5. Dewatered Sludge Polymer Injection – The operator may choose to inject polymer into the dewatered sludge piping, downstream of the Dewatered Sludge Pumps, to reduce friction in the piping therefore reducing the pump discharge pressure. The feed rate of polymer injection is controlled by adjusting the speed of the Sludge Cake Polymer Pump associated with the Dewatered Sludge Cake Pump in operation. These pumps will turn on based on the pressure in the Dewatered Sludge Cake pipe. The pressure set point is set by the operator.

Non Controllable Variables

1. Feed Sludge Solids Concentration – The feed sludge solids concentration is controlled by upstream processes. This concentration will affect how much sludge feed and polymer should be sent to the centrifuges in order to achieve the driest cake.

Calculations

Calculate the flow from the Sludge Cake Pump based on the outlet pressure and the pump revolutions per minute (RPM). Flow can be calculated based on the following:

0 - 60 psi flow = $0.5075 \times \text{RPM} - 4.927 \text{ lbs/min}$
60 - 180 psi flow = $0.4851 \times \text{RPM} - 4.2685 \text{ lbs/min}$
180 - 300 psi flow = $0.4874 \times \text{RPM} - 15.149 \text{ lbs/min}$
300 - 400 psi flow = $0.49 \times \text{RPM} - 36.661 \text{ lbs/min}$

Formula is based on RPM, 100% = 400 RPM

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Operating Strategies

The Sludge Dewatering System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. However, the centrifuge units have a local HMI that allows the operator to run the centrifuge units locally. The Compressed Air System is intended to operate through SCADA and is not intended to operate in a LOCAL-MANUAL mode.

Centrifuge Feed Pumps

There are two duty and one standby Centrifuge Feed Pumps. Each pump system includes a Centrifuge Feed Pump (with LCP), flushing connections, seal water, pressure gauge, flow meter, check valve, and isolation valves. Pumps are equipped with AFDs.

Centrifuge Feed Pump 3 has an additional control mode, SLUDGE TRANSFER, associated with transferring digested sludge between the Anaerobic Digesters. Exhibit 54-2 lists the control modes for the Centrifuge Feed Pumps.

EXHIBIT 54-2
Centrifuge Feed Pumps Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	LOCAL/REMOTE status of the Centrifuge Feed Pumps is controlled at the LCS.	
Manual/Local	When operating the Centrifuge Feed Pumps in the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs the pump speed at the LCS.	
Manual/Remote	When operating in REMOTE, the operator selects REMOTE-MANUAL or REMOTE-AUTO pump control mode at SCADA.	
Manual/Remote	When operating the Centrifuge Feed Pumps in the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs the pump speed at SCADA.	

Auto/Remote	When operating the Centrifuge Feed Pumps in the REMOTE-AUTO control mode, the speed of the pump will automatically adjust to maintain an operator- controlled FLOW setpoint.	
Auto/Remote	In the AUTO control mode, the speed command for the pumps will be overridden if all of the Sludge Pump Dump Valves are CLOSED.	
Auto/Remote	When operating Centrifuge Feed Pump 3 in the SLUDGE TRANSFER mode, the PLC will adjust the speed of the pump until the actual flow as measured by the Centrifuge Feed Pump 3 flowmeter matches the operator-input setpoint.	
Auto/Remote	SCADA monitors and reports LOCAL/REMOTE status, ON/OFF status, FAIL condition, speed, motor runtime, motor voltage, motor current, and power consumed for the Centrifuge Feed Pumps.	
NOTES: LCS = local control station SCADA = supervisory control and data acquisition PLC = programmable logic controller		

Dewatering Centrifuge Units

There are two duty Dewatering Centrifuge Units. Each centrifuge system includes a centrifuge unit, vendor-supplied LCP (located in the Solids Facility Electrical Room), sludge cake diverter gate, sampling connections, and multiple polymer and plant water (W3) injection points. Foul air connections exist on the centrate discharge and cake discharge chute. Exhibit 54-3 lists the control modes for the centrifuge units.

EXHIBIT 54-3
Centrifuge Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The Centrifuges can be controlled in MANUAL either in LOCAL or REMOTE mode set at the LCP.	

Manual	When operating the centrifuge units in the LOCAL-MANUAL control mode, centrifuge control shall only be available through the centrifuge control panel and AFD panel. In the REMOTE-MANUAL mode, Start, Stop, Backdrive control mode, torque set point, differential set point, and other specified centrifuge controls shall be from SCADA.	
Auto/Remote	SCADA monitors and reports the Emergency Stop, ON/OFF, READY, FAILED TO START, FAILED TO STOP, LOCAL/REMOTE, Backdrive control mode, Bowl speed, Scroll drive gear shaft speed (if gearbox supplied), Bowl/Scroll differential Speed, Backdrive torque, main drive motor amperage, Solid side bearing temperature, Liquid side bearing temperature, vibration alarms, FAULT, sludge feed ENABLE signal, polymer feed ENABLE signal, multiple flush water valve OPEN command, and dewatered sludge pump ENABLE signal for the Dewatering Centrifuge Units.	
NOTES: LCP = local control panel AFD = adjustable frequency drive SCADA = supervisory control and data acquisition		

Dewatered Sludge Pumps

There are two Dewatered Sludge Pumps, one dedicated to each Centrifuge. Each pump system includes a Dewatered Sludge Pump (with LCS), polymer injection ring, seal water, plant water (W3) injection point, AHP injection point, pressure gauge, weight cells, pneumatically actuated knife gates, and isolation valves. Pumps are equipped with AFDs. Exhibit 54-4 lists the control modes for the Dewatered Sludge Pumps.

EXHIBIT 54-4
Dewatered Sludge Pumps Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The LOCAL-MANUAL or REMOTE control modes are selected by the operator at the LCS.	

Manual/Local	When operating the Dewatered Sludge Pumps in the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs the pump speed at the LCS.	
Manual/Remote	When operating in REMOTE, the operator selects the REMOTE-MANUAL or REMOTE-AUTO pump control mode at SCADA.	
Manual/Remote	When operating the Dewatered Sludge Pumps in the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON and OFF and inputs the pump speed at SCADA.	
Auto/Remote	When operating the Dewatered Sludge Pumps in the REMOTE-AUTO control mode, the speed of the pump is automatically adjusted to maintain an operator-adjusted WEIGHT setpoint in SCADA. In the REMOTE-AUTO control mode, the speed command for the pumps will be overridden if all of the Sludge Pump Dump Valves are CLOSED.	
Auto/Remote	SCADA monitors and reports the LOCAL/REMOTE, ON/OFF status, FAIL condition, speed, motor runtime, motor voltage, motor current, load cell weight, and power consumed for the Dewatered Sludge Pumps.	
NOTES: LCS = local control station SCADA = supervisory control and data acquisition		

Dewatered Sludge Pump Dump Valves

Exhibit 54-5 lists the control modes for the Dewatered Sludge Pump Dump Valves.

EXHIBIT 54-5
Dewatered Sludge Pump Dump Valves Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The Dewatered Sludge Pump Dump Valves are only controlled in a REMOTE-MANUAL control mode.	

Manual/Remote	When operating the Dewatered Sludge Pump Dump Valves in the REMOTE-MANUAL control mode, the operator selects the OPEN or CLOSE position of the valves based on the type of truck configuration and cleaning or maintenance needs.	
Auto/Remote	An interlock is programmed into the operation of the Dewatered Sludge Pump to prevent operating the pump until proof of an OPEN Dewatering Sludge Pump Dump Valve associated with the pump is met.	
Auto/Remote	When one of the Dewatered Sludge Pump Dump Valves is OPEN and a Dewatered Sludge Pump is ON, SCADA calculates the total pounds of dewatered sludge being pumped to the trucks. Calculation shall be based on an Operator-input TSS concentration; pump discharge pressure; pump speed and pump run time at each speed.	<p>Calculate the flow from the pump based on the outlet pressure and the pump RPM. Flow can be calculated based upon the following:</p> <p>0 - 60 psi flow = $0.5075 \times \text{RPM} - 4.927$ 60 - 180 psi flow = $0.4851 \times \text{RPM} - 4.2685$ 180 - 300 psi flow = $0.4874 \times \text{RPM} - 15.149$ 300 - 400 psi flow = $0.49 \times \text{RPM} - 36.661$</p> <p>Formula is based on RPM, 100% = 400 RPM</p>
Auto/Remote	SCADA monitors and reports the OPEN/CLOSED status, FAIL-TO-OPEN, and FAIL-TO-CLOSE for the Dewatered Sludge Pump Dump Valves.	
<p>NOTES: SCADA = supervisory control and data acquisition TSS = total suspended solids RPM = revolutions per minute psi –pounds per square inch</p>		

Dewatered Sludge Flush Valves

Exhibit 54-6 lists the control modes for the Dewatered Sludge Flush Valves.

EXHIBIT 54-6
Dewatered Sludge Flush Valves Control Modes

MODE	DESCRIPTION	REFERENCES

Manual/Remote	The Dewatered Sludge Flush Valves can be operated in either REMOTE-MANUAL or REMOTE-AUTO control modes. The operator selects the particular REMOTE valve control mode at SCADA.	
Manual/Remote	When operating the Dewatered Sludge Flush Valves in the REMOTE-MANUAL control mode, the operator selects the OPEN or CLOSE position of the valve at SCADA.	
Auto/Remote	These valves are not operated in Auto	
NOTES: SCADA = supervisory control and data acquisition		

Dewatered Sludge Pump Flush

Exhibit 54-7 lists the control modes for Dewatered Sludge Pump flush control.

EXHIBIT 54-7
Dewatered Sludge Pump Flush Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The Dewatered Sludge Pump Flush Control can be operated in either REMOTE-MANUAL or REMOTE-AUTO control modes. The operator selects the particular REMOTE valve control mode at SCADA.	
Manual/Remote	When operating the Dewatered Sludge Pump Flush Control in the REMOTE-MANUAL control mode, the operator selects the OPEN or CLOSE position of the valve at SCADA.	
Auto/Remote	When operating the Dewatered Sludge Pump Flush Control in the REMOTE-AUTO control mode, the valve will OPEN and CLOSE at pressure set points set by the operator.	
Auto/Remote	SCADA monitors and reports the OPEN/CLOSED status, LOCAL/REMOTE, FAIL-TO-OPEN, and FAIL-TO-CLOSE for the Dewatered Sludge Pump Flush Control.	

NOTES:

SCADA = supervisory control and data acquisition

Sludge Cake Flush Valves

Exhibit 54-8 lists the control modes for the Sludge Cake Flush Water Valves.

EXHIBIT 54-8**Sludge Cake Flush Water Valves Control Modes**

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The Sludge Cake Flush Water Valve can be operated in either REMOTE-MANUAL or REMOTE-AUTO control modes. The operator selects the particular REMOTE valve control mode at SCADA.	
Manual/Remote	When operating the Sludge Cake Flush Water Valves in the REMOTE-MANUAL control mode, the operator selects the OPEN or CLOSE position of the valve at SCADA.	
Auto/Remote	These valves are not operated with an Auto function	
Auto/Remote	SCADA monitors and reports the OPEN/CLOSED status, LOCAL/REMOTE, FAIL-TO-OPEN, and FAIL-TO-CLOSE for the Sludge Cake Flush Water Valves.	

NOTES:

SCADA = supervisory control and data acquisition

HMI = human-machine interface

Startup Procedures

Local and Remote-Auto Mode:

At the LCS for each piece of equipment, select REMOTE operation for the Polymer Feed Pumps, Centrifuge Feed Pumps, and Dewatered Sludge Pumps.

The Centrifuge START command is done at the LCS located in the electrical control room. The user must first select Local control on the touch screen HMI and then push the round green start button located below the touch screen HMI. The centrifuge bowl and scroll motors will then begin to spin up. At this point the user can put the system back into Remote control on the touch screen HMI. This command will instruct the Centrifuge Control System (programming internal to the centrifuge PLC) to begin its start sequence. The centrifuge shall not be allowed to start more than two times per hour if cold and one time per hour if hot. The Centrifuge Control System will confirm the successful initiation and/or completion of each step in the startup sequence before continuing with the next step in the sequence. Once the Centrifuge has reached its operating speed, the HMI will display "Ready For Sludge". At this point the Operator will use the SCADA system to continue with the start up. On the Centrifuge page the operator must push the "Process Start" button to begin the automatic sequence detailed below.

1. The start sequence can only begin when the Centrifuge Feed Pump and Polymer Feed Pump are not running.
2. Provided all interlocks are in the normal state, the Centrifuge Control System will bring the bowl and scroll up to speed and signal when proper conditions have been attained to begin feeding polymer and digested sludge.
3. Initiate start of Polymer Feed Pump (centrifuge PLC will communicate ENABLE permissive signal to the PCS, which will then start the pump).
4. Initiate the start of the Centrifuge Feed Pump after a preset time delay.
5. Initiate closing of the Dewatered Sludge Diverter Slide Gate to discharge to the centrate piping and initiate Diverter Gate Flush Water Valve open for flushing.
6. Upon reaching an operator-input torque setpoint, initiate opening of the Dewatered Sludge Diverter Slide Gate and initiate closing of the Diverter Gate Flush Water Valve.
7. Initiate the start of the Dewatered Sludge Pump (centrifuge PLC will communicate ENABLE permissive signal to PCS, which will then start the pump).
8. If the start sequence is interrupted for any reason, the centrifuge controller will generate a time-delayed FAIL TO START alarm that has an operator-adjustable delay of from zero to 5 minutes. Stop the Centrifuge Feed Pump and Polymer Feed Pump, and allow the machine to coast to a standstill. Stopping the Centrifuge and Polymer Feed Pumps is accomplished by disabling the ENABLE commands.

9. If the sequence is successful, discontinue monitoring interlock status of polymer feed, sludge feed, and dewatered sludge conveyance.

Remote-Manual Mode:

1. REMOTE-MANUAL mode of operation for the Centrifuges, Centrifuge Feed Pumps, Polymer Feed Pumps, and the Dewatered Sludge Pumps is not provided.

Local-Manual Mode:

1. LOCAL-MANUAL mode of operation for the Centrifuges is not provided. See the Local and Remote-Auto Mode for operating the Centrifuge from the Centrifuge LCP.
2. Local-Manual operation of the Centrifuge Feed Pumps, Polymer Feed Pumps, and the Dewatered Sludge Pumps is not recommended for normal operation.
 - a. At the LCS for each piece of equipment, select LOCAL operation for the Centrifuge Feed Pumps, Polymer Feed Pumps, and the Dewatered Sludge Pumps.
 - b. At the LCS for the Centrifuge Feed Pumps, Polymer Feed Pumps, and the Dewatered Sludge Pumps, set the pump speed.

Shutdown Procedures

Local and Remote-Auto Mode:

The Centrifuge STOP command, either locally or from SCADA, will instruct the Centrifuge Control System (programming internal to the centrifuge PLC) to begin its shutdown sequence. The centrifuge system will confirm the successful initiation and/or completion of each step in the shutdown sequence. If a step in the sequence fails, the centrifuge controller shall generate an alarm specifying the failed step.

3. Stop the Centrifuge Feed Pump and Polymer Feed Pump.

4. The Centrifuge shall maintain a preset differential speed to clear the remaining cake from the bowl.
5. After a set adjustable time for removal of resident solids or upon reaching an operator-entered falling backdrive torque setpoint, initiate opening the Bowl Flush Water Valve and initiate closing of the Dewatered Sludge Diverter Slide Gate to discharge to the centrate piping, and initiate the Diverter Gate Flush Water Valve open for flushing.
6. Stop the Dewatered Sludge Pump.
7. After a predetermined (adjustable) period of time, close the Bowl Flush Water Valve and initiate opening the Dewatered Sludge Diverter Slide Gate and closing the Diverter Gate Flush Water Valve. The centrifuge will then coast to a standstill.

The following conditions will cause a “Controlled Shutdown” of the centrifuge units and alert this condition to SCADA. These automatic shutdown interlocks include:

1. Backdrive controller malfunction.
2. Left/right bearing HIGH HIGH temperature alarms.
3. Backdrive malfunction.
4. HIGH HIGH torque.
5. HIGH HIGH vibration.

The Centrifuge Control System will cause an automatic “Normal Stop” sequence shutdown of the centrifuge and alert this condition to SCADA if any of the following interlocks are triggered:

1. Backdrive HIGH temperature alarm.
2. Drive motor over temperature.
3. Main drive motor overload.

A “Controlled Shutdown” can be performed at either the centrifuge HMI by selecting Local control and “Flush and Shutdown” or at the SCADA terminal by selecting the “CIP start” button. Either requires reset at the centrifuge control panel before the unit can be restarted.

1. A "Controlled Shutdown" will de-energize the centrifuge main drive motor. If available, the backdrive shall remain active until the bowl has coasted to a standstill, controlled to clear as much solids as possible from the bowl.
2. The sludge and polymer feeds will stop (disable ENABLE commands).
3. Initiate the Bowl Flush Water Valve for flushing, initiate closing of the Dewatered Sludge Diverter Slide Gate, and initiate opening of the Diverter Gate Flush Water Valve. Subsequently, initiate the closing of the Bowl Flush Water Valve, closing of the Diverter Gate Flush Water Valve, and opening of the Dewatered Sludge Diverter Slide Gate after an adjustable period of time.
4. The Dewatered Sludge Pump will stop (disable ENABLE command).

An Emergency Stop is initiated via the E-stop pushbutton at the Centrifuge control panel/AFD panel or at the centrifuge unit itself. An emergency stop will stop the Centrifuge and all associated equipment instantaneously with no flush water.

1. This command will de-energize the centrifuge system.
2. The sludge and polymer feeds will stop (disable ENABLE commands).
3. Initiate closing of the Dewatered Sludge Diverter Slide Gate and initiate opening of the Diverter Gate Flush Water Valve. Subsequently, initiate closing of the Diverter Gate Flush Water Valve and opening of the Dewatered Sludge Diverter Slide Gate after an adjustable time period.
4. The Dewatered Sludge Pump will stop (disable ENABLE command).

Remote-Manual Mode:

1. REMOTE-MANUAL mode of operation for the Centrifuges, Centrifuge Feed Pumps, Polymer Feed Pumps, and the Dewatered Sludge Pumps is not provided.

Local Manual Mode:

1. LOCAL-MANUAL mode of operation for the Centrifuges is not provided. See the Local and Remote-Auto Mode for operation of the Centrifuge from the Centrifuge LCP.
2. At the LCS for the Centrifuge Feed Pumps and Polymer Feed Pumps and the Dewatered Sludge Pumps, with the LOCAL-REMOTE switch in LOCAL, set the pump speed to zero.

Abnormal Conditions

Centrifuge

1. Clean-In-Place: See Dewatering Centrifuge O&M Manual.
2. Recuperative Thickening: During periods of time when dewatered sludge cannot be taken to trucks for disposal, recuperative thickening of the Aerobic Digester is achievable. For this mode of operation, the Centrifuges shall be adjusted to produce approximately 8 percent TSS dewatered sludge rather than the design target 20 percent TSS dewatered sludge. See the Dewatering Centrifuge O&M Manual and field performance testing reports for proper centrifuge system adjustments during this mode of operations. In addition, the Dewatered Sludge Pump Dump valve to the Aerobic Digester shall be OPEN. All other dump valves shall be closed. Otherwise, the Centrifuge shall be run in either the LOCAL or REMOTE AUTO control mode as indicated above.

Centrifuge Feed Pumps

1. Normal operation is to draw digested sludge from the Aerobic Digester for dewatering. If the Aerobic Digester is out of service, digested sludge can be drawn directly from the Anaerobic Digesters for dewatering. To achieve this mode of operation, position the manual isolation valves on the digested sludge Centrifuge Feed Pump suction piping to draw from the Anaerobic Digester of choice rather than the Aerobic Digester.
2. Digested Sludge Transfer: Any one of the Centrifuge Feed Pumps can be used to transfer digested sludge from one Anaerobic Digester to another. The principle pump for this mode of operation is Centrifuge Feed Pump 3. To achieve this mode of operation, position the manual isolation valves on the Digested Sludge Centrifuge Feed Pump suction and discharge piping to draw sludge from one Anaerobic Digester and discharge to the other. This mode of operation should be conducted with the pump in use in the LOCAL mode of operation.

3. Recirculate a portion of the aerobically digested solids upstream of the Anaerobic Digesters. To accomplish this task, one pump, principally Centrifuge Feed Pump 3, can be used to send a portion of aerobically digested sludge back to the sludge feed piping upstream of the Anaerobic Digester. To achieve this mode of operation, position the manual isolation valves on the Digested Sludge Centrifuge Feed Pump suction and discharge piping to draw sludge from one Aerobic Digester and discharge to the sludge feed piping.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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54 - Dewatering System

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Centrifuge Feed Pump 1 FAIL-TO-START	Centrifuge Feed Pump 1 (78PMP26001) has Failed to Start.	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 2 FAIL-TO-START	Centrifuge Feed Pump 2 (78PMP26002) has Failed to Start.	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 3 FAIL-TO-START	Centrifuge Feed Pump 3 (78PMP26003) has Failed to Start.	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 1 FAIL-TO-STOP	Centrifuge Feed Pump 1 (78PMP26001) has Failed to Stop.	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 2 FAIL-TO-STOP	Centrifuge Feed Pump 2 (78PMP26002) has Failed to Stop.	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 3 FAIL-TO-STOP	Centrifuge Feed Pump 3 (78PMP26003) has Failed to Stop.	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 1 HIGH DISCHARGE PRESSURE	Instrument (78PSH26101) has detected High Discharge Pressure in Centrifuge Feed Pump 1 (78PMP26001).	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 2 HIGH DISCHARGE PRESSURE	Instrument (78PSH26102) has detected High Discharge Pressure in Centrifuge Feed Pump 2 (78PMP26002)	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 3 HIGH DISCHARGE PRESSURE	Instrument (78PSH26103) has detected High Discharge Pressure in Centrifuge Feed Pump 3 (78PMP26003)	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 1 HIGH STATOR TEMPERATURE	Instrument (78PSH26101) has detected HIGH STATOR TEMPERATURE in Centrifuge Feed Pump 1 (78PMP26001).	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 2 HIGH STATOR TEMPERATURE	Instrument (78PSH26102) has detected HIGH STATOR TEMPERATURE in Centrifuge Feed Pump 2 (78PMP26002)	Alarm on SCADA. Inspect the Centrifuge Equipment.
Centrifuge Feed Pump 3 HIGH STATOR TEMPERATURE	Instrument (78PSH26103) has detected HIGH STATOR TEMPERATURE in Centrifuge Feed Pump 3 (78PMP26003)	Alarm on SCADA. Inspect the Centrifuge Equipment.

ALARM	MEANING	RESPONSE OR ACTION
Dewatered Sludge Pump 1 FAIL-TO-START	Thickened Sludge Pump 1 (78PMP12901) has Failed to Start.	Alarm on SCADA. Inspect Thickened Sludge Pump 1
Dewatered Sludge Pump 2 FAIL-TO-START	Thickened Sludge Pump 2 (78PMP12902) has Failed to Start.	Alarm on SCADA. Inspect Thickened Sludge Pump 2
Dewatered Sludge Pump 1 FAIL-TO-STOP	Thickened Sludge Pump 1 (78PMP12901) has Failed to Stop.	Alarm on SCADA. Inspect Thickened Sludge Pump 1
Dewatered Sludge Pump 2 FAIL-TO-STOP	Thickened Sludge Pump 2 (78PMP12902) has Failed to Stop.	Alarm on SCADA. Inspect Thickened Sludge Pump 2
Dewatered Sludge Pump 1 HIGH DISCHARGE PRESSURE	Instrument (78PSH13001) has detected High Discharge Pressure on Dewatered Sludge Pump 1 (78PMP12901)	Alarm on SCADA. Pump shuts down. Inspect Dewatered Sludge Pump 1.
Dewatered Sludge Pump 2 HIGH DISCHARGE PRESSURE	Instrument (78PSH13002) has detected High Discharge Pressure on Dewatered Sludge Pump 2 (78PMP12902)	Alarm on SCADA. Pump shuts down. Inspect Dewatered Sludge Pump 2.
Dewatered Sludge Pump 1 HIGH STATOR TEMPERATURE	Instrument (78TSH13301) has detected High Stator Temperature on Dewatered Sludge Pump 1 (78PMP12901)	Alarm on SCADA. Inspect Dewatered Sludge Pump 1.
Dewatered Sludge Pump 2 HIGH STATOR TEMPERATURE	Instrument (78TSH13302) has detected High Stator Temperature on Dewatered Sludge Pump 2 (78PMP12902)	Alarm on SCADA. Inspect Dewatered Sludge Pump 2.
Centrifuge 1 Backdrive HIGH TEMPERATURE	Centrifuge 1 Backdrive (78BKD11301) has detected HIGH TEMPERATURE	Alarm on SCADA. Initiates a "Normal Stop" of the centrifuge.
Centrifuge 1 Drive Motor HIGH TEMPERATURE	Centrifuge 1 Drive Motor (78CEN10701) has detected HIGH TEMPERATURE	Alarm on SCADA. Initiates a "Normal Stop" of the centrifuge.
Centrifuge 1 Drive Motor HIGH HIGH TEMPERATURE	Centrifuge 1 Drive Motor (78CEN10701) has detected HIGH HIGH TEMPERATURE	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge.
Centrifuge 2 Drive Motor HIGH TEMPERATURE	Centrifuge 2 Drive Motor (78CEN10702) has detected HIGH TEMPERATURE	Alarm on SCADA. Initiates a "Normal Stop" of the centrifuge.
Centrifuge 2 Drive Motor HIGH HIGHTEMPERATURE	Centrifuge 2 Drive Motor (78CEN10702) has detected HIGH HIGH TEMPERATURE	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge Backdrive 1 HIGH TORQUE	Centrifuge 1 Backdrive (78BKD11301) has detected HIGH TORQUE	Alarm on SCADA.
Centrifuge Backdrive 1 HIGH HIGH TORQUE	Centrifuge 1 Backdrive (78BKD11301) has detected HIGH HIGH TORQUE	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.

ALARM	MEANING	RESPONSE OR ACTION
Centrifuge 2 Backdrive HIGH Torque	Centrifuge 2 Backdrive (78BKD11302) has detected HIGH TORQUE	Alarm on SCADA.
Centrifuge 2 Backdrive HIGH HIGH Torque	Centrifuge 2 Backdrive (78BKD11302) has detected HIGH HIGH TORQUE	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Dewatered Sludge Hopper 1 LOW WEIGHT	Instrument (78WIT12801) has detected a LOW WEIGHT in Dewatered Sludge Hopper 1	Alarm on SCADA.
Dewatered Sludge Hopper 2 LOW WEIGHT	Instrument (78WIT12802) has detected a LOW WEIGHT in Dewatered Sludge Hopper 2	Alarm on SCADA.
Centrifuge 1 Main Drive Controller (AFD) Malfunction	Centrifuge 1 (78CEN10701) Main Drive Controller (AFD) Malfunction	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge 2 Main Drive Controller (AFD) Malfunction	Centrifuge 2 (78CEN10702) Main Drive Controller (AFD) Malfunction	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge 1 Drive Motor Overload	Centrifuge 1 (78CEN10701) has detected a motor overload condition	Alarm on SCADA. Initiates a "Normal Stop" of the centrifuge.
Centrifuge 2 Drive Motor Overload	Centrifuge 2 (78CEN10702) has detected a motor overload condition	Alarm on SCADA. Initiates a "Normal Stop" of the centrifuge.
Centrifuge 2 Backdrive HIGH TEMPERATURE	Centrifuge 2 Backdrive (78BKD11302) has detected HIGH TEMPERATURE	Alarm on SCADA. Initiates a "Normal Stop" of the centrifuge.
Centrifuge 1 Drive Motor HIGH or HIGH-HIGH TEMPERATURE Outboard Bearing	Centrifuge 1 Drive Motor (78CEN10701) has detected HIGH or HIGH-HIGH TEMPERATURE on the Outboard Bearing	Alarm on SCADA.
Centrifuge 2 Drive Motor HIGH or HIGH HIGHTEMPERATURE Outboard Bearing	Centrifuge 2 Drive Motor (78CEN10702) has detected HIGH TEMPERATURE on the Outboard Bearing	Alarm on SCADA.
Centrifuge 1 Drive Motor HIGH or HIGH-HIGH VIBRATION on the Inboard Bearing	Centrifuge 1 Drive Motor (78CEN10701) has detected HIGH or HIGH-HIGH VIBRATION on the Inboard Bearing	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge 2 Drive Motor HIGH or HIGH-HIGH VIBRATION on the Inboard Bearing	Centrifuge 2 Drive Motor (78CEN10702) has detected HIGH or HIGH-HIGH VIBRATION on the Inboard Bearing	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge 1 Drive Motor HIGH DIFFERENTIAL SPEED on the Scroll Conveyor	Centrifuge 1 Drive Motor (78CEN10701) has detected HIGH DIFFERENTIAL SPEED on the Scroll Conveyor	Alarm on SCADA.
Centrifuge 2 Drive Motor HIGH DIFFERENTIAL SPEED on the Scroll Conveyor	Centrifuge 2 Drive Motor (78CEN10702) has detected HIGH DIFFERENTIAL SPEED on the Scroll Conveyor	Alarm on SCADA.

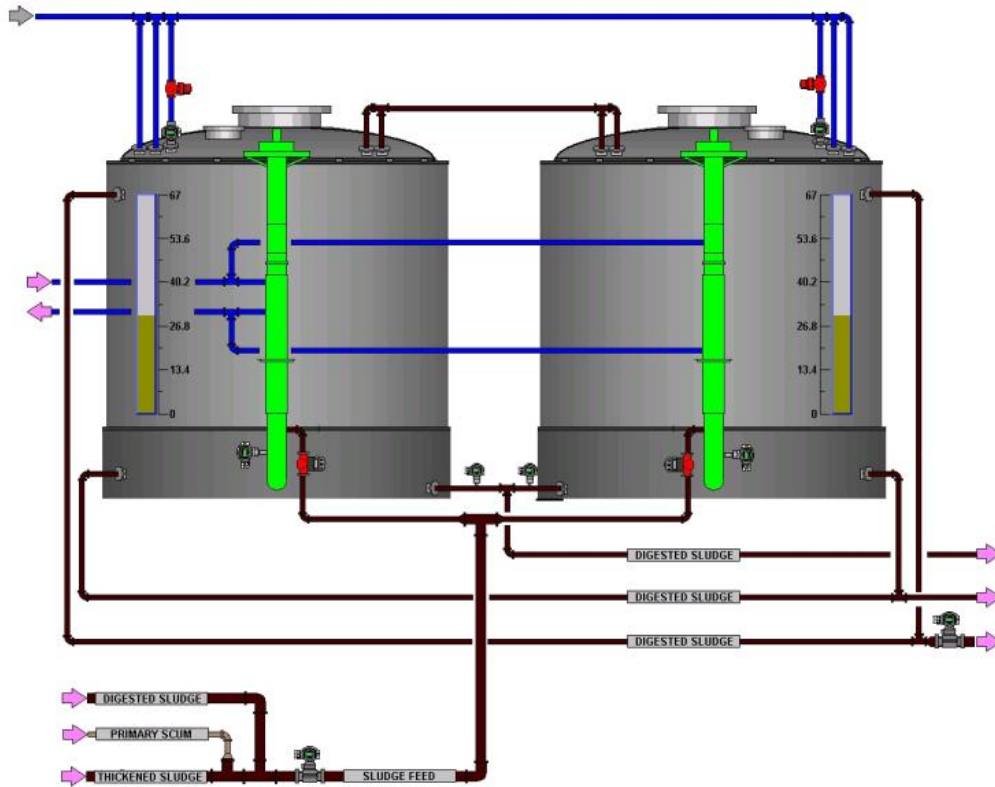
ALARM	MEANING	RESPONSE OR ACTION
Centrifuge 1 Back Drive Controller (AFD) Malfunction	Centrifuge 1 (78BKD11301) Back Drive Controller (AFD) Malfunction	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge 2 Back Drive Controller (AFD) Malfunction	Centrifuge 2 (78BKD11302) Back Drive Controller (AFD) Malfunction	Alarm on SCADA. Initiates a "Controlled Shutdown" of the centrifuge. Inspect Centrifuge.
Centrifuge 1 Grease Alarm	Centrifuge 1 (78CEN10701) Grease Timer on SCADA has reached the set minutes	Alarm on SCADA. Grease the Inboard and Outboard bearings, then push the reset for the Grease Timer on SCADA.
Centrifuge 2 Grease Alarm	Centrifuge 2 (78CEN10702) Grease Timer on SCADA has reached the set minutes	Alarm on SCADA. Grease the Inboard and Outboard bearings, then push the reset for the Grease Timer on SCADA.
Dewatered Sludge Valve (78FV10801) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV10801) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV10802) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV10802) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV13201) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV13201) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV13202) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV13202) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14001) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14001) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14002) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14002) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14101) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14101) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14102) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14102) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14201) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14201) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14202) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14202) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV13102) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV13102) Failed to Open	Alarm on SCADA. Inspect valve

ALARM	MEANING	RESPONSE OR ACTION
Dewatered Sludge Valve (78FV14401) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14401) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14402) FAIL-TO-OPEN	Dewatered Sludge Valve (78FV14402) Failed to Open	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV10801) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV10801) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV10802) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV10802) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14001) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14001) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14002) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14002) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14101) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14101) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14102) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14102) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14201) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14201) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14202) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14202) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14401) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14401) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14402) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14402) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV13101) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV13101) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV13102) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV13102) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV13201) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV13201) Failed to Close	Alarm on SCADA. Inspect valve

ALARM	MEANING	RESPONSE OR ACTION
Dewatered Sludge Valve (78FV13202) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV13202) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Valve (78FV14301) FAIL-TO-CLOSE	Dewatered Sludge Valve (78FV14301) Failed to Close	Alarm on SCADA. Inspect valve
Dewatered Sludge Hopper 1 HIGH WEIGHT	Instrument (78WIT12801) has detected HIGH WEIGHT in the Dewatered Sludge Hopper 1	Alarm on SCADA. Speed controller for Centrifuge Feed Pump is overridden to secondary speed setpoint on HIGH WEIGHT in Dewatered Sludge Hopper
Dewatered Sludge Hopper 2 HIGH WEIGHT	Instrument (78WIT12802) has detected HIGH WEIGHT in the Dewatered Sludge Hopper 2	Alarm on SCADA. Speed controller for Centrifuge Feed Pump is overridden to secondary speed setpoint on HIGH WEIGHT in Dewatered Sludge Hopper
Solids Dewatering Air Receiver LOW PRESSURE	Instrument (78PSL13900) has detected LOW Pressure in the Solids Dewatering Air Receiver	Alarm on SCADA. Starts the Compressor.
Solids Dewatering Air Receiver HIGH PRESSURE	Instrument (78PSH13900) has detected HIGH Pressure in the Solids Dewatering Air Receiver	Alarm on SCADA. Stops the Compressor.
Solids Dewatering Air Receiver HIGH PRESSURE	Instrument (78PSH13900) has detected HIGH-HIGH Pressure in the Solids Dewatering Air Receiver	Alarm on SCADA.

60 - Anaerobic/Aerobic Digestion

Overview



Purpose

Anaerobic Digestion

The Anaerobic Digester System located to the west of the Solids Facility consists of components that provide digestion of the primary scum and aerated grit basin scum (PSM) and thickened combined (or separate) primary/waste activated sludge (TS). The primary components of this system include two 550,000-gallon, fixed-cover Anaerobic Digesters, two 9,200 gpm External Draft Tube Mixers with heating jackets, and two motorized Sludge Feed Valves. Included in the Anaerobic Digester Complex but discussed in the Digester Gas Storage/Conditioning process control narrative is the Digester Gas Equipment Room, located to the east of the Anaerobic Digesters.

Anaerobic digestion is a biochemical process by which anaerobic microorganisms stabilize and reduce the mass of sludges. Through a series of reactions, the raw sludge is transformed from organic sludge to inert organic and or inorganic compounds, methane, and carbon dioxide. As a result of these processes, the disease, infection, vector attraction, and odor potential of the raw sludge is dramatically reduced. End products of the process are stabilized biosolids and biogas comprised primarily of methane and carbon dioxide, which can be a fuel source for boilers, engine generators, fuel cells or microturbines. See the Digester Gas Storage/Conditioning process control narrative for additional information on the storage and use of digester gas at the Spokane County RWRf.

Aerobic Digestion

The Aerobic Digester/Biosolids Storage Tank System located to the east of the Solids Facility is configured as a covered Aerobic Sludge Digester/Biosolids Storage Tank. The primary components of this system include a 700,000-gallon fixed-cover Aerobic Digester, two turbo blowers, one positive displacement blower, coarse bubble diffuser system, and three analyzer probes with associated analyzer panel. The primary functions of this system are described below.

1. For nitrogen removal, the aerobic digester will be operated to first oxidize ammonia to either nitrite or nitrate and then to reduce the nitrite or nitrate to nitrogen gas. This will remove the majority of the nitrogen from the dewatering centrate, which is returned back to the liquids train. The digester is designed to operate in a range of DO conditions ranging from 0.01-mg/L to fully aerobic at 1 mg/L. The net effect of this nitrogen removal process is to reduce the potential need for carbon addition in the main bioreactor system.
2. The system equalizes sludge loads upstream of dewatering.
3. The system aerobically digests the Anaerobic Digester effluent for a further decrease in volatile solids.

Description

Anaerobic Digestion

The digestion process for the Spokane County RWRF is single-stage mesophilic (95°F) anaerobic digestion, which produces Class B biosolids. The design incorporates two 550,000-gallon, fixed-cover silo type anaerobic digesters operated in parallel and designed for a 15-day SRT at maximum month loads. These digesters are tall and relatively narrow, minimizing site space while allowing for an improved mixing process within each digester. The operating pressure for the digesters is 14 inches water column.

Digester contents will be mixed by means of an external draft tube mixer with a maximum turnover rate of 1 hour. Draft tube mixers combine a top-mounted propeller type mixer to provide mixing energy to the digester, along with a heating jacket to provide thermal input into the digester to keep the sludge in the mesophilic temperature range. Suction/discharge piping associated with the draft tube is centrally located near the bottom and top of the digester. Normal operation pulls sludge from the bottom of the digester and discharges it to the top. Another foam management provision in the Anaerobic Digesters is a sludge spray for the sludge transfer launder/trough. One of the centrifuge feed pumps located in the Solids Facility can redirect digested sludge for this use. Water sprays have been added to the digester overflow piping and the radar level transmitter stilling wells to help with foam control. A small amount of W3 water is sent to the p-trap on each digester overflow piping to keep it primed to prevent digester gas from escaping.

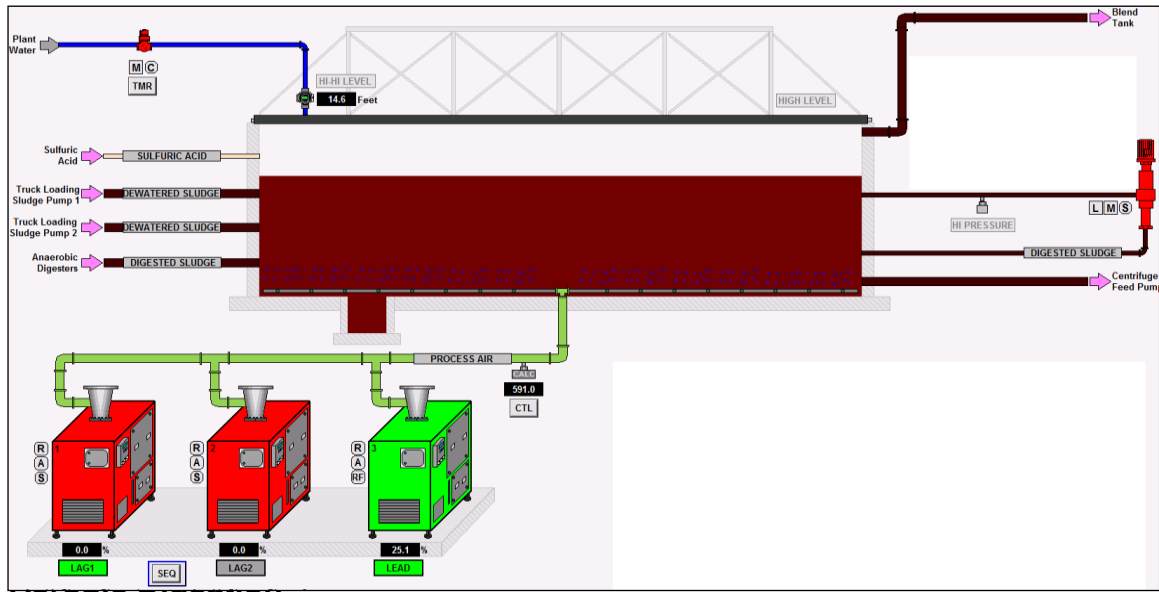
The Anaerobic Digesters are heated to the mesophilic temperature range (95°F) using hot water from the biogas utilization system (see the Digester Heating process control narrative). The feed consists of the scum from aerated grit and primary scum, in addition to the sludge supplied on a continuous basis from the thickening system. The net digester feed is designed at a feed solids concentration of 5 percent. The digesters use a “fill and spill” system, which will allow overflow to the Aerobic Digester.

The Anaerobic Digesters will meet the Class B criteria after anaerobic stabilization without relying on any additional treatment within the Aerobic Digester. When an Anaerobic Digester is taken out of service for cleaning, the thickness of the feed sludge will be increased, and recuperative thickening implemented as needed, to maintain class B biosolids.

Recuperative thickening takes a portion of the digested sludge (via the Gravity Belt Feed Pumps) from the digester, thickens it (via the GBTs), and returns the thickened solids to the digesters (via the Thickened Sludge Pumps). This increases the solids concentration within the digestion process, beyond what is possible with feed thickening alone.

One of the Centrifuge Feed Pumps can be used to transfer the contents from one digester to the other, which may be needed when taking a digester down for maintenance purposes.

The Anaerobic Digester System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup.



The Aerobic Digester is designed to operate at normal aerobic digestion aeration rates which provides the needed oxygen for full nitrification. However, it has also been designed to run at lower air rates (between 0.1 and 0.2 mg/L DO) to encourage nitritation ($\text{NH}_4 \rightarrow \text{NO}_2$)/denitritation ($\text{NO}_2 \rightarrow \text{N}_2$) mode. The elimination of the oxidation to nitrate ($\text{NO}_2 \rightarrow \text{NO}_3$) and its subsequent reduction to nitrite ($\text{NO}_3 \rightarrow \text{NO}_2$) reduces the aeration and carbon needs normally associated with this process. These operations are performed at low DO levels, which also reduces the energy requirements normally exerted in the digester, compared with operating the digester at more conventional DO levels of 2 mg/L or higher.

The Aerobic Digester/Biosolids Storage Tank System also incorporates recuperative thickening of the Aerobic Digester contents (via the Centrifuge Feed Pumps) to allow the combination of sludge storage and aerobic digestion in the same tank.

Recuperative thickening of the Aerobic Digester contents can be implemented to increase the solids content and increase solids storage capacity. The contents of the anaerobic digester can be further thickened if needed to provide additional solids storage capacity. Because the nutrient removal capabilities of the digester are not required during the winter season, the entire digester volume may be used as storage without having to do any additional thickening.

Traditionally, centrate equalization or treatment is warranted at nutrient removal facilities. This is a result of the high nutrient content of anaerobic digestion liquors from dewatering, typically greater than 500 mg/L for both nitrogen and phosphorus. In this system, the dewatering liquors will have a very low nutrient content. In the case of phosphorus, the metal salts that were used in the CEPT process and in the bioreactor will absorb any significant phosphorus released during the digestion process. As such, the very low nutrient levels do not require further treatment or equalization.

Two variable-speed turbo blowers located in the Solids Facility, one variable speed positive displacement blower located in the Solids Facility, and a coarse bubble diffuser system located inside the digester, will provide the necessary air flow requirements for further sludge digestion.

The analyzer located on top of the digester lid and an analyzer panel located to the south of the Aerobic Digester will continuously sample for ammonia, nitrate, temperature, DO, and pH levels.

The Aerobic Digester/Biosolids Storage Tank System is intended to operate remotely through SCADA and is not intended to operate in LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

Design Criteria and Component List

Exhibit 60-1 is a partial list of the components for the Anaerobic Digesters.

EXHIBIT 60-1

Anaerobic Digesters Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Sludge Feed Valve	85FV02101, 85FV02102	Quantity: 2 Type: Motorized Position: OPEN/CLOSE
Draft Tube Mixer	85MXR02001, 85MXR02002	Quantity: 2 Type: Propeller, Adjustable Speed Flow Rate (gpm): 9,200 Rated Differential Pressure (TDH/ft): 10 Power (hp): 7.5
Anaerobic Digester		Quantity: 2 Type: Silo, Fixed Cover Volume (gal): 555,500
Flow Meter	82FET00800	Quantity: 1

EXHIBIT 60-1**Aerobic Digester Component List (partial list)**

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Aerobic Digester		Quantity: 1 Type: Pancake, Fixed Cover Volume (gal): 700,000
Aerobic Digester Positive Displacement Blower	78BLW30003	Quantity: 1 Type: Positive displacement, variable speed Rated Flow Capacity (scfm): 3000 Rated Differential Pressure (psig): 8.5 Power (hp): 100
Aerobic Digester Blowers	78BLW30001 78BLW30002	Quantity: 2 Type: Turbo Rated Flow Capacity (scfm): 3000 Rated Differential Pressure (psig): 8.5 Power (hp): 100
NOTES: gpm = gallons per minute TDH/ft = total dynamic head per foot gal = gallons psig = pounds per square inch gauge scfm = standard cubic feet per minute		

Process Control Variables

Control Variables

- *Digester feed to Anaerobic Digesters*

Plant operators will have the ability to adjust the duration of feed to each of the two Anaerobic Digesters. The starting point for sludge feed duration to each digester is 30 minutes.

- *Operating Speed of External Draft Tube Mixers*

Plant operators can adjust the mixing rate of the External Draft Tube Mixers. At 100 percent speed of the mixers, the turnover rate for the digesters will be approximately 1 hour. Operators should set the speed of the mixers at 100 percent initially. The operator has the option to reduce mixer speed as long as digester gas production is not negatively affected (reduced).

- Operating Direction of External Draft Tube Mixers

Plant operators can adjust the operating direction of the External Draft Tube Mixers. An occasional flow reversal will help handle foam and minimize grit deposition at the bottom of the digester. Operators should start out by manually initiating a flow reversal of the mixers for a period of 5 to 10 minutes daily, as long as no process interruptions are witnessed. This duration and frequency of flow reversal should be continued on the mixers.

- Air Flow Rate to Aerobic Digester

Although it is not typical for the Aerobic Digester Blowers to be run manually, the option exists for the operators to manually adjust the blower speed, flow rate, and pressure.

Non-controllable Variables

- Sludge Feed Rates to both the Anaerobic and Aerobic Digester
- Sludge characteristics

Calculations

- None

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60 - Anaerobic/Aerobic Digesters

Operating Strategies

Anaerobic Digesters

Sludge feed is sent to the Anaerobic Digesters via the Thickened Sludge Pumps, Centrifuge Feed Pumps, Primary Sludge Pumps, and Primary Scum Pumps. Flow to each digester is based on an operator-entered time setpoint (for the Sludge Feed Valves) from SCADA that will alternate the feed to each digester. Digester mixing via the External Draft Tube Mixers shall run continuously when the digester is in operation.

There are two control modes for the External Draft Tube Mixers: LOCAL, and REMOTE-MANUAL. The two control modes are selected locally via the LCSs for the External Draft Tube Mixers. Exhibit 60-2 lists the control modes for the External Draft Tube Mixers.

EXHIBIT 60-2
External Draft Tube Mixers Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	When operating the External Draft Tube Mixers (85MXR02001 and 85MXR02001) in the LOCAL-MANUAL control mode, the operator manually turns the draft tube mixers ON or OFF, selects FORWARD or REVERSE, and inputs mixing speed at the local control station (LCS).	
Manual/Remote	When operating the External Draft Tube Mixers in the REMOTE-MANUAL control mode, the operator manually turns the draft tube mixers ON or OFF, selects FORWARD or REVERSE, and inputs mixing speed at supervisory control and data acquisition (SCADA).	

There are three control modes for the Anaerobic Digester Sludge Feed Valves: LOCAL, REMOTE-MANUAL, and REMOTE-AUTO. Selection of these control modes is shared locally at the valves (via the actuator) and at SCADA. Exhibit 60-3 lists the control modes for the Anaerobic Digester Sludge Feed Valves.

EXHIBIT 60-3
Anaerobic Digester Sludge Feed Valves Control Modes

MODE	DESCRIPTION	REFERENCES
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Manual/Local	When operating the Anaerobic Digester Sludge Feed Valves in the LOCAL-MANUAL control mode, the operator sets the valve to LOCAL at the valve through the LOCAL/REMOTE switch on the actuator. Once the valve is set to LOCAL at the valve, the valve can be OPENED or CLOSED locally.	
Manual/Remote	When operating the Anaerobic Digester Sludge Feed Valves in the REMOTE-MANUAL control mode, the operator sets the valve to REMOTE at the valve through the LOCAL/REMOTE switch on the actuator. Once the valve is set to REMOTE at the valve, the valve can be OPENED or CLOSED through the PCS.	
Auto/Remote	When operating the Anaerobic Digester Sludge Feed Valves in the REMOTE-AUTO control mode, the operator sets the valve to REMOTE at the valve through the LOCAL/REMOTE switch on the actuator. Once the valve is set to REMOTE at the valve, the operator can enter a time setpoint at the PCS that regulates the time duration at which the feed valves direct flow to each digester. Logic will prevent a sludge feed valve from being CLOSED prior to the adjacent digester sludge feed valve being OPENED.	
NOTES: PCS = Plant Control System		

Aerobic Digester

Anaerobic Digester effluent (digested sludge) flows by gravity to the Aerobic Digesters. Digested sludge flow to the Aerobic Digester is monitored by a flow meter.

Aerobic Digester Blowers provide air to the coarse bubble diffuser system in the Aerobic Digester. The Aerobic Digester Analyzer Probes located on the lid of the digester continuously monitor for the ammonia, nitrate, temperature, DO, and pH of the digested sludge.

There are five Aerobic Digester Blower control modes that control the operation of the blowers: LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO-FLOW, REMOTE-AUTO-DISSOLVED OXYGEN, and REMOTE-AUTO-pH. The operator manually selects the blower control mode at SCADA. Exhibit 60-4 lists the control modes for the Aerobic Digester Blower.

EXHIBIT 60-4
Aerobic Digester Blower Control Modes

MODE	DESCRIPTION	REFERENCES
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Manual/Local	When operating the Aerobic Digester blowers in the LOCAL-MANUAL control mode, the operator manually turns the blowers ON and OFF and inputs a blower speed at the blower HMI.	
Manual/Remote	When operating the Aerobic Digester Blowers in the REMOTE-MANUAL control mode, the operator manually turns the blowers ON and OFF and inputs a blower speed at SCADA.	
Auto/Remote	When operating in the AUTO-FLOW control mode, the number and speed of the Aerobic Digester Blowers shall adjust to maintain an operator-input air flow setpoint. The Aerobic Digester flow setpoint is adjustable through SCADA.	
Auto/Remote	When operating in the AUTO-DISSOLVED OXYGEN control mode, the number and speed of the Aerobic Digester Blowers shall adjust to maintain an operator-input DO setpoint (expected to range between 0.25 mg/L to 1 mg/L). The Aerobic Digester DO setpoint is adjustable through SCADA. In the DO control mode, it is expected that one blower will run continuously. Note, additional air flow from the blowers increases DO levels, and less air flow lowers DO levels. A timer exists in this operational mode allowing for two separate DO setpoints.	
Auto/Remote	When operating in the AUTO-pH control mode, the number and speed of the Aerobic Digester Blowers shall adjust to maintain an operator-input pH setpoint (approximately 6.9). The Aerobic Digester pH setpoint is adjustable through SCADA. In the pH control mode, it is expected that one blower will run continuously. Note, additional air flow from the blowers lowers pH levels, and less air flow increases pH levels.	
NOTES: HMI = human-machine interface SCADA = supervisory control and data acquisition DO = dissolved oxygen ORP = oxidation reduction potential		

Startup Procedures

Anaerobic Digester General:

1. Confirm that priming water is being sent to the digested sludge /OF traps on each Anaerobic Digester.
2. Confirm that the isolation valves located on the branches to the pressure/vacuum relief valves on each Anaerobic Digester are open.

3. Confirm that the isolation valves located on the spray water lines to the level transmitters on each Anaerobic Digester are open.
4. The isolation valves on the digested sludge lines that connect to the Sludge/Transfer Launder Trough should be closed initially and then used only as determined by operators for foam control/management.
5. The isolation valves on the spray water lines for the digested sludge /OF line and the digester gas lines should be closed initially and then used only as determined by operators for foam control/management.
6. Confirm that the isolation valves on the sludge feed lines to the Anaerobic Digesters are open.
7. Confirm that the isolation valves located on the digested sludge lines that feed the Aerobic Digester are open.

Aerobic Digester General:

1. Confirm that isolation valves on the spray water piping to the foul air piping and level transmitter are open.
2. Confirm that the isolation valve located on the digested sludge feed line to the Aerobic Digester from the Anaerobic Digester is open.
3. Confirm that the isolation valves located on the digested sludge lines to the Centrifuge Feed Pumps are open.
4. Confirm that the isolation valves located on the PD lines originating from the digested sludge feed line (from Anaerobic Digester) and the digested sludge feed line (to the Centrifuge Feed Pumps) are closed.
5. Confirm that the isolation valves located upstream and downstream of the Aerobic Digester Analyzer Panel (82ACP001) are open.

Remote-Manual Control for External Draft Tube Mixers:

1. Confirm adequate sludge level in the Anaerobic Digesters prior to starting the External Draft Tube Mixers. Sludge level in the digester should be close to 1992.5 feet.
2. Confirm water flow to the External Draft Tube Mixer heating jacket. The pumps that send flow the heating jackets on the External Draft Tube Mixers are the Hot Water Pumps 1 and 2 located in the Boiler Room of the Solids Facility.
3. At the LCS for the External Draft Tube Mixer, select REMOTE operation.

4. Through the PCS, set the External Draft Tube Mixer into the MANUAL mode.
5. Through the PCS, START the External Draft Tube Mixer.

Local-Manual Control for External Draft Tube Mixers:

1. Confirm adequate sludge level in the Anaerobic Digesters prior to starting the External Draft Tube Mixers. Sludge level in the digester should be close to 1992.5 feet.
2. Confirm water flow to the External Draft Tube Mixer heating jacket. The pumps that send flow the heating jackets on the External Draft Tube Mixers are the Hot Water Pumps 1 and 2 located in the Boiler Room of the Solids Facility.
3. At the LCS for the External Draft Tube Mixer, select LOCAL operation.
4. Turn the External Draft Tube Mixer ON with the ON/OFF/REMOTE switch at the LCS.

Remote-Auto Flow Control for Aerobic Digester Blowers:

1. Confirm normal sludge level in the Aerobic Digesters prior to starting the Aerobic Digester Blowers. Sludge level in the digester should be in the range of 1952.5 to 1971.5 feet.
2. Confirm that manual isolation valves located on the discharge of the blowers are open.
3. At the HMI for the Aerobic Digester Blowers, select REMOTE operation.
4. Through the PCS, set the Aerobic Digester Blower FLOW setpoint (adjustable between 600 scfm to 5,900 scfm).
5. Through the PCS, set both blowers into the AUTO-FLOW mode.
6. Through the PCS, START the Aerobic Digester Blowers.

Remote-Auto DO Control for Aerobic Digester Blowers:

1. Confirm normal sludge level in the Aerobic Digesters prior to starting the Aerobic Digester Blowers. Sludge level in the digester should be in the range of 1952.5 to 1971.5 feet.
2. Confirm that manual isolation valves located on the discharge of the blowers are open.

3. At the HMI for the Aerobic Digester Blowers, select REMOTE operation.
4. Through the PCS, set the Aerobic Digester Blower DO setpoints (adjustable between 0.01 mg/L to 5 mg/L). If required two DO setpoints can be used.
5. Through the PCS, set the Aerobic Digester Blower DO timer setpoint. This is the timed value between multiple DO setpoints.
6. Through the PCS, set the blowers into the AUTO-DO mode.
7. Through the PCS, START the Aerobic Digester Blowers.

Remote-Auto pH Control for Aerobic Digester Blowers:

1. Confirm normal sludge level in the Aerobic Digesters prior to starting the Aerobic Digester Blowers. Sludge level in the digester should be in the range of 1952.5 to 1971.5 feet.
2. Confirm that manual isolation valves located on the discharge of the blowers are open.
3. At the HMI for the Aerobic Digester Blowers, select REMOTE operation.
4. Through the PCS, set both Aerobic Digester Blowers pH setpoints (approximately 6.9).
5. Through the PCS, set the blowers into the AUTO-pH mode.
6. Through the PCS, START the Aerobic Digester Blowers.

Remote-Manual Control for Aerobic Digester Blowers:

1. Confirm normal sludge level in the Aerobic Digesters prior to starting the Aerobic Digester Blowers. Sludge level in the digester should be in the range of 1952.5 to 1971.5 feet.
2. Confirm that manual isolation valves located on the discharge of the blowers are open.
3. At the HMI for the Aerobic Digester Blowers, select REMOTE operation.
4. Through the PCS, set the Aerobic Digester Blower FLOW setpoint (adjustable between 600 scfm to 5,900 scfm).

5. Through the PCS, START the required number of Aerobic Digester Blowers.

Local-Manual Control for Aerobic Digester Blowers:

1. Confirm normal sludge level in the Aerobic Digesters prior to starting the Aerobic Digester Blowers. Sludge level in the digester should be in the range of 1952.5 to 1971.5 feet.
2. Confirm that manual isolation valves located on the discharge of the blowers are open.
3. At the HMI for the Aerobic Digester Blowers, select LOCAL operation.
4. Through the HMI, set the Aerobic Digester Blower FLOW setpoint (adjustable between 600 scfm to 5,900 scfm).
5. Through the HMI, START the Aerobic Digester Blowers.

Shutdown Procedures

Remote-Manual Control for External Draft Tube Mixers:

1. Initiate STOP commands through the PCS for the External Draft Tube Mixer.

Local-Manual Control for External Draft Tube Mixers:

1. Turn the External Draft Tube Mixer OFF with the ON/OFF/REMOTE switch at the LCS.

Remote-Auto Flow Control for Aerobic Digester Blowers:

1. Through the PCS, place the Aerobic Digester Blowers into MANUAL mode. Initiate STOP commands for the Aerobic Digester Blowers.

Remote-Auto DO Control for Aerobic Digester Blowers:

1. Through the PCS, place the Aerobic Digester Blowers into MANUAL mode. Initiate STOP commands for the Aerobic Digester Blowers.

Remote-Auto pH Control for Aerobic Digester Blowers:

1. Through the PCS, place the Aerobic Digester Blowers into MANUAL mode. Initiate STOP commands for the Aerobic Digester Blowers.

Remote-Manual Control for Aerobic Digester Blowers:

1. Initiate STOP commands through the PCS for the Aerobic Digester Blowers.

Local-Manual Control for Aerobic Digester Blowers:

1. Initiate STOP commands through the HMI for the Aerobic Digester Blowers.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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60 - Anaerobic and Aerobic Digester

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Anaerobic Digester HIGH LEVEL	Instrument (85LIT02601) has detected HIGH LEVEL in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH LEVEL	Instrument (85LIT02602) has detected HIGH LEVEL in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH TEMPERATURE	Instrument (85TET02501) has detected HIGH TEMPERATURE in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH TEMPERATURE	Instrument (85TET02502) has detected HIGH TEMPERATURE in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester LOWTEMPERATURE	Instrument (85TET02501) has detected LOWTEMPERATURE in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester LOW TEMPERATURE	Instrument (85TET02502) has detected LOWTEMPERATURE in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH LEVEL	Instrument (85LET02201) has detected HIGH LEVEL in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH LEVEL	Instrument (85LET02202) has detected HIGH LEVEL in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester Feed Valve FAIL-TO-OPEN	Anaerobic Digester Feed Valve (85FV02101) Failed to Open.	Alarm on SCADA.
Anaerobic Digester Feed Valve FAIL-TO-OPEN	Anaerobic Digester Feed Valve (85FV02102) Failed to Open.	Alarm on SCADA.
Anaerobic Digester Feed Valve FAIL-TO-CLOSE	Anaerobic Digester Feed Valve (85FV02101) Failed to Close.	Alarm on SCADA.
Anaerobic Digester Feed Valve FAIL-TO-CLOSE	Anaerobic Digester Feed Valve (85FV02102) Failed to Close.	Alarm on SCADA.

ALARM	MEANING	RESPONSE OR ACTION
Aerobic Digester LOW LEVEL	Instrument (82LET00100) has detected LOW Aerobic Digester Level.	Alarm on SCADA.
Aerobic Digester HIGH LEVEL	Instrument (82LET00100) has detected HIGH Aerobic Digester Level.	Alarm on SCADA.
Aerobic Digester LOW-LOW LEVEL	Instrument (82LET00100) has detected LOW-LOW Aerobic Digester Level.	Alarm on SCADA.
Aerobic Digester HIGH-HIGH LEVEL	Instrument (82LET00100) has detected HIGH-HIGH Aerobic Digester Level.	Alarm on SCADA.
Aerobic Digester HIGH pH	Instrument (82AE00500) has detected HIGH pH in the Aerobic Digester.	Alarm on SCADA.
Aerobic Digester LOW pH	Instrument (82AE00500) has detected LOW pH in the Aerobic Digester.	Alarm on SCADA.
Aerobic Digester HIGH DISSOLVED OXYGEN	Instrument (82AE00400) has detected HIGH DISSOLVED OXYGEN in the Aerobic Digester.	Alarm on SCADA.
Aerobic Digester LOW DISSOLVED OXYGEN	Instrument (82AE00400) has detected LOW DISSOLVED OXYGEN in the Aerobic Digester.	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH SUCTION TEMPERATURE	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH SUCTION TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 2 (78BLW30002) HIGH SUCTION TEMPERATURE	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH SUCTION TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH HEADLOSS	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH HEADLOSS	Alarm on SCADA.
Aerobic Digester Air Blower 2 (78BLW30002) HIGH HEADLOSS	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH HEADLOSS	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH DISCHARGE TEMPERATURE	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH DISCHARGE TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 2 (78BLW30002) HIGH DISCHARGE TEMPERATURE	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH DISCHARGE TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH MOTOR TEMPERATURE	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH MOTOR TEMPERATURE.	Alarm on SCADA.

ALARM	MEANING	RESPONSE OR ACTION
Aerobic Digester Air Blower 2 (78BLW30001) HIGH MOTOR TEMPERATURE	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH MOTOR TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH DISCHARGE TEMPERATURE	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH DISCHARGE TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 2 (78BLW30002) HIGH DISCHARGE TEMPERATURE	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH DISCHARGE TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH BEARING TEMPERATURE	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH BEARING TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 2 (78BLW30002) HIGH BEARING TEMPERATURE	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH BEARING TEMPERATURE.	Alarm on SCADA.
Aerobic Digester Air Blower 1 (78BLW30001) HIGH ROTOR VIBRATION	Aerobic Digester Air Blower 1 (78BLW30001) has detected HIGH ROTOR VIBRATION.	Alarm on SCADA.
Aerobic Digester Air Blower 2 (78BLW30002) HIGH ROTOR VIBRATION	Aerobic Digester Air Blower 2 (78BLW30002) has detected HIGH ROTOR VIBRATION.	Alarm on SCADA.
Aerobic Digester Air Blower 3 (78BLW30003) FAIL	Aerobic Digester Air Blower 3 (78BLW30003) has FAILED	Alarm on SCADA.
Aerobic Digester HIGH FEED	Instrument (82FIT00800) has detected HIGH total flow to the Aerobic Digester	Alarm on SCADA.
Aerobic Digester HIGH-HIGH FEED	Instrument (82FIT00800) has detected HIGH-HIGH total flow to the Aerobic Digester	Alarm on SCADA.
Aerobic Digester HIGH AMMONIA	Instrument (82AIT00300) has detected HIGH Ammonia in the Aerobic Digester.	Alarm on SCADA.
Aerobic Digester HIGH NITRATE	Instrument (82AIT00300) has detected HIGH Nitrate in the Aerobic Digester.	Alarm on SCADA.
Aerobic Digester HIGH TEMPERATURE	Instrument (82AIT00300) has detected HIGH Temperature in the Aerobic Digester.	Alarm on SCADA.

Aerobic Digestion UPCP

Project: Spokane, WA
Plant: Spokane County RWRf
Date: April 18, 2011, October 23, 2013
Unit process number: 60

Summary

The primary functions of the aerobic digester are nitrogen removal, to further decrease the volatile solids, and to provide sludge storage.

Process Overview

The Aerobic Digester receives digested sludge from the Anaerobic Digesters by gravity flow. The digester is aerated with coarse bubble diffusers that provide oxygen to create an aerobic environment for ammonia removal and provide mixing. The Aerobic Digester also incorporates recuperative thickening of the aerobic digester contents to allow the combination of sludge storage and aerobic digestion in the same tank. The contents of the Aerobic Digester are removed using centrifuges for dewatering. Centrate is returned to the front of the plant and solids are hauled off to compost.

Unit Physical Information

The Aerobic Digester is located east of the Blended Sludge Tank and Solids Building. The 700,000-gallon digester is constructed of concrete, and includes an aluminum cover to contain foul air. The contained foul air is collected and conveyed to the Odor Control System. The digester is 78 feet in diameter and has a 20 foot sidewall depth. An 8 inch pipe transfers digested sludge from the anaerobic digesters to the aerobic digesters. The feed pipe reduces down to 2 four inch pipes inside the Aerobic Digester that distribute the influent evenly throughout the tank. Two 6 inch pipes can convey dewatered sludge back to the aerobic digester via the Dewatered Sludge Pumps. Aerobically digested sludge is pumped out by the centrifuge feed pumps through an 8 inch line. There is a sulfuric acid feed system that consists of one chemical feed pump and one 275 gallons tote. This can be used if the pH of the digester gets too high to bring the pH down. The Aeration system includes 2 Nueros turbo blowers, 1 Atlas Copco positive displacement blower, a 12 inch air-line pipe, an air chiller unit, and 107 coarse bubble diffusers. Each of the two Nueros turbo blower systems include a high speed turbo blower; vendor supplied local control panel, motorized blow off valve, silencer, check valve, isolation valves, and are equipped with adjustable frequency drives. The Atlas Copco blower system includes one positive displacement blower, an insulated cabinet for noise reduction, isolation valves, and an adjustable frequency drive. The air chiller unit utilizes plant water pumped through as radiator within the low pressure airline that cools the air that is delivered by the 3 blowers. The 107 coarse bubble diffusers are evenly spaced throughout the bottom of the digester. There are three online analyzers mounted to the aluminum cover. They monitor pH, DO, Temperature, Ammonia and Nitrate. All three probes have air blast systems on

them to prevent sludging and ragging. A 12" pipe runs from the top of the aerobic digester to the blended sludge tank for foam relief.

Operational Parameters and Theory

The aerobic digester is designed to remove nitrogen by converting ammonia to nitrogen gas. This will be accomplished primarily by nitrification and denitrification. This will reduce the nitrogen loading on the plant from the dewatered sludge return stream. The digester is designed to operate in a range of dissolved oxygen conditions ranging from anoxic at 0.01 mg/L to fully aerobic at >1 mg/L.

The Aerobic Digestion System requires a minimum 5-day SRT. During this time, adequate temperatures for biological nitrogen removal will be sustained by the addition of warm anaerobic digester feed and also from heat generated internally from aerobic digestion. The air chiller unit will help to prevent the digester contents from becoming too hot and inhibiting the biological nitrogen removal.

In this system, the dewatering liquors will have a relatively low nutrient content. In the case of phosphorus, the metal salts that were used in the CEPT process and in the bioreactor will absorb any significant phosphorus released during the digestion process. For nitrogen, the aerobic digestion process is expected to reduce the total inorganic nitrogen levels by 85%. As such, the very low nutrient levels do not require further treatment or equalization.

Two variable-speed turbo blowers and one variable speed positive displacement blower located in the Solids Facility, and a coarse bubble diffuser system located inside the digester, will regulate the dissolved oxygen concentrations and keep the digester contents mixed.

Process Monitoring and Responsibilities

The operators should check the aerobic digester once per day for odors and unusual operating conditions. Once per week the pH probe, DO probe and ANISE probe should be removed from the process, verified and/or calibrated, cleaned and returned to the process. Blowers should be checked weekly for proper operation and unusual conditions.

Aerobic Digester

Parameter	Units	Frequency	Source
Blowers	#	Continuous	SCADA
DO	mg/L	Continuous	SCADA
pH	SU	Continuous	SCADA
Temperature	°C	Continuous	SCADA
Flow to Digester	GPD	Continuous	SCADA
Ammonia	mg/L	Continuous	SCADA
Nitrate	mg/L	Continuous	SCADA

Sludge level	Feet	Continuous	SCADA
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Control Parameters

The control parameters for the digester include flow, level, pH, temperature, and DO. The Aerobic Digester receives digested sludge from the Anaerobic Digesters by gravity flow. The control for this flow is in the feed to the anaerobic digesters. A Flow Transmitter measures the amount of digested sludge being sent from the Anaerobic Digesters to the Aerobic Digester. The control of level is based on the input and output of sludge from the digester.

There are several different modes of aeration control. The aeration controls are based on flow, pH, ammonia, or a timer with the following options:

- **AUTO-FLOW** control mode-the number and speed of the Aerobic Digester Blowers shall adjust to maintain an Operator input flow setpoint.
- **REMOTE-MANUAL** control mode-the Operator manually turns the blowers ON and OFF and inputs a blower speed at SCADA.
- **AUTO-DISSOLVED OXYGEN (DO)** control mode-the number and speed of the Aerobic Digester Blowers shall adjust to maintain an Operator inputted DO setpoint (expected to range between 0.01 mg/L to 5 mg/L).
- **AUTO-pH**-control mode-the number and speed of the Aerobic Digester Blowers shall adjust to maintain an Operator inputted pH setpoint (approximately 6.9). Additional air flow from the blowers lower pH levels while less air flow increases pH levels.
- **AUTO-Timer/ammonia** control mode-the number and speed of the Aerobic Digester Blowers shall adjust to reach an Operator inputted DO upper setpoint (approximately 1.5 mg/l). Upon reaching the DO upper setpoint, air flow to the Aerobic Digesters shall continue for an operator inputted time setpoint. On reaching an Operator inputted time setpoint (which is approximately 180 minutes), or a low ammonia reading (5 mg/l), the combined air flow of the Aerobic Digester Blowers shall adjust to reach the lower DO setpoint. The lower DO setpoint (approximately 0.1 mg/l) will continue for an operator inputted time setpoint (approximately 210 minutes).
- In all four REMOTE-AUTO control modes listed above, the three Aerobic Digester Blowers shall operate in a LEAD-LAG1-LAG2 configuration based upon the following: Should the output exceed 95 percent the flow capacity of the LEAD blower, the LAG1 blower shall be called to run. Should the output exceed 95 percent the flow capacity of the LAG1 blower, the LAG2 blower shall be called to run. If the output drops to 40 percent the capacity of the LEAD blower, the LAG2 blower shall be called to stop. If the output drops to 40 percent the capacity of the LEAD blower, the LAG1 blower shall be called to stop. Blower flow rate shall be determined based on blower amp draw.

Calculations and Recordkeeping

$$SRT = (\text{Total Sludge Mass, lb}) / (\text{Solids Removed Per Day, lb/d})$$

The flow into the aerobic digester, pH, ammonia, nitrate, temperature and DO will be

recorded continuously by the SCADA system and exported to OP10.

Targets and Process Performance

Aerobic Digester targets are based on desired nitrogen removal and decreasing volatile solids.

Targets for Aerobic Digester

Parameter	Units	Minimum	Maximum
PD Blower (control SP)	%	25	100
Turbo Blower (control SP)	%	90	100
Blower (Flow Range)	SCFM	600	6000
Blower (Discharge Press Range)	PSIG	4	8.5
DO (aerobic)	mg/L	.25	1.0
DO (anoxic)	mg/L	.1	.2
pH	SU	5.9	7.7
SRT (Solids Retention Time)	Days	5	10
Flow to Digester	GPD	0	100,000
Sludge Level	Feet	7	20

Relationship to Other Unit Processes

The Aerobic Digester receives flow from the Anaerobic Digester. The Sludge Dewatering System consist of the Centrifuge Feed Pumps, Centrifuges, and Dewatered Sludge and all follow the Aerobic digesters. The odor control system removes foul odor from the aerobic digester for filtering. The GBT, Anaerobic digester and Centrifuge Feed Pumps can be used to increase sludge holding times in the aerobic digester.

Common Problems and Troubleshooting

Aerobic Digester Troubleshooting Guide

Condition	Possible Cause	Possible Solutions
Excessive Foaming	<ul style="list-style-type: none">Organic Overload	<ul style="list-style-type: none">Check Organic loads, Reduce feed rateIncrease solids in digester by decanting and recycling solids
Excessive Foaming	<ul style="list-style-type: none">Excessive Aeration	<ul style="list-style-type: none">Check dissolved oxygen, Reduce aeration rate
Low dissolved oxygen	<ul style="list-style-type: none">Clogging	<ul style="list-style-type: none">Increase air pressure to clear

Condition	Possible Cause	Possible Solutions
		<ul style="list-style-type: none"> • Drain digester and Clean diffusers
Low dissolved oxygen	<ul style="list-style-type: none"> • Improper Liquid Level 	<ul style="list-style-type: none"> • Check equipment specifications, Establish proper liquid level
Low dissolved oxygen	<ul style="list-style-type: none"> • Blower malfunction 	<ul style="list-style-type: none"> • Check and repair leaks, set valves in proper position, repair blower
Low dissolved oxygen	<ul style="list-style-type: none"> • Organic overload 	<ul style="list-style-type: none"> • Check organic load, Reduce feed rate
Odor emanating from digester	<ul style="list-style-type: none"> • Odor control system malfunction 	<ul style="list-style-type: none"> • Check foul odor lines • Ensure valve to the odor control system is open • Check odor control system, repair odor control system
High pH	<ul style="list-style-type: none"> • Loss of nitrification 	<ul style="list-style-type: none"> • Increase DO/cycle time • Add sulfuric acid
Low pH	<ul style="list-style-type: none"> • De-nitrification is not occurring. 	<ul style="list-style-type: none"> • Decrease D.O. • Extend low air cycle time

Alternate Modes of Operation

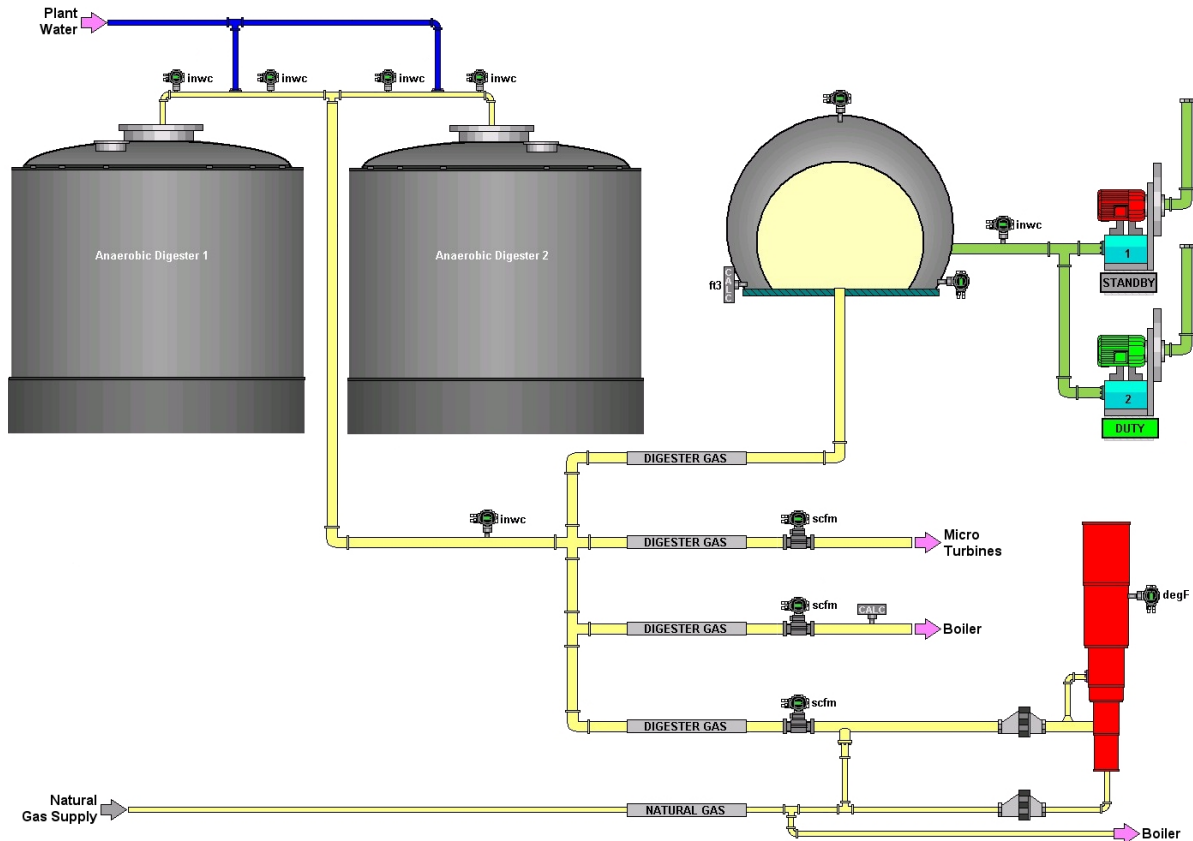
The Aerobic digester has also been designed to run at lower air rates (between 0.1 and 0.2 mg/L DO) to encourage the nitrification ($\text{NH}_4 \rightarrow \text{NO}_2$)/denitrification ($\text{NO}_2 \rightarrow \text{N}_2$) mode. The elimination of the oxidation to nitrate ($\text{NO}_2 \rightarrow \text{NO}_3$) and its subsequent reduction to nitrite ($\text{NO}_3 \rightarrow \text{NO}_2$) reduces the energy and carbon needs normally associated with this process. These operations are performed at low DO levels, which also reduces the energy requirements normally exerted in the digester, compared with operating the digester at more conventional DO levels of 2 mg/L or higher.

Recuperative thickening of the Aerobic Digester contents can be implemented to bring the solids concentration level up to approximately 5 percent and increase the solids retention time. The contents of the anaerobic digester can also be thickened to provide additional storage. Because the nutrient removal capabilities of the digester are not required during the winter season, the entire digester volume may be used as storage without the need for additional thickening.

For maintenance the aerobic digester may have to be drained completely. In this situation the anaerobic digester would need to be recuperative thickened or dewatering would have to be directly from the anaerobic digester to stop flow to the aerobic digester.

62 - Digester Gas Storage and Utilization

Overview



Purpose

The Digester Gas System can be divided into two categories: storage, and utilization. The facilities/equipment under this umbrella include Anaerobic Digesters, Digester Gas Equipment Room (located between the two Anaerobic Digesters), Digester Gas Storage Facility (located to the south of the Anaerobic Digesters), Hot Water Boiler (located in the Boiler Room in the Solids Facility), Cogeneration Facility (located to the south of the Solids Facility), and the Waste Gas Burner (located to the west of the Plant Drain Pump Station).

Description

STORAGE

Digester gas is produced as a by-product from the Anaerobic Digestion process in the two Anaerobic Digesters at the total rate of approximately 90 scfm. Two pressure/vacuum relief valves are installed on each gas bonnet to protect the digesters from being over-pressurized. The pressure/vacuum relief valves will prevent the digester from experiencing a positive pressure condition of more than 17 inches WC or a vacuum condition of 2 inches WC below atmospheric pressure.

Digester gas is withdrawn from the gas bonnet of each digester through withdrawal piping. Digester gas flows from each gas bonnet through a foam separator and sediment trap before going to the Dual Membrane Gasholder (also known as the Gas Storage Sphere), Hot Water Boiler, Cogeneration System, and the Waste Gas Burner. The foam separator and sediment trap are located in the Digester Gas Equipment Room, which is situated between the two digesters. The Digester Gas Equipment Room contains a lower explosive limit (LEL) monitor for combustible gas detection. The foam separators use water sprays (using W3) and internal baffles to remove foam from the gas. A running drip trap located on the foam separator drain will prevent digester gas from escaping the foam separator. Spray water to the foam separators will run continuously when any combination of the two digesters are in operation. The sediment trap provides protection to downstream equipment from corrosion and clogging by removing liquid and solids from the digester gas. An automatic drip trap located on the sediment trap drain periodically drains the sediment trap at operator-selected time intervals.

From the Digester Gas Equipment Room, digester gas is stored in a 17,500-cubic-foot (ft³) Dual Membrane Gasholder (approximately 2 to 3 hours of digester gas production), which is essentially a wide spot in the digester gas system. Two Gas Storage Supply Fans (DUTY/STANDBY) run to keep the overall digester gas system pressure at 14 inches WC. A pressure relief valve located on the discharge side of the fans set at +/- 14 inches WC allows the correct volume of air to occupy the annular space between the inner and outer storage membranes. The inner storage membrane contains digester gas and the outer membrane is exposed to the atmosphere. A flame arrestor located on the digester gas line to the Dual Membrane Gasholder serves to stop the propagation of a flame if one develops in the digester gas system.

UTILIZATION

Stored digester gas is used at the Cogeneration (Cogen) Facility and Hot Water Boiler, and flared at the Waste Gas Burner if necessary. The Cogeneration Facility will be the first in line to use stored digester gas. Once a certain level in the Dual Membrane Gasholder is reached, conditioned digester gas (via the gas handling/conditioning equipment located at the Cogen Facility) will be sent to the microturbines. One of the most important roles of the gas handling/conditioning equipment is the removal of siloxanes from the digester gas. Siloxanes are chemicals widely used in personal care, consumer, and industrial products that can affect microturbine performance and reduce thermal efficiency. In addition, odor-causing sulfides will be removed prior to the fuel entering the microturbines. The majority of the gas handling/conditioning equipment (excluding the siloxane filtration vessels) is located in a skid-mounted enclosure. The gas handling enclosure has a thermostatically controlled heater to keep the enclosure temperature above 44°F and a thermostatically controlled exhaust fan to keep the enclosure temperature below 104°F. The gas handling enclosure also contains an LEL monitor. Downstream of the digester gas handling/conditioning equipment, four microturbines will generate electricity (approximately 260 kW) and hot water for digester heating and other facility utilities (hot water unit heaters). The hot water recovery from the four microturbines will average approximately 1,000,000 British thermal units (Btu)/hour.

A flame trap assembly (comprised of a flame arrestor and thermal shutoff valve) located on the digester gas line going to the Cogeneration Facility serves to stop the propagation of a flame if one develops in the Digester Gas System. Little diurnal variation is expected in digester gas production as a result of primary sludge equalization and 24/7 operation of the thickening system. This optimizes the performance of the micro-turbines, allowing a steadier load on the system.

If digester gas production exceeds the amount that can be used at the Cogeneration Facility and a predetermined level in the Dual Membrane Gasholder is reached, digester gas can be used at the Hot Water Boiler. A dual fuel burner on the Hot Water Boiler allows both natural gas and digester gas to be used as fuel. A flame trap assembly is located on the digester gas line going to the Hot Water Boiler.

If digester gas production exceeds the amount that can be used at both the Cogeneration Facility and the Hot Water Boiler, the Waste Gas Burner will combust the excess gas. In normal operations, similar to the microturbines and the Hot Water Boiler, predetermined levels in the Dual Membrane Gasholder will trigger the start and stop operation of the Waste Gas Burner. As a backup, operation of the Waste Gas Burner will also start based on a high pressure in the digester gas system. At a pressure of approximately 15.5 inches WC, the pressure switch located upstream of the Waste Gas Burner will send a signal to the burner control panel to start the pilot process for the Waste Gas Burner. On

proof of pilot, the 3-way solenoid valve plumbed to the back pressure sustaining valve (located upstream of the Waste Gas Burner) will open, causing the back pressure sustaining valve to open gas flow to the burner. As the Digester Gas System pressure falls below 14 inches WC, the 3-way solenoid valve will close, causing the back pressure sustaining valve to close. The flame trap assembly is located on the digester gas line going to the Waste Gas Burner.

Design Criteria and Component List

Exhibit 62-1 is a partial list of the components for digester gas storage, and Exhibit 62-2 is a partial list of the components for digester gas utilization.

EXHIBIT 62-1
Digester Gas Storage Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Gas Storage Sphere		Quantity: 1 Type: Dual Membrane Volume (ft ³): 17,500
Gas Storage Air Supply Fan	83BLW00901, 83BLW00902	Quantity: 2 Type: Centrifugal, Constant Speed Rated Flow Capacity (scfm): 200 Pressure (in WC): 14 Power (hp): 3
Foam Separator	85TNK00700	Quantity: 1 Type: SST Vessel
Sediment Trap	85TRP00600	Quantity: 1 Type: SST Vessel
Automatic Drip Trap	N/A	Quantity: 1 Capacity: 6-quart
Pressure/Vacuum Relief Valves with Flame Arrestors	85PSV00201/85TRP 01501, 85PSV00202/85TRP 01601, 85PSV03201/85TRP 02501, 85PSV00302/85TRP 02601,	Quantity: 4 Type: Pressure and Vacuum Relief
NOTES: ft ³ = cubic feet scfm = standard cubic feet per minute in WC = inches water column SST = stainless steel		

EXHIBIT 62-2
Digester Gas Utilization Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Gas Handling Skid	95FLT00100	Quantity: 1 Type: Siloxane Moisture Removal Flow Rate (scfm): 125
Microturbine	95GEN00301, 95GEN00302, 95GEN00303, 95GEN00304	Quantity: 4 Type: Cogeneration Power Output (kW): 65 Heat Output (Btu/hr): 251,000
Hot Water Boiler	78BLR24100	Quantity: 1 Type: Firebox Heat Output (BTU/hr): 1,500,000
Waste Gas Burner	83BRN02300	Quantity: 1 Type: Enclosed Flare Flow Rate (scfm): 195
Pressure Regulating Valve	83PRV02100	Quantity: 1 Type: Back pressure regulating
NOTES: scfm = standard cubic feet per minute kW = kilowatts Btu/hr = British thermal units per hour		

Process Control Variables

Control Variables

- Digester Gas Flow to Hot Water Boiler

Plant operators will have the ability to route digester gas to the Hot Water Boiler during times when the digester gas requirements at the microturbines have been met. Plant operators will need to monitor the level in the Digester Gas Storage Sphere during times when they are sending digester gas to the Hot Water Boiler to be sure that they do not unintentionally reduce the thermal/electrical output of the Cogen System resulting from a shutdown of a microturbine based on a low level in the storage sphere.

Non Controllable Variables

- **Digester Gas Quantity**

The amount of digester gas produced at the plant should be somewhat stable because the feed to the Anaerobic Digester is fairly consistent in flow. Some variations will arise occasionally as a result of scum feed to the digesters, but this should not result in any process interruptions in the digester gas storage and utilization.

- **Digester Gas Quality**

The quality of the digester gas may vary throughout the operational life of the plant. Attention will need to be paid, especially at the siloxane vessels. The useful life of the media in the vessels will vary proportionally to the quality of the digester gas being sent to it. Regular testing of the siloxane media should be incorporated into an overall Digester Gas System standard operating procedure (SOP).

Calculations

Digester Gas Storage volume in the Gas Storage Sphere is calculated using the equation shown below:

Digester Gas Storage Sphere Volume = $(175 * ((0.78 * [\text{Gas Storage Sphere Level}] + 22))$

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62 - Digester Gas Storage and Utilization

Operating Strategies

Digester Gas Storage

The Digester Gas Storage System includes two gas storage fans (with LCPs), check valves, isolation valves, a shared pressure transmitter, shared pressure safety valve, and the Digester Gas Storage Sphere. The fans are equipped with constant speed drives.

Digester gas produced in the Anaerobic Digesters is stored in the Digester Gas Storage Sphere. Air Supply Fans are used to adjust the volume of the inner membrane of the dual membrane sphere to allow storage of digester gas at a constant pressure.

There are three control modes for the Gas Storage Air Supply Fans: LOCAL, REMOTE-MANUAL, and REMOTE-AUTO. When operating in REMOTE, the operator selects the particular REMOTE gate control mode at SCADA. In REMOTE-AUTO the air supply fans run in a DUTY-STANDBY configuration. If the DUTY fan fails, the STANDBY fan starts automatically. A pressure relief valve regulates the pressure of the stored Digester Gas in the Digester Gas Storage Sphere. Exhibit 62-3 lists the control modes for the Digester Gas Storage System.

EXHIBIT 62-3
Digester Gas Storage Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	When operating the Gas Storage Air Supply Fan(s) (83BLW00901 and 83BLW00902) in the LOCAL-MANUAL control mode, the operator manually turns the fans ON or OFF at the LCS ON/OFF/REMOTE switch.	
Manual/Remote	When operating the Gas Storage Air Supply Fan(s) (83BLW00901 and 83BLW00902) in the REMOTE-MANUAL control mode, the operator selects REMOTE on the LOCAL/REMOTE switch on the LCS and then is able to turn the fans ON or OFF through the PCS by selecting REMOTE-MANUAL.	
Auto/Remote	In the REMOTE-AUTO control mode, the Gas Storage Air Supply Fans(s) operate as DUTY-STANDBY. Should the DUTY fan FAULT, the STANDBY fan automatically starts. The operator is able to select the REMOTE-	

	AUTO mode for the fans by selecting REMOTE on the LOCAL/REMOTE switch on the LCS for the fans and then selecting AUTO mode through the PCS.	
NOTES: LCS = local control station PCS = Plant Control System		

Digester Gas Utilization

The Hot Water Boiler System includes a vendor-supplied LCP, dual fuel burner and firebox boiler, and a Boiler Supply Pump System that contains a temperature control valve, pressure gauge, temperature transmitter, check valve, isolation valves, and air release valve. The pump is equipped with a constant speed drive.

The control modes for the Hot Water Boiler System are covered in the Digester Heating process control narrative.

The Waste Gas Burner System includes an enclosed flare, vendor-supplied LCP, back pressure sustaining valve, flow meter, pressure relief valve, a running drip trap for removing condensation, flame trap assembly, flame check, and inlet isolation valve.

There are two control modes for the Waste Gas Burner: REMOTE-MANUAL, and REMOTE-AUTO. The operator selects the control mode through the PCS. When operating in REMOTE, the operator selects the particular REMOTE Waste Gas Burner control mode through the PCS. The Waste Gas Burner is turned on when digester gas levels exceed approximately 17,000 ft³.

The Cogeneration System contains two sub-systems: the Microturbine System, and the Gas Handling/Conditioning System. The Microturbine System includes four microturbines with separate heat recovery modules, and a Microturbine Supply Pump System that has a check valve, isolation valves, and air release valve. The pump is equipped with a constant speed drive. The Gas Handling/Conditioning System includes a glycol heat exchanger, scrubber, flooded screw compressor, gas/oil separator, glycol chiller, gas-to-gas heat exchanger, moisture separator, and siloxane scrubber. The flooded screw compressor is equipped with an AFD. The Gas Handling/Gas Conditioning System has a vendor-supplied master control panel located in the Solids Facility Electrical Room. This master control panel also serves the microturbines. The glycol chiller has a vendor-supplied LCP.

There are two control modes for the Cogeneration System: REMOTE-MANUAL, and REMOTE-AUTO. The operator selects the control mode at SCADA. When operating in REMOTE, the operator selects the particular REMOTE

Cogeneration System control mode through the PCS. The microturbines operate in a LEAD-LAG configuration and turn on based on digester gas levels and ON/OFF cycles. Exhibit 62-4 lists the control modes for digester gas utilization.

EXHIBIT 62-4
Digester Gas Utilization Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Remote	When operating the Waste Gas Burner (83BNR02300) in the REMOTE-MANUAL control mode, the operator selects MANUAL control at the PCS and is then able to turn the Waste Gas Burner ON or OFF through the PCS.	
Auto/Remote	When operating the Waste Gas Burner (83BNR02300) in the REMOTE-AUTO control mode, the operator selects AUTO control at the PCS and then the Waste Gas Burner turns ON or OFF through the PCS based on a high level in the Digester Gas Storage Sphere or a high pressure level in the Digester Gas System.	
Manual/Remote	There are two control modes for the Cogeneration System: REMOTE-MANUAL, and REMOTE-AUTO. The operator selects the control mode through the PCS. When operating in REMOTE, the operator selects the particular REMOTE Cogeneration System control mode at SCADA.	
Manual/Remote	When operating the Cogeneration System (95FLT00100, 95CHL00200, 95FLT00500, 95GEN00301, 95GEN00302, 95GEN00303, and 95GEN00304) in the REMOTE-MANUAL control mode, the operator selects MANUAL control at the PCS and is then able to turn the Cogeneration System ON or OFF through the PCS. In the REMOTE-MANUAL control mode, and upon the Cogeneration System receiving a START command, the microturbines will start only when in the READY state. Achieving the READY state is from the Cogeneration System Master Control Panel.	
Auto/Remote	When operating the Cogeneration System (95FLT00100, 95CHL00200, 95FLT00500, 95GEN00301, 95GEN00302, 95GEN00303, and 95GEN00304) in the REMOTE-AUTO control mode, the operator selects AUTO control at the PCS and then the Cogeneration System will automatically turn ON and OFF based on digester gas storage level in the Digester Gas Storage Sphere. In the REMOTE-AUTO control mode, and upon the Cogeneration System receiving a START command, the microturbines will start only when in the READY state. Achieving the READY state is from the Cogeneration System Master Control Panel	
NOTES: PCS = Plant Control System SCADA = supervisory control and data acquisition		

Startup Procedures

Digester Gas Storage and Utilization System General:

1. Confirm that spray water is being sent to the Foam Separator (85TNK00700) located in the Digester Gas Equipment Room.
2. Confirm that the running drip traps located on the Foam Separator and in the Waste Gas Burner Vault have been primed.
3. Confirm that the isolation valve upstream of the automatic drip trap located on the Sediment Trap (85TRP00600) is open.
4. Confirm that the isolation valves located on 1) the digester gas piping in the vault by the Digester Gas Storage Sphere, 2) the piping located out at the microturbines, and 3) the glycol piping running between the Gas Handling Chiller and the Gas Conditioning Enclosure/Skid are open.
5. Confirm that the isolation valves located at the various sample locations on the digester gas piping are closed.
6. Confirm that the isolation valve located upstream of the Pressure Regulation Valve (83PCV02400) in the Waste Gas Burner Vault is open.
7. Note, the isolation valve located on the digester gas pilot line at the Waste Gas Burner will be closed during the early operation of the plant. It will be open when the plant is producing a steady supply of digester gas. At this point, the isolation valves on the natural gas pilot line to the Waste Gas Burner will be closed.

Remote-Auto Control for Gas Storage Air Supply Fans:

1. Confirm that isolation valves located on the discharge of the Gas Storage Air Supply Fans are open.
2. At the LCS for the Gas Storage Air Supply Fans, select REMOTE operation.
3. Through the PCS, select which fan is DUTY and which is STANDBY.
4. Through the PCS, set the Gas Storage Air Supply Fans into the AUTO mode.
5. Through the PCS, START the DUTY Gas Storage Air Supply Fan.

Remote-Manual Control for Gas Storage Air Supply Fans:

1. Confirm that isolation valves located on the discharge of the Gas Storage Air Supply Fans are open.
2. At the LCS for the Gas Storage Air Supply Fans, select REMOTE operation.
3. Through the PCS, set the Gas Storage Air Supply Fans into the MANUAL mode.
4. Through the PCS, START the Gas Storage Air Supply Fan.

Local-Manual Control for Gas Storage Air Supply Fans:

1. Confirm that isolation valves located on the discharge of the Gas Storage Air Supply Fans are open.
2. At the LCS for the Gas Storage Air Supply Fans, select LOCAL operation.
3. START the Gas Storage Air Supply Fan from the LCS.

Remote-Auto Control for Waste Gas Burner:

1. Confirm that digester gas manual isolation valves located on the digester gas piping from the Anaerobic Digester to the Waste Gas Burner are open.
2. At the LCP for the Waste Gas Burner, turn power switch to the ON position and select REMOTE operation. Note, on the LCP for the Waste Gas Burner, REMOTE selection is made by switching to the AUTO position on the AUTO/MANUAL selector switch.
3. Through the PCS, select AUTO control for the Waste Gas Burner.
4. Once in the AUTO control mode, the Waste Gas Burner will receive a START signal through either a high level in the Gas Storage Sphere, or a high pressure indication in the Digester Gas System (monitored by the high pressure switch located upstream of the Pressure Regulating Valve 83PRV02100).

Remote-Manual Control for Waste Gas Burner:

1. Confirm that digester gas manual isolation valves located on the digester gas piping from the Anaerobic Digester to the Waste Gas Burner are open.

2. At the LCP for the Waste Gas Burner, turn power switch to the ON position and select REMOTE operation. Note, on the LCP for the Waste Gas Burner, REMOTE selection is made by switching to the AUTO position on the AUTO/MANUAL selector switch.
3. Through the PCS, select MANUAL control for the Waste Gas Burner.
4. Once in the MANUAL control mode, the Waste Gas Burner will receive operator-initiated START signals.

Remote-Auto Control for Cogeneration System:

1. Confirm that isolation valves located upstream of the Gas Conditioning Skid Enclosure, between the skid and the siloxane vessels, and from the vessels to the microturbines, are open.
2. Confirm that the isolation valves on the hot water piping leading to and from the microturbines are open. For further details on the heat exchanger portion of the microturbines, see the Digester Heating process control narrative. Note, without water flow to the microturbines, the microturbines will not have the capacity to run.
3. Through the PCS, select AUTO for the Cogeneration System.
4. Once in the AUTO control mode, the Cogeneration System will automatically turn ON based on the digester gas storage level in the Digester Gas Storage Sphere. The number and speed of the microturbines is controlled by controls integral to the Cogeneration System supplied master control panel.

Remote-Manual Control for Gas Storage Air Supply Fans:

1. Note that, because of the complexities of the Cogeneration System, it is highly recommended that the operators do not run the Cogeneration System in the REMOTE-MANUAL mode.
2. Confirm that isolation valves located upstream of the Gas Conditioning Skid Enclosure, between the skid and the siloxane vessels, and from the vessels to the Microturbines, are open.
3. Confirm that the isolation valves on the hot water piping leading to and from the microturbines are open. For further details on the heat exchanger portion of the Microturbines, see the Digester Heating process control narrative. Note, without water flow to the microturbines they will not have the capacity to run.
4. Through the PCS, select MANUAL control for the Cogeneration System.

5. Once in the MANUAL control mode, the Cogeneration System will automatically turn ON based on Operator-initiated START.

Shutdown Procedures

Remote-Auto Control for Gas Storage Air Supply Fans:

1. Through the PCS, place the Gas Storage Air Supply Fans into MANUAL mode. Initiate a STOP command for the Gas Storage Air Supply Fan.

Remote-Manual Control for Gas Storage Air Supply Fans:

1. Through the PCS, initiate a STOP command for the Gas Storage Air Supply Fan.

Local-Manual Control for Gas Storage Air Supply Fans:

1. Initiate a STOP command for the Gas Storage Air Supply Fan from the LCS.

Remote-Auto Control for Waste Gas Burner:

1. Through the PCS, place the Waste Gas Burner into MANUAL mode. Initiate a STOP command for the Waste Gas Burner.

Remote-Manual Control for Waste Gas Burner:

1. Through the PCS, initiate a STOP command for the Waste Gas Burner.

Remote-Auto Control for Cogeneration System:

1. Through the PCS, place the Cogeneration System into MANUAL mode. Initiate a STOP command for the Cogeneration System.

Remote-Manual Control for Cogeneration System:

1. Through the PCS, initiate a STOP command for the Cogeneration System.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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62 - Digester Gas Storage and Utilization

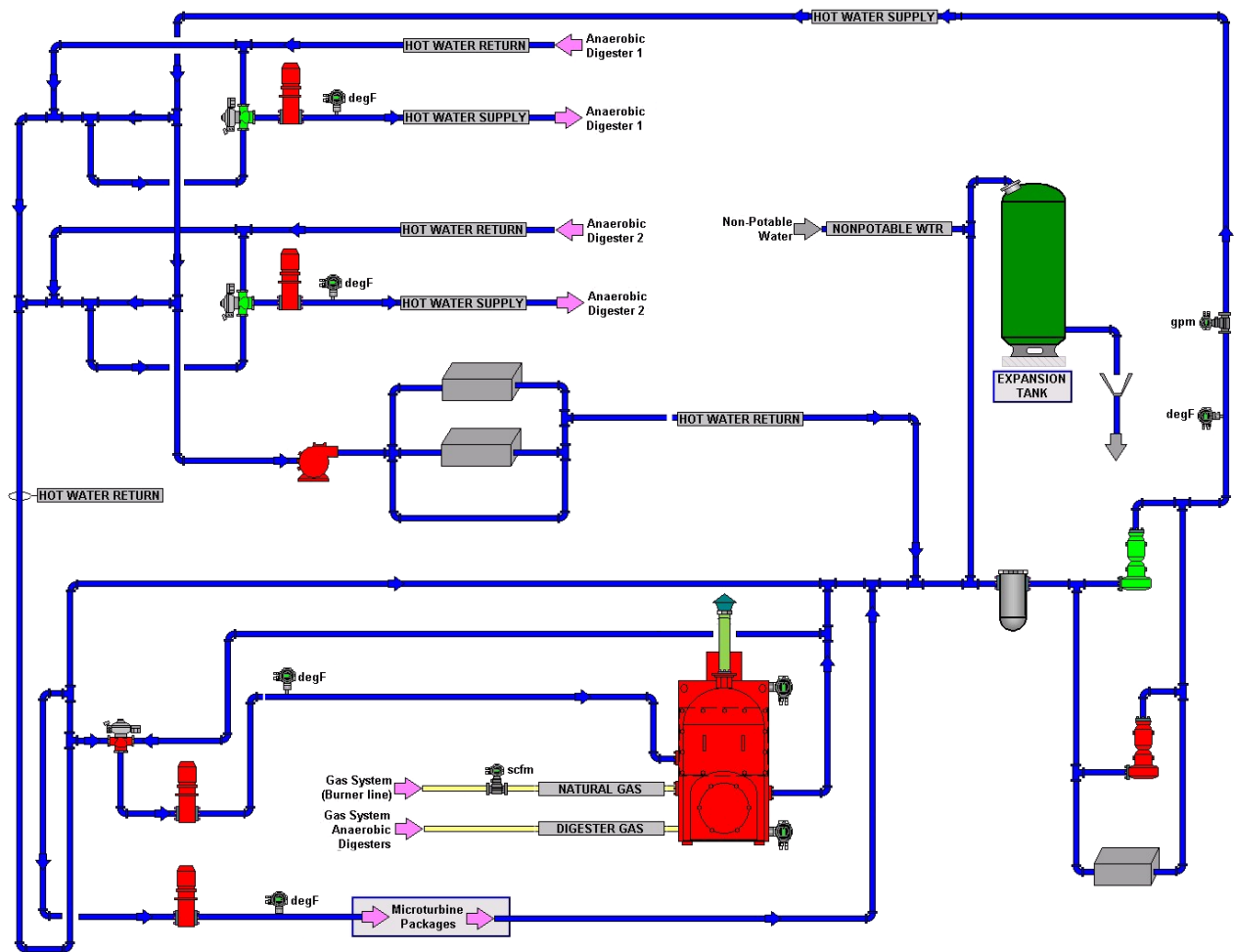
Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Anaerobic Digester HIGH PRESSURE	Instrument (83PIT00500) has detected High Pressure in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester LOW PRESSURE	Instrument (83PIT00500) has detected Low Pressure in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH LEL	Instrument (83AET00200) has detected High LEL condition in the Anaerobic Digester.	Alarm on SCADA.
Anaerobic Digester HIGH LEL	Instrument (83AET01300) has detected High LEL condition in the Anaerobic Digester.	Alarm on SCADA.
Gas Storage Air Supply Fan 1 FAIL-TO-START	Gas Storage Air Supply Fan 1 (83BLW00901) has Failed to Start.	Alarm on SCADA.
Gas Storage Air Supply Fan 1 FAIL-TO-STOP	Gas Storage Air Supply Fan 1 (83BLW00901) has Failed to Stop.	Alarm on SCADA.
Gas Storage Air Supply Fan 2 FAIL-TO-START	Gas Storage Air Supply Fan 2 (83BLW00902) has Failed to Start.	Alarm on SCADA.
Gas Storage Air Supply Fan 2 FAIL-TO-STOP	Gas Storage Air Supply Fan 2 (83BLW00902) has Failed to Stop.	Alarm on SCADA.
Waste Gas Burner FAULT	Waste Gas Burner (83BRN02300) has detected a Fault	Alarm on SCADA.
Anaerobic Digester 1 LOW PRESSURE	Instrument (83PIT00401) has detected Low Pressure in Anaerobic Digester 1.	Alarm on SCADA.
Anaerobic Digester 1 HIGH PRESSURE	Instrument (83PIT00401) has detected High Pressure in Anaerobic Digester 1.	Alarm on SCADA.
Anaerobic Digester 2 LOW PRESSURE	Instrument (83PIT00402) has detected Low Pressure in Anaerobic Digester 2.	Alarm on SCADA.

ALARM	MEANING	RESPONSE OR ACTION
Anaerobic Digester 2 HIGH PRESSURE	Instrument (83PIT00402) has detected High Pressure in Anaerobic Digester 2.	Alarm on SCADA.
Anaerobic Digester 1 LOW PRESSURE	Instrument (83PIT00501) has detected Low Pressure in Anaerobic Digester 1.	Alarm on SCADA.
Anaerobic Digester 1 HIGH PRESSURE	Instrument (83PIT00501) has detected High Pressure in Anaerobic Digester 1.	Alarm on SCADA.
Anaerobic Digester 2 LOW PRESSURE	Instrument (83PIT00502) has detected Low Pressure in Anaerobic Digester 2.	Alarm on SCADA.
Anaerobic Digester 2 HIGH PRESSURE	Instrument (83PIT00502) has detected High Pressure in Anaerobic Digester 2.	Alarm on SCADA.

64 - Digester Heating

Overview



Purpose

The digestion process for the Spokane County RWRf is single-stage mesophillic (95°F) anaerobic digestion, which produces Class B biosolids. To maintain effective digestion, the sludge contained within the two Anaerobic Digesters is heated via the heat recovery equipment located on the microturbines at the Cogeneration Facility (located to the south of the Solids Facility) and from the packaged boiler system located within the Solids Facility.

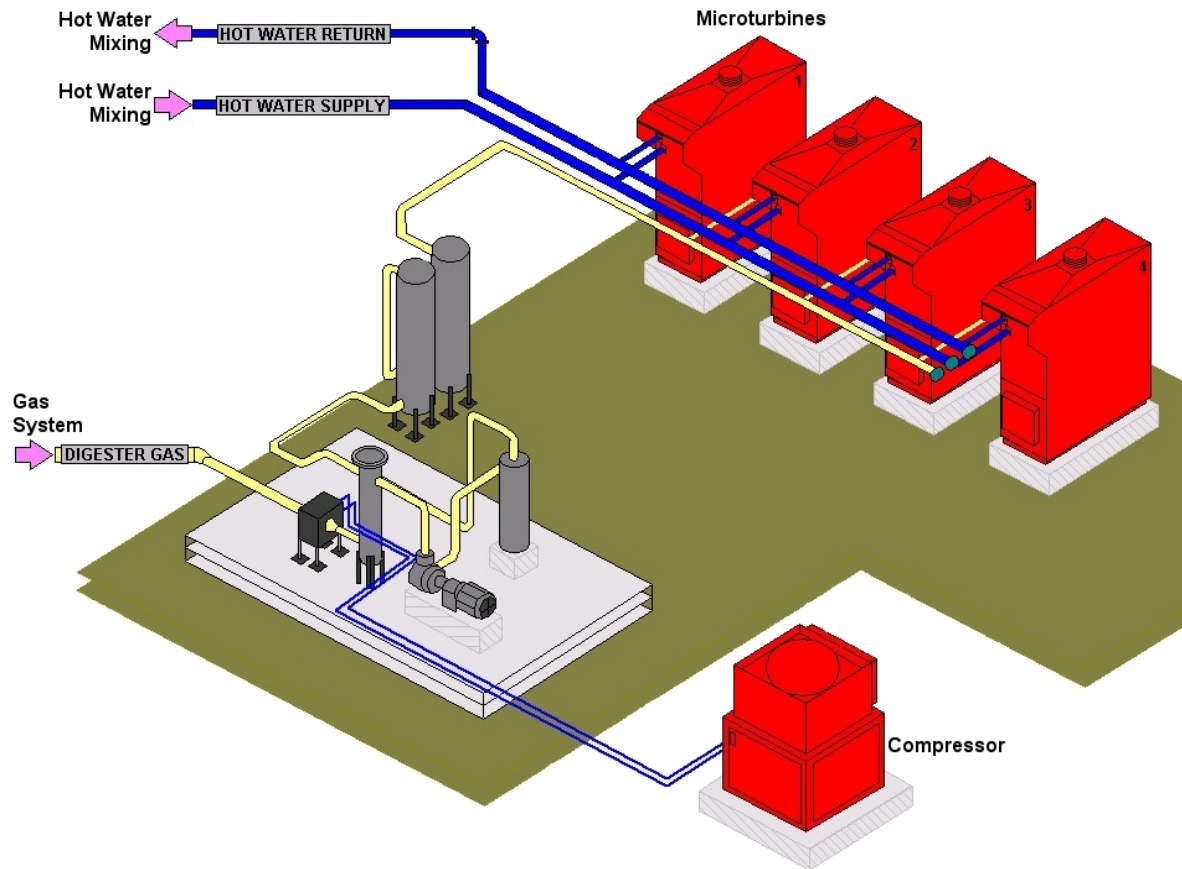
The Digester Heating System includes a boiler, microturbine supply pump (associated with the heat recovery unit on the microturbine), boiler supply pump, primary hot water loop circulating pumps, and hot water pumps. The Hot Water System will include a Water Treatment System (chemical feeder) to help protect the piping and boiler materials against corrosion. The Digester Heating System has been designed to maintain the digesters at 95°F.

Description

Energy recovered from each microturbine exhaust will average approximately 250,000 BTUs/hour for a total of 1,000,000 BTUs for the four microturbines. Excess hot water will be used for building heat in the form of two hot water unit heaters located in the Solids Facility. The 1.5 million Btus per hour (MBH) digester gas/natural gas-fired boiler will provide heat to back up or supplement the heat generated by the microturbines. An air separator (78ASU21700) located on the primary hot water loop will remove air that has dissolved in the Hot Water System. An expansion tank (78TNK21800) provides a minimum pressure for the Hot Water System, which provides a temperature buffer between the system temperature and the temperature of vaporization. A chemical feeder (78VCF22200) located on the primary hot water loop protects the hot water heating system from scale and corrosion.

A brief description of each of the hot water loops associated with the Hot Water System is described below.

MICROTURBINE HOT WATER LOOP:



There is no operator-selectable control mode for the microturbines with respect to heating. An outlet temperature setpoint will be established for the microturbines during commissioning that will not be adjusted under normal operating conditions. The temperature setpoint for the microturbines will be set to approximately 195°F. The microturbines will adjust certain parameters internal to the Microturbine Control System (adjustment of the turbine exhaust damper to direct a certain percentage of exhaust to either the Heat Recovery Module or to the atmosphere) to maintain a certain hot water outlet temperature at the microturbines. The Heat Recovery Modules are located directly on top of each microturbine. The Microturbine Supply Pump (78PMP21102) located in the Solids Facility will pump approximately 30 gpm of flow to each microturbine's Heat Recovery Module. Under normal operating conditions, the Microturbine Supply Pump will run at all times.

BOILER HOT WATER LOOP:

A modulating three-way temperature control valve (78TCV21301) controls the mixing of water between the primary hot water loop and the boiler hot water loop, as well as making sure that properly tempered water is being sent to the boiler.

Water that is not properly tempered has the potential to shock the boiler. Shock occurs when a sudden thermal change happens within the boiler, causing rapid and uneven expansion and contraction of the boiler's structure. Water is circulated in the boiler hot water loop by the Boiler Hot Water Supply Pump, which is controlled by the boiler local control panel (LCP). The Boiler Supply Pump (78PMP21101) will START and STOP in conjunction with the START and STOP of the Hot Water Boiler (78BLR24100). As the boiler heats the water in the boiler hot water loop, the three-way valve for the boiler opens to mix additional water from the primary hot water loop. The three-way temperature control valve will start to open and allow a blending of water from the primary hot water loop at a temperature of approximately 100°F. The temperature transmitter that controls the operation of the three-way temperature control valve 78TCV21301 is located off the discharge of the Boiler Supply Pump. At a temperature of approximately 175°F, the three-way temperature control valve is allowing a 100 percent blend of primary hot water loop water into the boiler hot water loop. The outlet water temperature setpoint for the Hot Water Boiler will be set to approximately 185°F.

PRIMARY HOT WATER LOOP:

The plant has two Hot Water Loop Circulating Pumps (78PMP22101 and 78PMP22102). Under normal operation one pump is running continuously and the other pump is provided as a backup unit. The pumps circulate hot water between the boiler hot water loop/microturbine hot water loop and the two secondary heating loops. The primary hot water loop temperature is monitored and used by supervisory control and data acquisition (SCADA) to start and stop the boiler and to provide high temperature shutdown of the microturbines. The operator-adjustable temperature setpoints should be approximately 170°F to START the boiler and 190°F to STOP the boiler. Note, 100 percent of the heat recovery off the microturbine(s) will go into the primary hot water loop.

Under normal operating conditions, operators should not attempt to raise the sludge temperature in the Anaerobic Digesters too quickly; rather, if a temperature increase is required, it should be done gradually over many days. In normal operations, operators should strive for a "steady state" operation that requires only small, gradual increases to the energy input needed to heat the digester sludge.

SECONDARY HOT WATER LOOPS:

In the secondary hot water loops, the Hot Water Pumps (78PMP22701 and 78PMP22702) draw water from the primary hot water loop and circulate the hot water through the heat exchanger jackets located on the draft tube mixers (85MXR02001 and 85MXR02002). A modulating three-way temperature control valve in each secondary hot water loop blends the cooler water returning from

the heat exchangers with the water from the primary hot water loop to maintain the secondary loop water temperature set point of approximately 150°F. Hot water inlet temperatures to the draft tube mixers will be maintained low enough to prevent the sludge from “cooking” to the walls of the draft tube heat exchangers. Sludge temperature in the Anaerobic Digester is used to control the START and STOP of the Hot Water Pumps. These operator-adjustable setpoints will be approximately 94.6°F to START the pumps and 95.4°F to STOP the pumps.

A third Hot Water Pump (78PMP80400) draws water from the hot water loop and sends it to two Hot Water Unit Heaters for building heat in the Boiler Room and Polymer Storage Room. Exhibit 64-1 is a partial list of components for the Digester Heating System.

Design Criteria and Component List

EXHIBIT 64-1

Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Hot Water Boiler	78BLR24100	Quantity: 1 Type: Firebox Gross Output (MBH): 1.5
Boiler Supply Pump	78PMP21101	Quantity: 1 Type: Centrifugal, Constant Speed Rated Flow Capacity (gpm): 150 Rated Differential Pressure (TDH/ft): 23 Power (hp): 2
Microturbine Supply Pump	78PMP21102	Quantity: 1 Type: Centrifugal, Constant Speed Rated Flow Capacity (gpm): 120 Rated Differential Pressure (TDH/ft): 15 Power (hp): 1
Hot Water Pump for Process Hot Water	78PMP22701, 78PMP22702	Quantity: 2 Type: Centrifugal, Constant Speed Rated Flow Capacity (gpm): 75 Rated Differential Pressure (TDH/ft): 22 Power (hp): 3/4
Hot Water Pump for Hot Water Unit Heaters	78PMP80400	Quantity: 1 Type: Centrifugal, Constant Speed Rated Flow Capacity (gpm): 20 Rated Differential Pressure (TDH/ft): 25 Power (hp): 1/3
Hot Water Loop Circulating Pump	78PMP22101, 78PMP22102	Quantity: 2 Type: Centrifugal, Constant Speed Rated Flow Capacity (gpm): 355 Rated Differential Pressure (TDH/ft): 11 Power (hp): 2

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Microturbine	95GEN00301, 95GEN00302, 95GEN00303, 95GEN00304	Quantity: 4 Type: Cogeneration Power Output (kW): 65 Heat Recovery (Btu/hr): 250,000
Temperature Control Valves	78TCV21301, 78TCV22901, 78TCV22902	Quantity: 3 Type: Temperature Control
NOTES: MBH = million Btu per hour gpm = gallons per minute TDH/ft = total dynamic head per foot Btu/hr = British thermal units per hour		

Process Control Variables

Control Variables

The digester heating system microturbine loop has the following controllable variables. The normal mode of operation is for the primary loop pumps to be left in AUTO.

- Microturbine hot water temperature setpoint (this temperature setpoint will be adjusted during commissioning of the Hot Water System and will only rarely be adjusted).

The digester heating system primary loop has the following controllable variables. The normal mode of operation is for the hot water loop circulating pumps to be left in AUTO.

- Primary loop temperature setpoint

The digester heating system secondary loop has the following controllable variables. The normal mode of operation is for the hot water pumps to be left in AUTO.

- Secondary loop temperature setpoint

Non-controllable Variables

- Ambient temperature
- Digester feed temperature

The temperature of the feed sludge to the Anaerobic Digesters should be somewhat constant throughout the year but can vary slightly going into the seasons.

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Operating Strategies

The Digester Heating System/Hot Water System provides heat to the Anaerobic Digesters necessary for them to operate in the mesophillic (95°F) anaerobic digestion range.

MICROTURBINE(S) HOT WATER LOOP

There is no operator-selectable control mode for the microturbines (with respect to heating). An outlet temperature setpoint will be established for the microturbines during commissioning that will not be adjusted under normal operating conditions. The microturbines will adjust certain parameters internal to the Microturbine Control System to maintain a certain hot water outlet temperature at the microturbine. The outlet hot water temperature setpoint will be approximately 195°F.

There are two control modes for the Microturbine Supply Pump: LOCAL, and REMOTE-MANUAL. Exhibit 64-2 lists the control modes for the Microturbine Supply Pump.

EXHIBIT 64-2
Microturbine Supply Pump Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	When operating the Microturbine Supply Pump (78PMP21102) in the LOCAL-MANUAL control mode, the operator will select LOCAL on the LOCAL/REMOTE selector switch located on the local control station (LCS). The operator is then able to manually START and STOP the pump at the LCS through the START/STOP switch.	
Manual/Remote	When operating the Microturbine Supply Pump (78PMP21102) in the REMOTE-MANUAL control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located on the LCS. The operator is then able to manually START and STOP the pump through the Plant Control System (PCS).	

BOILER HOT WATER LOOP/HOT WATER BOILER

There are three control modes for the Hot Water Boiler: REMOTE-MANUAL, REMOTE-AUTO, and LOCAL-MANUAL:

- In the LOCAL-MANUAL control mode (accomplished by selecting LOCAL at the Boiler LCP), the boiler operates to heat incoming water to a predetermined temperature (firing rate of boiler will automatically adjust to obtain desired outlet water temperature) and selected fuel determined by the operator. Once the Hot Water System is balanced as part of the commissioning activities, the boiler outlet water temperature setting should not be adjusted.
- In the REMOTE-MANUAL control mode (accomplished by selecting REMOTE at the Boiler LCP and by selecting MANUAL control through the PCS), the boiler operates to heat incoming water to a predetermined temperature (firing rate of boiler will automatically adjust to obtain desired outlet water temperature) and selected fuel determined by the operator.
- In the REMOTE-AUTO control mode (accomplished by selecting REMOTE at the Boiler LCP and by selecting MANUAL control through the PCS), the boiler operates to heat incoming water to a predetermined temperature (firing rate of boiler will automatically adjust to obtain desired outlet water temperature) and selected fuel determined by the operator.

There are three control modes for the Boiler Supply Pump: LOCAL-MANUAL, REMOTE-MANUAL (through MANUAL start of Boiler), and REMOTE-AUTO (through AUTO start of Boiler). When operating in REMOTE, the operator selects the particular REMOTE control mode through the PCS.

A modulating three-way temperature control valve (78TCV21301) controls mixing of water between the Primary Hot Water Loop and the Boiler Hot Water Loop. There are two control modes for the temperature control valve located in the boiler supply loop: REMOTE-MANUAL, and REMOTE-AUTO. When operating in REMOTE, the operator selects the particular REMOTE valve control mode through the PCS. In REMOTE-AUTO control mode, logic in the PCS controls the position of the three-way valve located on the suction side of the Boiler Supply Pump to maintain a Boiler Hot Water Loop temperature of approximately 185°F.

The PCS allows the operator to manually switch from digester gas to natural gas. A switch from natural gas to digester gas is only available locally via the Boiler LCP. The decision by the operator to switch from natural gas to digester gas is based on the digester gas level in the Dual Membrane Gasholder (Gas Storage Sphere). If digester gas production results in a considerable amount of flaring of digester gas via the Waste Gas Burner, the operator has the option of burning digester gas at the Hot Water Boiler to better match the digester gas utilization at

the Cogeneration System and Hot Water Boiler with digester gas production. Exhibit 64-3 lists the control modes for the Boiler Hot Water Loop.

EXHIBIT 64-3
Boiler Hot Water Loop Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local-Boiler	When operating the Boiler (78BLR24100) in the LOCAL-MANUAL control mode, the operator will select HAND or OFF on the HAND/OFF/AUTO selector switch located on the LCP at the boiler to START or STOP the boiler, respectively.	
Manual/Remote-Boiler	When operating the Boiler (78BLR24100) in the REMOTE-MANUAL control mode, the operator will select AUTO on the HAND/OFF/AUTO selector switch located on the LCP at the boiler. The operator is then able to manually START and STOP the boiler through the PCS.	
Auto/Remote-Boiler	When operating the Boiler (78BLR24100) in the REMOTE-MANUAL control mode, the operator will select AUTO on the HAND/OFF/AUTO selector switch located on the LCP at the boiler. The operator will then select AUTO through the PCS. When the upper and lower temperature setpoints in the Primary Hot Water Loop are reached, the boiler will automatically START and STOP.	
Manual/Local-Pump	When operating the Boiler Supply Pump (78PMP21101) in the LOCAL-MANUAL control mode, the operator will select LOCAL on the LOCAL/REMOTE selector switch located on the LCS. The operator is then able to manually START and STOP the pump at the LCS through the START/STOP switch. Note, a Boiler Supply Pump HAND/OFF/AUTO switch is also located on the Boiler LCP. Coordination between the pump LCS and the Boiler LCP will need to take place when operating the Boiler Supply Pump.	
Manual/Remote-Pump	When operating the Boiler Supply Pump (78PMP21101) in the REMOTE-MANUAL control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located on the LCS. The operator will then select the MANUAL control mode through the PCS. The operator is then able to manually START and STOP the pump through the PCS when in the MANUAL mode. Note, a Boiler Supply Pump HAND/OFF/AUTO switch is also located on the Boiler LCP. Coordination between the pump LCS and the Boiler LCP will need to take place when operating the Boiler Supply Pump.	

Auto/Remote-Pump	When operating the Boiler Supply Pump (78PMP21101) in the REMOTE-AUTO control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located on the LCS. The operator will then select the AUTO control mode through the PCS. The Boiler Supply Pump will then automatically START and STOP based on the operation of the Boiler. Note, a Boiler Supply Pump HAND/OFF/AUTO switch is also located on the Boiler LCP. Coordination between the pump LCS and the Boiler LCP will need to take place when operating the Boiler Supply Pump.	
NOTES: LCP = Local Control Panel PCS = Plant Control System LCS = Local Control Station		

HOT WATER LOOP CIRCULATING PUMPS

There are three control modes for the Hot Water Loop Circulating Pumps: LOCAL-MANUAL, REMOTE-MANUAL, and REMOTE-AUTO. When operating in REMOTE, the operator selects the particular REMOTE pump control mode through the PCS. In REMOTE-AUTO the pumps run in a DUTY-STANDBY configuration. Upon failure of the DUTY pump, the STANDBY pump automatically starts.

When in operation, one of the two Hot Water Loop Circulating Pumps will run continuously. Exhibit 64-4 lists the control modes for the Hot Water Loop Circulating Pumps.

EXHIBIT 64-4
Hot Water Loop Circulating Pumps Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	When operating the Hot Water Loop Circulating Pumps (78PMP22101 and 78PMP22102) in the LOCAL-MANUAL control mode, the operator will select LOCAL on the LOCAL/REMOTE selector switch located at the LCSs for the pumps. The operator is then able to manually START and STOP the pumps at the LCS through the START/STOP switches.	
Manual/Remote	When operating the Hot Water Loop Circulating Pumps (78PMP22101 and 78PMP22102) in the REMOTE-MANUAL control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located at the LCSs for the pumps. The operator will then select the MANUAL control mode through the PCS. The operator is then able to manually START and STOP the pumps through the PCS when in the MANUAL mode.	

Auto/Remote	When operating the Hot Water Loop Circulating Pumps (78PMP22101 and 78PMP22102) in the REMOTE-AUTO control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located on the LCSs for the pumps. The operator will then select the AUTO control mode through the PCS. When in the AUTO control mode, the pumps will automatically run in a DUTY-STANDBY configuration.	
NOTES: LCS = Local Control Station PCS = Plant Control System		

SECONDARY HOT WATER LOOPS

There are three control modes for the Hot Water Pumps: LOCAL-MANUAL, REMOTE-MANUAL, and REMOTE-AUTO. When in AUTO control, the Hot Water Pumps will START and STOP based on sludge temperature in the Anaerobic Digesters.

A modulating three-way valve in each Secondary Hot Water Loop blends the cooler water returning from the heat exchangers on the External Draft Tube Mixers with the water from the Primary Hot Water Loop to maintain the secondary loop water temperature setpoint of approximately 145°F to 150°F.

There are two control modes for the temperature control valves located in the hot water loops: REMOTE-MANUAL, and REMOTE-AUTO. When operating in REMOTE, the operator selects the particular REMOTE valve control mode through the PCs. When operating in REMOTE-AUTO, logic in the PCS adjusts the position of the three-way temperature control valve in each Secondary Hot Water Loop in order to maintain the outlet water temperature of approximately 145°F to 150°F. Exhibit 64-5 lists the control modes for the Secondary Hot Water Loops.

EXHIBIT 64-5
Secondary Hot Water Loops Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Local	When operating the Hot Water Pumps (78PMP22701, 78PMP22702, and 78PMP80400) in the LOCAL-MANUAL control mode, the operator will select LOCAL on the LOCAL/REMOTE selector switch located at the LCSs for the pumps. The operator is then able to manually START and STOP the pumps at the LCS through the START/STOP switches.	

Manual/Remote	When operating the Hot Water Pumps (78PMP22701, 78PMP22702, and 78PMP80400) in the REMOTE-MANUAL control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located at the LCSs for the pumps. The operator will then select the MANUAL control mode through the PCS. The operator is then able to manually START and STOP the pumps through the PCS when in the MANUAL mode.	
Auto/Remote	<p>When operating the Hot Water Pumps (78PMP22701 and 78PMP22702) in the REMOTE-AUTO control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located on the LCSs for the pumps. The operator will then select the AUTO control mode through the PCS. When in the AUTO control mode, the pumps will automatically START and STOP based on sludge temperature setpoints in the Anaerobic Digesters.</p> <p>When operating the Hot Water Pump (78PMP80400) in the REMOTE-AUTO control mode, the operator will select REMOTE on the LOCAL/REMOTE selector switch located on the LCS for the pump. The operator will then select the AUTO control mode through the PCS. When in the AUTO control mode, the pump will automatically START and STOP based on room temperature setpoints in the Solids Facility Boiler Room and Polymer Storage Room.</p>	
NOTES: LCS = Local Control Station PCS = Plant Control System		

Startup Procedures

Hot Water System General:

1. Confirm that the drain valves associated with the expansion tank and air separator are closed.
2. Confirm that the makeup water (W2) assembly bypass valve is closed.
3. Confirm that the makeup water assembly pressure control valve (78PCV21400) will provide 15 pounds per square inch (psi) downstream pressure. Consult with the manufacturer if adjustment is required.
4. Confirm that makeup water pressure safety valve will open at 18 psi. Consult with the manufacturer if adjustment is required.
5. Confirm that isolation valves leading to and from the Expansion Tank (78TNK21800) are open.

6. Confirm that the isolation valves located upstream and downstream of the Air Separator (78ASU21700) and Chemical Feeder (78VCF22200) are open. Once these valves are open, they should stay open during normal operation.
7. Confirm that the isolation valves on the primary and secondary hot water loops are open. Note: the balancing valves in the Hot Water System will be set during commissioning. The position of these valves should not be changed.
8. Confirm that the isolation valves located on the hot water lines at the External Draft Tube Mixers are open.
9. Confirm that the isolation valves located on the hot water lines at the microturbines are open.

Remote-Manual Control for Microturbine Supply Pump:

1. Confirm that the isolation valves located on the suction and discharge of the Microturbine Supply Pump are open.
2. At the LCS for the Microturbine Supply Pump, select REMOTE operation.
3. Through the PCS, set the Microturbine Supply Pump into the MANUAL mode.
4. Through the PCS, START the Microturbine Supply Pump.

Local-Manual Control for Microturbine Supply Pump:

1. Confirm that the isolation valves located on the suction and discharge of the Microturbine Supply Pump are open.
2. At the LCS for the Microturbine Supply Pump, select LOCAL operation.
3. START the Microturbine Supply Pump from the LCS.

Remote-Auto Control for Boiler:

1. At the LCP for the Boiler, select REMOTE operation. This is done by selecting AUTO on the HAND/OFF/AUTO switch on the Boiler LCP.
2. Through the PCS, select AUTO.
3. The Boiler will automatically START based on a temperature setpoint in the Primary Hot Water Loop.

Remote-Manual Control for Boiler:

1. At the LCP for the Boiler, select REMOTE operation. This is done by selecting AUTO on the HAND/OFF/AUTO switch on the Boiler LCP.
2. Through the PCS, select MANUAL.
3. Through the PCS, START the Boiler.

Local-Manual Control for Boiler:

1. At the LCP for the Boiler, select LOCAL-ON operation. This is done by selecting HAND on the HAND/OFF/AUTO switch on the Boiler LCP.

Remote-Auto Control for Boiler Supply Pump:

1. Confirm that the isolation valves located on the suction and discharge of the Boiler Supply Pump are open.
2. At the LCS for the Boiler Supply Pump, select REMOTE operation.
3. Through the PCS, set the Boiler Supply Pump into the AUTO mode.
4. The Boiler Supply Pump will automatically START based on a START command issued to the Boiler.

Remote-Manual Control for Boiler Supply Pump:

1. Confirm that the isolation valves located on the suction and discharge of the Boiler Supply Pump are open.
2. At the LCS for the Boiler Supply Pump, select REMOTE operation.
3. Through the PCS, set the Boiler Supply Pump into the MANUAL mode.
4. Through the PCS, START the Boiler Supply Pump.

Local-Manual Control for Boiler Supply Pump:

1. Confirm that the isolation valves located on the suction and discharge of the Boiler Supply Pump are open.
2. At the LCS for the Boiler Supply Pump, select LOCAL operation.
3. START the Boiler Supply Pump from the LCS.

Remote-Auto Control for Hot Water Loop Circulating Pumps:

1. Confirm that the isolation valves located on the suction and discharge of the Hot Water Loop Circulating Pumps are open.

2. At the LCSs for the Hot Water Loop Circulating Pumps, select REMOTE operation.
3. Through the PCS, select DUTY-STANDBY designation for the two pumps.
4. Through the PCS, set the Hot Water Loop Circulating Pumps into the AUTO mode.
5. After initially starting the pump while in the AUTO control mode, the STANDBY pump will automatically START if the DUTY pump fails.

Remote-Manual Control for Hot Water Loop Circulating Pumps:

1. Confirm that the isolation valves located on the suction and discharge of the Hot Water Loop Circulating Pumps are open.
2. At the LCSs for the Hot Water Loop Circulating Pumps, select REMOTE operation.
3. Through the PCS, set the Hot Water Loop Circulating Pumps into the MANUAL mode.
4. Through the PCS, START the Hot Water Loop Circulating Pumps. Note, under normal operations, only one Hot Water Loop Circulating Pump will be required.

Local-Manual Control for Hot Water Loop Circulating Pumps:

1. Confirm that the isolation valves located on the suction and discharge of the Hot Water Loop Circulating Pumps are open.
2. At the LCSs for the Hot Water Loop Circulating Pumps, select LOCAL operation.
3. Through the LCS stations for the pumps, START the pumps. Note, under normal operations, only one Hot Water Loop Circulating Pump will be required.

Remote-Auto Control for Hot Water Pumps:

1. Confirm that the isolation valves located on the suction and discharge of the Hot Water Pumps are open.
2. At the LCSs for the Hot Water Pumps, select REMOTE operation.
3. Through the PCS, set the Hot Water Loop Circulating Pumps into the AUTO mode.

4. Hot Water Pumps 78PMP22701 and 78PMP22702 will automatically start based on reaching a lower temperature setpoint for the sludge in the Anaerobic Digesters.
5. Hot Water Pumps 78PMP80400 will automatically start based on reaching a lower temperature setpoint for the ambient conditions in either the Boiler Room or Polymer Storage Room in the Solids Facility.

Remote-Manual Control for Hot Water Pumps:

1. Confirm that the isolation valves located on the suction and discharge of the Hot Water Pumps are open.
2. At the LCSs for the Hot Water Pumps, select REMOTE operation.
3. Through the PCS, set the Hot Water Pumps into the MANUAL mode.
4. Through the PCS, START the Hot Water Pumps.

Local-Manual Control for Hot Water Loop Circulating Pumps:

1. Confirm that isolation valves located on the suction and discharge of the Hot Water Pumps are open.
2. At the LCSs for the Hot Water Pumps, select LOCAL operation.
3. Through the LCS stations for the pumps, START the pumps.

Shutdown Procedures

Remote-Manual Control for Microturbine Supply Pump:

1. Through the PCS, STOP the Microturbine Supply Pump.

Local-Manual Control for Microturbine Supply Pump:

1. Through the LCS, STOP the Microturbine Supply Pump.

Remote-Auto Control for Boiler:

1. Through the PCS, select MANUAL.
2. Through the PCS, STOP the Boiler.

Remote-Manual Control for Boiler:

1. Through the PCS, STOP the Boiler.

Local-Manual Control for Boiler:

1. At the LCP for the Boiler, STOP the Boiler. This is done by selecting OFF on the HAND/OFF/AUTO switch located on the Boiler LCP.

Remote-Auto Control for Boiler Supply Pump:

1. Through the PCS, select MANUAL.
2. Through the PCS, STOP the Boiler Supply Pump.

Remote-Manual Control for Boiler Supply Pump:

1. Through the PCS, STOP the Boiler Supply Pump.

Local-Manual Control for Boiler Supply Pump:

1. Through the LCS for the pump, STOP the Boiler Supply Pump.

Remote-Auto Control for Hot Water Loop Circulating Pumps:

1. Through the PCS for the pumps, select MANUAL.
2. Through the PCS, STOP the Hot Water Loop Circulating Pumps.

Remote-Manual Control for Hot Water Loop Circulating Pumps:

1. Through the PCS, STOP the Hot Water Loop Circulating Pumps.

Local-Manual Control for Hot Water Loop Circulating Pumps:

1. Through the LCS for the pumps, STOP the Hot Water Loop Circulating Pumps.

Remote-Auto Control for Hot Water Pumps:

1. Through the PCS for the pumps, select MANUAL.
2. Through the PCS, STOP the Hot Water Pumps.

Remote-Manual Control for Hot Water Pumps:

1. Through the PCS, STOP the Hot Water Pumps.

Local-Manual Control for Hot Water Loop Circulating Pumps:

1. Through the LCS for the pumps, STOP the Hot Water Pumps.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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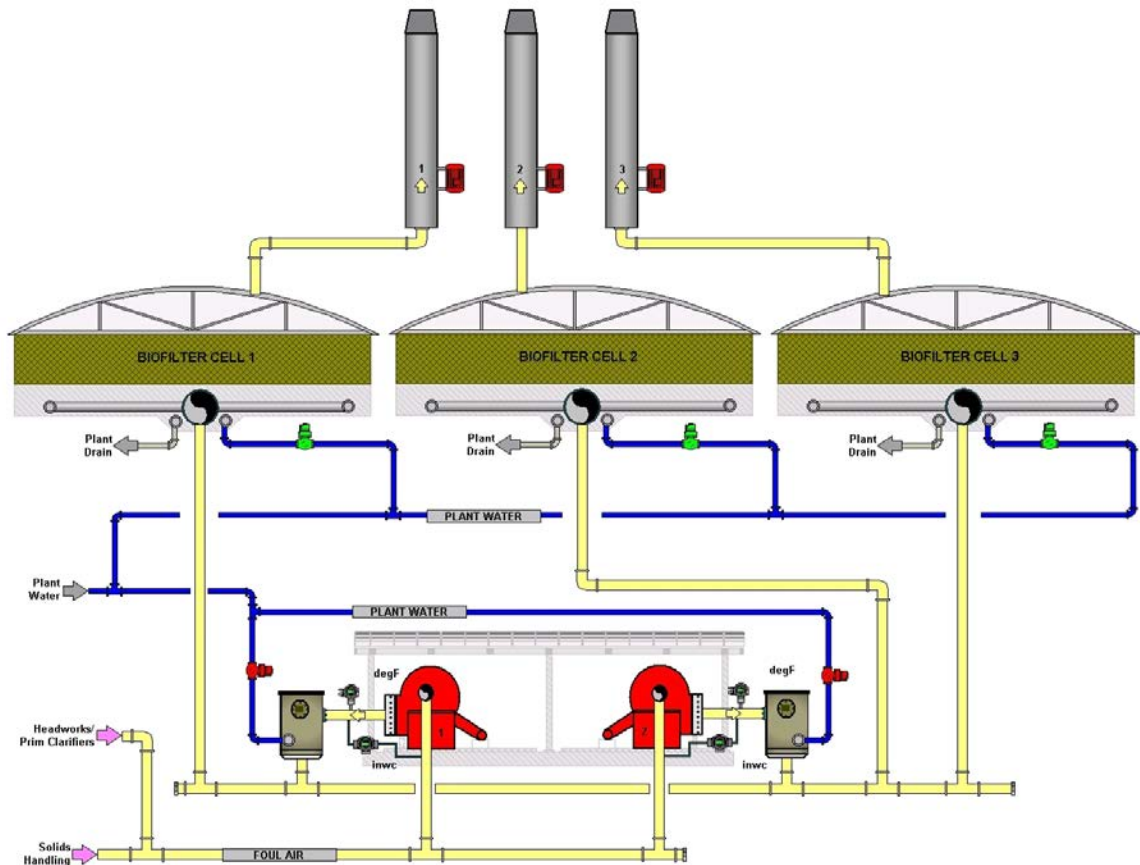
64 - Digester Heating

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Boiler Hot Water Supply Pump FAIL-TO-START	Boiler Hot Water Supply Pump (78PMP21101) has Failed to Start.	Alarm on SCADA. Inspect Hot Water Boiler.
Boiler Hot Water Supply Pump FAIL-TO-STOP	Boiler Hot Water Supply Pump (78PMP21101) has Failed to Stop.	Alarm on SCADA. Inspect Hot Water Boiler.
Microturbine Supply Pump FAIL-TO-START	Microturbine Supply Pump (78PMP21102) has Failed to Start.	Alarm on SCADA. Inspect Microturbine Supply Pump.
Microturbine Supply Pump FAIL-TO-STOP	Microturbine Supply Pump (78PMP21102) has Failed to Stop.	Alarm on SCADA. Inspect Microturbine Supply Pump.
Hot Water Loop Circulating Pump 1 FAIL-TO-START	Hot Water Loop Circulating Pump 1 (78PMP22101) has Failed to Start.	Alarm on SCADA. Inspect Hot Water Loop Circulating Pump 1.
Hot Water Loop Circulating Pump 1 FAIL-TO-STOP	Hot Water Loop Circulating Pump 1 (78PMP22101) has Failed to Stop.	Alarm on SCADA. Inspect Hot Water Loop Circulating Pump 1.
Hot Water Loop Circulating Pump 2 FAIL-TO-START	Hot Water Loop Circulating Pump 2 (78PMP22102) has Failed to Start.	Alarm on SCADA. Inspect Hot Water Loop Circulating Pump 2.
Hot Water Loop Circulating Pump 2 FAIL-TO-STOP	Hot Water Loop Circulating Pump 2 (78PMP22102) has Failed to Stop.	Alarm on SCADA. Inspect Hot Water Loop Circulating Pump 2.
Hot Water Pump 1 FAIL-TO-START	Hot Water Pump 1 (78PMP22701) has Failed to Start.	Alarm on SCADA. Inspect Hot Water Pump 1.
Hot Water Pump 1 FAIL-TO-STOP	Hot Water Pump 1 (78PMP22701) has Failed to Stop.	Alarm on SCADA. Inspect Hot Water Pump 1.
Hot Water Pump 2 FAIL-TO-START	Hot Water Pump 2 (78PMP22702) has Failed to Start.	Alarm on SCADA. Inspect Hot Water Pump 2.
Hot Water Pump 2 FAIL-TO-STOP	Hot Water Pump 2 (78PMP22702) has Failed to Stop.	Alarm on SCADA. Inspect Hot Water Pump 2.

ALARM	MEANING	RESPONSE OR ACTION
Hot Water Pump 3 FAIL-TO-START	Hot Water Pump 3 (78PMP80400) has Failed to Start.	Alarm on SCADA. Inspect Hot Water Pump 3.
Hot Water Pump 3 FAIL-TO-STOP	Hot Water Pump 3 (78PMP80400) has Failed to Stop.	Alarm on SCADA. Inspect Hot Water Pump 3.

Overview



Purpose

Odor generation is the result of gas production by microorganisms present in wastewater liquids and solids. Hydrogen sulfide and ammonia are the most common causes of odor; however, numerous other organic and inorganic compounds can create unpleasant odors.

At the Spokane County RWRf, odorous air is transferred to a bulk media biofilter through a centralized fan system for odor treatment. Two variable speed fans (one duty, one standby) are each sized to handle 100 percent of the odor flow capacity. Odorous air captured in the containment systems at each tank or building is directed through ductwork to three biofilter cells using corrosion-resistant fiberglass-reinforced plastic (FRP) blowers. Underground ducting consists of high-density polyethylene (HDPE) piping, above-grade exterior

ductwork is vinyl ester FRP. Interior ductwork will be aluminum (from odor sources representing low corrosion potential) or stainless steel (from odor sources representing higher corrosion potential).

A bulk media biofilter provides treatment of the odorous air. Three biofilter cells are placed at grade to maintain a low-profile configuration. Each cell is sized to treat one-third of the flow. Normally all cells will operate, but one can be taken out of service for maintenance when required. Each cell is provided with an aluminum cover. A dedicated stack fan pulls the treated air from beneath the cover and out a stack. The stack size and height was selected to prevent offsite odor impacts and to meet Spokane Regional Clean Air Agency (SRCAA) requirements as determined by air dispersion modeling.

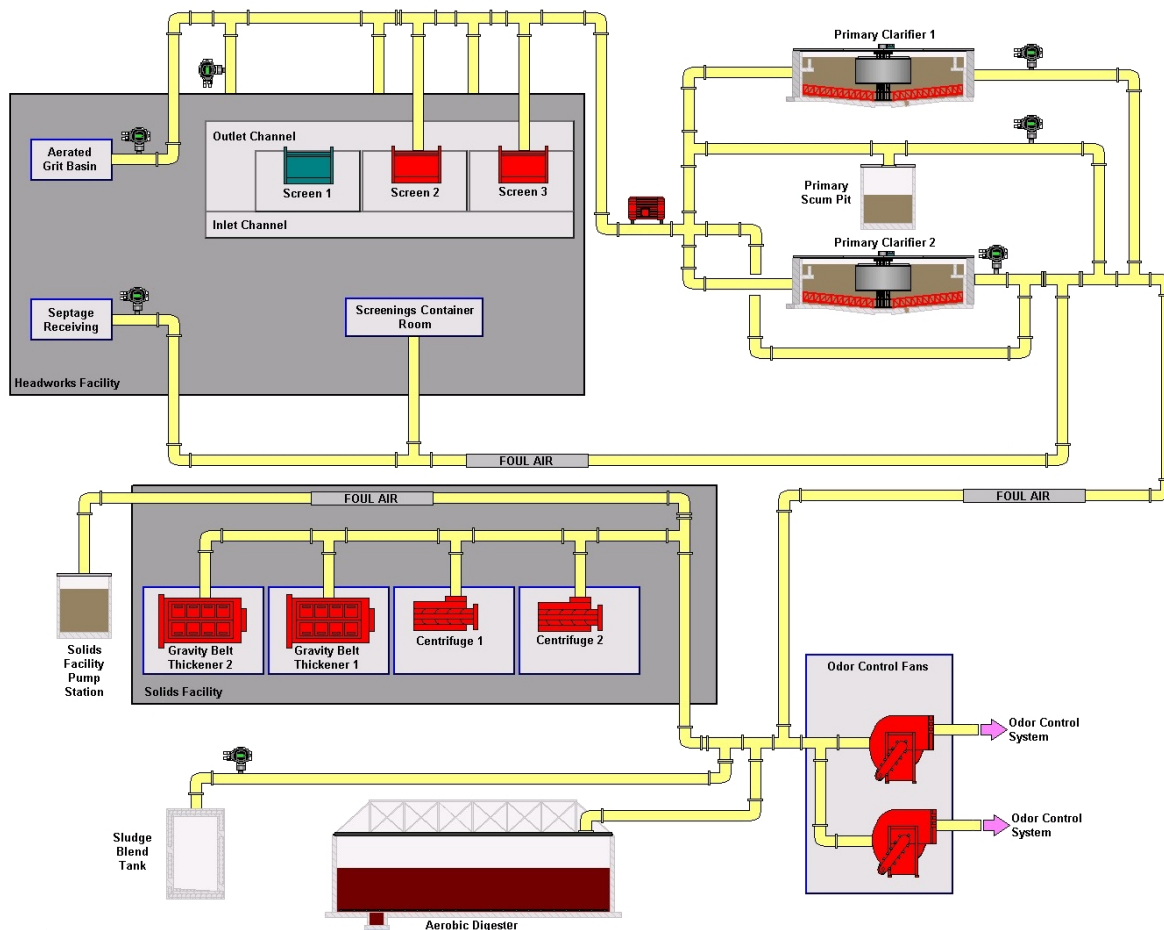
Less odorous air is transferred from the bioreactor basins through two (one duty and one standby) aluminum exhaust fans and out a stack untreated. The stack size and height was selected to prevent offsite odor impacts and meet Spokane Regional Clean Air Agency (SRCAA) requirements as determined by air dispersion modeling.

Description

All significant sources of odors are either enclosed in buildings or covered. Exhaust air from these structures is routed for odor treatment at the centralized Odor Control System.

The major processes for odor control are:

- Septage handling area
- Headworks (including Aerated Grit Chamber and Grit Bin Room)
- Primary Clarifiers
- Liquid Biosolids Storage Tank (blend tank)
- Aerobic Digester/Biosolids Storage Tank
- Solids Facility (thickening, dewatering, biosolids loadout)
- Solids Drain Pump Station



The aeration basins are considered a minor source and therefore are covered and ventilated through two exhaust fans (one duty and one standby) for routing out of a stack untreated.

To reduce overall biofilter capacity requirements and prevent ice formation below primary clarifier covers, warmer airflow from the Headworks is transferred to the primary clarifier headspace via a transfer fan.

The facility is operated and maintained to prevent objectionable odors, captures and treats all objectionable odor sources, and follows best management practices for the prevention of objectionable odors. The facility complies with the requirements of Applicable Law with respect to odor and will meet the following Odor Control Standards:

- There shall be no objectionable odors at the Site fence line (or beyond) that exceed a value of 10 dilution-to-thresholds (D/T) as determined by dispersion modeling.

- Atmospheric hydrogen sulfide shall not exceed 0.01 parts per million by volume in air (ppm_v) as measured at the Site fence line.
- Per Washington Administrative Code (WAC) 173-460-160, the fence line 24- hour average acceptable source impact level (ASIL) for hydrogen sulfide shall not exceed 2.0 micrograms per cubic meter (µg/m³), or that stipulated in the latest adopted WAC.

Exhibit 70-1 is a partial list of the components for the Odor Control System.

Design Criteria and Component List

EXHIBIT 70-1

Odor Control Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Odor Control Fan	91FAN00401, 91FAN00402	Quantity: 2 Type: FRP, Centrifugal Airflow Rate (acfm): 25750 Pressure (in WC): 7.2 Power (hp): 60
Headworks Transfer Fan		Quantity: 1 Type: FRP, Axial Airflow Rate (acfm): 4600 Pressure (in WC): 2.3 Power (hp): 5
Humidifier	91HMD00701, 91HMD00702	Quantity: 2
Biofilter Cell		Quantity: 3 Type: Aluminum Airflow Rate (SCFM): 8583
Inline Stack Fan	91BLW01201, 91BLW01202, 91BLW01203	Quantity: 3 Type: Aluminum, Mixed Flow Airflow Rate (acfm): 9400 Pressure (in WC): 1.2 Power (hp): 5
Bioreactor Fan	91FAN01501, 91FAN01502	Quantity: 2 Type: Aluminum, Centrifugal Airflow Rate (acfm): 12600 Pressure (in WC): 3.1 Power (hp): 15
NOTES: FRP = fiberglass-reinforced plastic acfm = actual cubic feet per minute		

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
in WC = inches water column		

Process Control Variables

Biofilter Odor Control System

Control Variables

- Foul Air Flow Monitoring and Speed Control:*** SCADA will receive speed input from each variable frequency drive (VFD) unit, as well as a fan pressure differential from each fan PDIT. SCADA will take the two inputs and run a calculation to determine flow. The correlation will be based on the actual fan curve. Fan speed will be controlled to match the specific flow setpoint. A thermal mass flow meter is not recommended for flow monitoring because they are prone to fouling as a result of the dirty conditions of the foul airstream. Target value is 25,750 cubic feet per minute (cfm).
- Primary Humidification:*** Normally, in-vessel humidifiers will be operated continuously. A solenoid valve will be provided for each humidifier to allow for automatic on-off control of humidification. A rotameter will be provided at each humidifier to allow for adjustment of water flows and alert the plant operators to plugging of spray nozzles. All exposed piping and accessories will be heat-traced and insulated for freeze protection. Target value for rotameter flow is 0.5-gallon(s) per minute (gpm). See calculation below for determining adjusted flow values.
- Secondary Humidification:*** During the warm summer months, a secondary humidification system will be operated to be sure the media remains moist. Irrigation control valves will be opened and closed via SCADA based on a timer approach. Any exposed piping will be heat-traced and insulated for freeze protection. Target duration and frequency is 15 minutes every 4 hours.

Non Controllable Variables

- Exhaust Fan Pressure Differential:*** Pressure differential will be measured across each fan for speed control (mentioned previously), as well as for

general monitoring. A high differential pressure alarm will alert plant personnel that media must be changed out or that some other system anomaly has occurred. A low differential pressure alarm will alert plant personnel that the fan is energized but not performing (for example the fan has thrown a belt). A low differential pressure alarm will also initiate fire alarm trouble status in compliance with National Fire Protection Association (NFPA) 820 requirements. Target alarm setpoints will be 9 inches WC and 2 inches WC, respectively.

- *Biofilter Inlet Temperature:* Biofilter inlet temperature will be measured and recorded at SCADA. Inlet temperature can have a significant impact on biofilter removal performance. Temperatures approaching freezing will reduce bacterial metabolism rates and therefore removal performance efficiency. When the inlet temperature drops to a low temperature setpoint, a low temperature alarm will be initiated at SCADA. Target alarm setpoint is 35°F.

Calculations

- *Primary Humidification Flows*

Primary humidification water flows can be estimated using the following calculation method. A psychrometric chart is necessary to determine the inlet and outlet moisture levels. Data from the weather station can be used to estimate average inlet relative humidity levels. The biofilter inlet temperature sensor (TET) instrument can be used to estimate average inlet temperatures. Once inlet temperature and inlet relative humidity are known, one can read the grains value from the psychrometric chart. An example calculation is as follows:

$$F = (G2-G1)/7000 \times (Q \times 0.075)/8.34$$

Where:

G1 = Inlet moisture level (grains)

G2 = Outlet moisture level (grains). This is found from the psychrometric chart by reading the value at the intersection of the dry bulb (inlet) temperature and the saturation (100% relative humidity) line.

F = Flow rate (gpm) per humidifier vessel

Q = Flow (cfm) per humidifier vessel

8.34 = Conversion factor (in this case, pounds per gallon of water)

7,000 = Conversion factor (7,000 grains per pound of water)

0.075 = Conversion factor (density of air in pounds per cubic feet)

Example calculation:

G1 = 80 grains

G2 = 140 grains

Q = 14,000 cfm

$F = (140-80)/7000 \times (14,000 \times 0.075)/8.34 = 1.0 \text{ gpm}$

- *Biofilter Odor Control Fans*

The flow of the odor control fans is based on the static pressure reading and the speed of the fan. This relation is described by the following equation:

$$\text{CFM2} = (\text{RPM2} / \text{RPM1}) * \text{CFM1}$$

Where

CFM2 = calculated CFM

RPM2 = actual fan RPM

RPM1 = fan curve RPM

CFM1 = calculated flow based on the fan curve formula and the known static pressure

Non-controllable Variables

- *Exhaust Fan Pressure Differential:* Pressure differential will be measured across each fan for general monitoring. A high differential pressure alarm will alert plant personnel that some system anomaly has occurred. A low differential pressure alarm will alert plant personnel that the fan is energized but not performing (for example, the fan has thrown a belt). Target alarm setpoints will be 5 inches WC and 1 inch WC, respectively.

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Operating Strategies

The biofilter odor control fans, biofilter stack fans, Headworks Screening Room transfer fan, in-line humidifiers, and bioreactor exhaust fans are the only major equipment in the odor control process.

As biofilter media decomposes and fines develop, head loss through the biofilter will increase. Fans are provided with VFDs such that fan speed is controlled to be sure the setpoint volume of air is maintained under increasing head conditions.

The biofilter odor control fan speed is controlled via SCADA. SCADA will take the fan pressure differential input as well as the fan speed input to determine the calculated airflow. Calculated flow is determined from a lookup table or formula developed from the respective fan curve. Speed is adjusted to match the airflow setpoint.

Bioreactor exhaust fans and the Headworks Screening Room transfer fan are constant speed units. These units are ON continuously under normal operation.

Dampers to isolate and balance airflow from each process area will be operated manually.

In-line humidifiers are provided with solenoid valves such that valves are opened via SCADA anytime their respective fan is on. Soaker hose secondary humidification will likely only be used in the summer and is controlled via a SCADA timer control scheme. Exhibit 70-2 lists the control modes for the odor control process.

EXHIBIT 70-2
Odor Control Process Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Backdraft dampers that isolate and balance airflow from each process area are operated manually.	
Manual/Local	ON-OFF-REMOTE, SPEED and RESET controls for the Odor Control Fans are provided at the LCPs of their respective AFDs.	

Remote	The Biofilter Odor Control Fan speed will be controlled via SCADA. SCADA monitors the fan pressure differential input as well as the fan speed input to determine the calculated airflow. Calculated flow will be determined from a lookup table or formula developed from the respective fan curve. Speed is adjusted to match the airflow setpoint.	
Auto/Remote	In-line humidifiers are provided with solenoid valves such that valves are opened via SCADA anytime their respective fan is on. Soaker hose secondary humidification will likely only be used in the summer and is controlled via a SCADA timer control scheme.	
Manual/Local	The ON-OFF-REMOTE status of the Headworks Transfer Fan is controlled by the operator at the LCP.	
Remote	In REMOTE mode the Headworks Transfer Fan receives a RUN command from SCADA. The fan is constant speed and runs continuously under normal operating conditions.	
Auto/Remote	SCADA monitors the ON-OFF-REMOTE status of the Headworks Transfer Fan.	
Manual/Local	The ON-OFF-REMOTE status of each Inline Stack Fan is controlled by the operator at the LCP.	
Remote	In REMOTE mode the Inline Stack Fans receive a RUN command from SCADA. The fans are constant speed and run continuously under normal operating conditions.	
Auto/Remote	SCADA monitors the ON-OFF-REMOTE status of the Inline Stack Fans.	
Manual/Local	The LOCAL-REMOTE status of the Bioreactor Fans is controlled at the LCP.	
Manual/Local	In LOCAL mode the START-STOP controls of the Bioreactor Fans are provided at the LCP. The fans are constant speed and run continuously under normal operating conditions.	
Remote	In REMOTE the Bioreactor Fans receive a RUN command from SCADA.	
NOTES: LCP = local control panel AFD = adjustable frequency drive SCADA = supervisory control and data acquisition		

Startup Procedures

Odor Control Exhaust Fans:

Manufacturer's information for the odor control exhaust fans should be reviewed carefully prior to use to ensure proper alignments, clearances,

lubrication, and equipment operation. General guidelines to be followed are listed below:

1. Check that primary humidification isolation valve is open.
2. Check that the irrigation system isolation valve is open. If starting up after seasonal shutdown of the irrigation system, make sure drain valves are closed.
3. Check the W3 strainers and clean/flush if necessary.
4. Ensure all foul air ductwork is clear and ready for utilization.
5. Ensure HVAC systems serving the headworks (Facility 59) and solids facility (Facility 78) are operational.
6. Ensure isolation damper at fan inlet is closed.
7. Check that exhaust fan sheaves and belts are secure and properly tensioned, respectively.
8. If starting an exhaust fan after disassembly, check to ensure the motor is wired for correct rotation. This can be verified by placing the fan in ON mode and “jogging” the fan.
9. Check to ensure exhaust fan scroll drains are closed.
10. Check to ensure exhaust fan discharge sample valves and test ports are closed.
11. Open the inlet damper for the fan to be started and place this fan in REMOTE mode at its respective motor starter control panel. **Note: During any long-term single fan operation, the inlet damper for the standby fan should remain closed to prevent short-circuiting and reverse rotation.** Fans are provided with discharge backdraft dampers to prevent starting a fan under reverse rotation conditions. **Note: Under no circumstance should a fan be started with its respective inlet damper closed. This will place a large vacuum on the short duct section between the damper and the fan and could damage the duct or flexible connection.**
12. Check reading at local exhaust fan PDIT. Measurement should read between 4-7 inches WC.
13. If starting the system after long-term shutdown, the organic media bacteria may be dormant or have died off or be dried out. Re-hydration may be necessary.
14. Make sure in-line stack fans are running to prevent over-pressurizing the biofilter headspace.

In-Line Stack Fans:

Manufacturer's information for the in-line stack fans should be reviewed carefully prior to use to ensure proper alignments, clearances, lubrication, and equipment operation. General guidelines to be followed are listed below:

1. Ensure that duty odor control fan is operating. Do not start a stack fan without one odor control exhaust fan operating to prevent pulling an elevated negative pressure below the biofilter cover.
2. Ensure all foul air ductwork is clear and ready for utilization.

3. Check that exhaust fan sheaves and belts are secure and properly tensioned, respectively.
4. If starting a stackfan after disassembly, check to ensure the motor is wired for correct rotation. This can be verified by placing the fan in ON mode and “jogging” the fan.
5. Check to ensure exhaust fan discharge sample valves are closed and that condensate drain P-traps are primed.
6. Place the fan in REMOTE mode at its respective motor starter control panel.

Bioreactor Fans:

Manufacturer's information for the bioreactor exhaust fans should be reviewed carefully prior to use to ensure proper alignments, clearances, lubrication, and equipment operation. General guidelines to be followed are listed below:

1. Ensure that bioreactor process blowers are operational. Do not start a bioreactor fan when bioreactor process blowers are off-line to prevent pulling a high negative pressure below the bioreactor cover.
2. Ensure all foul air ductwork is clear and ready for utilization.
3. Ensure isolation damper at fan inlet is closed.
4. Check that exhaust fan sheaves and belts are secure and properly tensioned, respectively.
5. If starting an exhaust fan after disassembly, check to ensure the motor is wired for correct rotation. This can be verified by placing the fan in ON mode and “jogging” the fan.
6. Check to ensure exhaust fan scroll drains are closed.
7. Check to ensure exhaust fan discharge sample valves are closed.
8. Open the inlet damper for the fan to be started and place this fan in REMOTE mode at its respective motor starter control panel. **Note: During any long-term single fan operation, the inlet damper for the standby fan should remain closed to prevent short-circuiting and reverse rotation.** Fans are provided with discharge backdraft dampers to prevent starting a fan under reverse rotation conditions. **Note: Under no circumstance should a fan be started with its respective inlet damper closed. This will place a large vacuum on the short duct section between the damper and the fan and could damage the duct or flexible connection.**
9. Check reading at local exhaust fan PDIT. Measurement should read between 2-4 inches WC.

Headworks Transfer Fan:

Manufacturer's information for the in-line transfer fan should be reviewed carefully prior to use to ensure proper alignments, clearances, lubrication, and equipment operation. General guidelines to be followed are listed below:

1. Ensure that headworks HVAC system is operating. Do not start the transfer fan without the HVAC system operating to prevent creating an excessive negative pressure within the headworks.
2. Ensure all foul air ductwork is clear and ready for utilization.
3. Check that exhaust fan sheaves and belts are secure and properly tensioned, respectively.
4. If starting a stackfan after disassembly, check to ensure the motor is wired for correct rotation. This can be verified by placing the fan in ON mode and “jogging” the fan.
5. Place the fan in REMOTE mode at its respective motor starter control panel.

Shutdown Procedures

To remove odor control exhaust fans, bioreactor exhaust fans, stack fans, or the headworks transfer fan from operational service, the following general procedures should be followed:

1. Place the equipment selector switch at the motor control center in OFF position, attach safety tag.
2. Open the disconnect breaker at the motor control center and lock it in that position with a padlock.
3. Open the power disconnect switch at the equipment (if so equipped) and tag when doing electrical maintenance.
4. Close and tag the inlet damper at the exhaust fan to prevent short-circuiting.
5. For the biofilter odor control exhaust fans, avoid shutdowns that could last longer than a few hours in order to prevent organic media biofilm from drying out. If possible, keep irrigation system operational during any long-term shutdown in order to maintain biofilm. Zero food source will mean bacteria going dormant. However, once the system is started up again the bacteria will typically re-activate.

For seasonal shutdown of the irrigation system to prevent pipe freeze-up and possible damage, the following general procedures should be followed:

1. Close the W3 isolation valves upstream of the control valves.
2. Open the irrigation drain valves located at the end of the lines.

3. Allow piping contents to drain. After drainage is complete, place control valves in OFF mode at SCADA.

Isolation Procedures

To isolate an odor control biofilter cell for media replacement, the following general procedures should be followed:

1. Keeping the duty exhaust fan operational, close the respective biofilter cell isolation damper.
2. Shut-off associated stack fan per procedures provided herein.
3. Biofilter cell is effectively isolated. Some untreated foul air may enter the isolated biofilter cell via the perforated drain line. However, flows will be minimal due to limited size of drain line (4-inch).

To isolate an odor control exhaust fan for maintenance, the following general procedures should be followed:

1. Shutoff isolated exhaust fan following shutdown procedures herein.
2. Close the inlet isolation damper to prevent short-circuiting and reverse rotation.
3. Backdraft damper at fan discharge will prevent most foul air from entering fan housing during maintenance. For complete isolation, a temporary blind flange may be required.

To isolate an odor control primary humidifier vessel for spray nozzle maintenance, the following general procedures should be followed:

1. Keeping the duty exhaust fan operational, remove spray nozzle piping assembly from vessel by disassembling union and blind flange.
2. Once pipe assembly is removed, close blast gate to isolate vessel.
3. Clean spray nozzle per manufacturer's recommendations.
4. To re-install spray nozzle pipe assembly reverse procedure.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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81 - Anionic Polymer

Overview

Purpose

Anionic polymer is used in conjunction with ferric chloride to supplement the CEPT process. Activated anionic polymer improves the solids removal in the Primary Clarifiers by coagulating the chemical precipitate formed by ferric chloride and phosphorus.

Description

The Anionic Polymer Storage and Feed System located in the Headworks Building consist of two anionic polymer storage tote, polymer blending unit, and post-dilution static mixer. The system is designed to activate neat polymer to 0.5 percent polymer solution at the blend unit with addition of post-dilution water to aid in mixing prior to injection. Storage of chemical is provided by onsite delivery of supplier-provided chemical totes. A roll-up door allows for maneuvering the chemical tote into the Headworks Building. A forklift is used to position the chemical tote over the containment platform inside the Headworks Facility. Consequently, the chemical unloading is a manual process to be performed by plant operators. Exhibit 81-1 is a partial list of the components of the Anionic Polymer Storage and Feed System.

Design Criteria and Component List

EXHIBIT 81-1

Anionic Polymer Storage and Feed System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Anionic Polymer Tote	59TNK02800	Quantity: 2 Type: Polyethylene, Intermediate Bulk Containment Volume (gal): 270
Static Mixer	59MXR02600	Quantity: 1 Rated Flow (gph): 10

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Anionic Polymer Blend Unit	59PBU02700, 59PMP02700	Quantity: 1 Type: Proportional Flow Control, Metering Pump Rated Flow (gph): 3 Power (hp): 1
NOTES: gal = gallons gph = gallons per hour		

Process Control Variables

Control Variables

Dose – range is 0.5 to 5 mg/L with a typical value of 2 mg/L

Post-dilution water – 5-20 gpm

Polymer specific gravity – typical value is 1.10 and is dependent upon polymer product as shown on the material safety data sheets (MSDSs)

Non Controllable Variables

Dilution water – 0.5 to 10 gpm; used by polymer blend unit to achieve 0.5 percent polymer solution

Calculations

$$q = Q \cdot PO / SG \cdot C \cdot 24$$

Where:

- q = calculated flow rate of polymer (gph)
- PO = polymer dosage (mg/L)
- SG = specific gravity of POL (1.10 [adjustable])
- C = polymer concentration (%)
- Q = sum of the plant influent flowmeters (mgd)

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Operating Strategies

The Anionic Polymer Storage and Feed System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

Anionic polymer is pumped from the tote through the polymer blend unit where it is activated with dilution water. To increase mixing and reaction with primary influent, it is mixed with post-dilution water through the static mixer and finally discharged into the Aerated Grit Basin Effluent Channel.

Three polymer blending unit modes control anionic polymer feed and dilution water flow rates: LOCAL-MANUAL, REMOTE-MANUAL, and REMOTE-AUTO-DOSAGE. When operating in REMOTE, the operator selects the particular REMOTE polymer blending unit control mode at SCADA. The ON, OFF, and speed of the pump can be controlled to provide the desired polymer dosage. When operating the polymer blending unit in the DOSAGE control mode, the operator inputs the polymer dosage (typical value is 1.0 mg/L), specific gravity (typically 1.10), and the polymer blend unit transfer pump capacity, which is used with the sum of the plant influent flowmeters to determine the feed rate of the polymer.

SCADA monitors the LOCAL/REMOTE status, ON/OFF status, loss of water, loss of polymer, blending unit run time, and speed from the Anionic Polymer Blending Unit. Exhibit 81-2 lists the control modes for the blending unit.

EXHIBIT 81-2
Blending Unit Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Operator sets the polymer blending unit to LOCAL-MANUAL or REMOTE.	
Manual/Local	In LOCAL-MANUAL control mode the operator manually turns the polymer blending unit ON or OFF and inputs pump speed at the LCP.	
Manual/Remote	In REMOTE, the Operator selects the particular REMOTE polymer blending unit control mode at SCADA.	
Manual/Remote	In REMOTE-MANUAL, the operator manually turns the polymer blending unit ON or OFF and inputs pump speed at SCADA.	

Manual/Remote	In REMOTE-AUTO-DOSAGE the operator manually selects the polymer dosage, specific gravity of the polymer, and the polymer blend unit transfer pump capacity.	
Auto/Remote	In REMOTE-AUTO-DOSAGE SCADA provides the total plant influent flow and calculates the feed rate.	
Auto/Remote	SCADA monitors LOCAL/REMOTE status, ON/OFF status, loss of water, loss of polymer, blending unit run time, and speed from the polymer blending unit.	
NOTES: LCP = local control panel SCADA = supervisory control and data acquisition		

Startup Procedures

Note: this is anticipated to be an intermittent system to provide as-needed coagulation/flocculation in the Primary Clarifier.

- Check polymer tote level and be sure it is connected to the polymer blend system.
- Open water valve to the polymer blend system.
- Turn on polymer blend system per manufacturer's instructions (put in REMOTE-AUTO or REMOTE-MANUAL)
- Set post-dilution water flow to 5-20 gpm at rotameter by throttling globe valve.

Shutdown Procedures

- Shut down polymer blend unit.
- Turn off water.

Abnormal Conditions

- Loss of water – check valves
- Loss of polymer – check tote, change out tote if empty. Close valve to tote, disconnect coupling, change out tote and reconnect/open.

Additional Control Features

- Calibration of polymer transfer pump. – see manufacturer's instructions.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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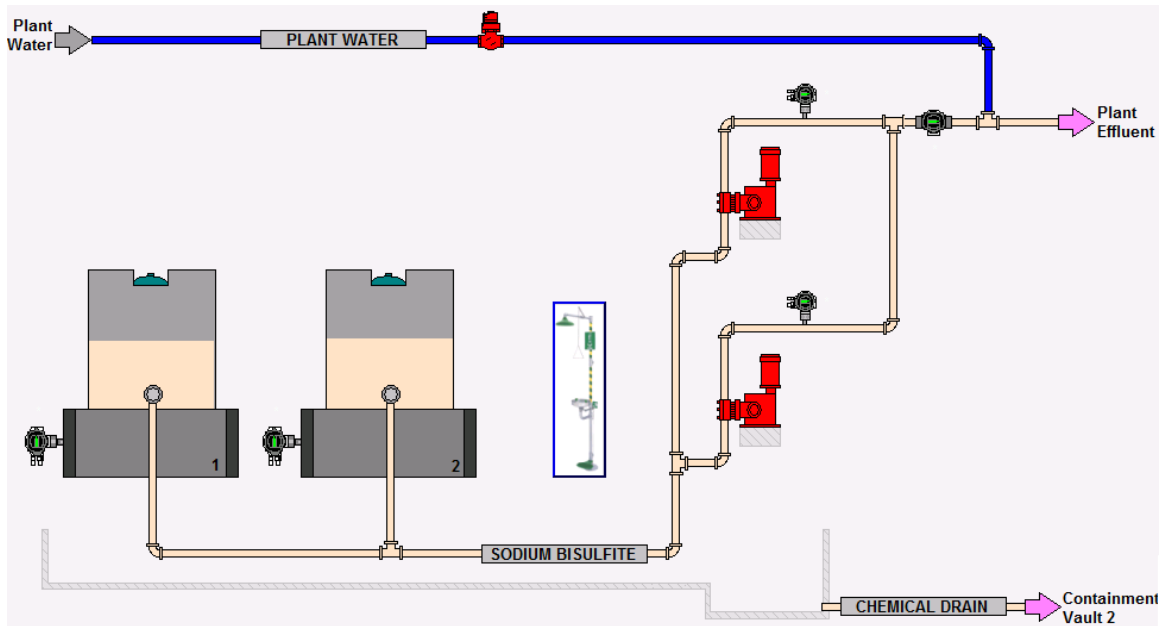
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Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Anionic Polymer Blend LOSS of DILUTION WATER	Anionic Polymer Polyblend (59PBU02700) has detected Loss of Dilution Water.	Alarm of SCADA when loss of dilution water is met.
Anionic Polymer Blend LOSS of POLYMER	Anionic Polymer Polyblend (59PBU02700) has detected Loss of Polymer.	Alarm of SCADA when loss of polymer is met.

82 - Sodium Bisulfite

Overview



Purpose

Sodium bisulfite is added to chlorinated plant effluent after it has passed the chlorine contact basins to neutralize the chlorine in the water before it is sent to the Spokane River.

Description

Storage of sodium bisulfite is provided by onsite delivery of supplier-provided chemical totes. The storage and feed portions of the system are located in the Chemical Room at the Membrane Building. Roll-up doors allow for maneuvering the totes into the Chemical Room.

The Sodium Bisulfite Storage and Feed System is located in the Chemical Room of the Membrane Facility. The system consists of components that provide dechlorination of plant effluent water. The system is designed to deliver a concentration of 40 percent sodium bisulfite solution to the reclaimed water wet well.

All chemical areas are equipped with spill containment measures. Refer to the Chemical Unloading and Containment process control narrative. Exhibit 82-1 is a

partial list of example components for the Sodium Bisulfite Storage and Feed System.

Design Criteria and Component List

EXHIBIT 82-1

Sodium Bisulfite Storage and Feed System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Sodium Bisulfite Tote	64TNK16001, 64TNK16002	Quantity: 2 Type: Polyethylene Volume (gal): 270
Sodium Bisulfite Feed Pump	64PMP16501, 64PMP16502	Quantity: 2 Type: Diaphragm, Adjustable Speed Flow Rate (gph): 12 Power (hp): $\frac{3}{4}$
Chemical Sump Manual Valve	64VBF16388	Quantity: 1 Type: Butterfly Position: Normally Closed
Flowmeter	64AIT20800	Quantity: 1 Type: Electromagnetic Flow Rate (gph): 20
NOTES: gal = gallons gph = gallons per hour		

Process Control Variables

Control Variables

Specific gravity – typical range is 1.34 for 40 percent sodium bisulfite

Concentration – typical value is 40 percent

Dose – typical range is 2 to 10 mg/L Pump Speed – In MANUAL mode, pump output is controlled by pump speed. Pump speed is adjusted based on flowmeter readings.

Carrier water – typical value is approximately 5 gpm

Non Controllable Variables

Weight – Tote weight determines when lead tote requires changing and switching to lag tote for feed.

Plant effluent flow rate – effluent flow rate is measured by a flow meter on the discharge pipe of the Reclaimed Water Wet Well.

Calculations

DOSAGE CONTROL MODE

When operating in the DOSAGE control mode, the operator manually inputs the following parameters to SCADA:

d = desired dose of sodium bisulfite (mg/L)

SG = specific gravity of sodium bisulfite (1.34 (adjustable))

C = concentration of sodium bisulfite (40% [adjustable])

SCADA provides the following parameters:

Q = plant effluent flow meter (mgd)

q = calculated chemical feed rate

The calculated value for “q” is the setpoint for the chemical flow control loop. Once the calculation is performed, the PLC adjusts pump speed(s) until actual flow as measured by the chemical discharge magmeter matches the calculated flow setpoint. The calculation and pump speed adjustment occur continuously. .An alarm is activated by SCADA if the actual measured chemical deviates from the calculated setpoint. SCADA calculates the chemical feed rate based on the equation given below:

$$q = Q \cdot d / SG \cdot C \cdot 24$$

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Operating Strategies

The Sodium Bisulfite Storage and Feed System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

Sodium bisulfite is pumped by metering pumps to the Chlorinated Plant Effluent Channel. There are two sodium bisulfite pumps, one duty and one standby. Each pump system includes calibration column, pulsation dampener, pressure gauge, pressure sustaining valve, flushing connections, and isolation valves. DC motors allow manual stroke adjustments. The sodium bisulfite pump flow rate is paced from the plant effluent flow rate.

When the Sodium Bisulfite Pump is running, the carrier water valve is OPEN to provide carrier water to aid in dispersion and mixing of sodium bisulfite in the Reclaimed Water Wet well. Exhibit 82-2 lists the control modes for the Sodium Bisulfite Storage and Feed System.

EXHIBIT 82-2
Sodium Bisulfite Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The liquid level in each sodium bisulfite tote is monitored manually by plant operators, who perform periodic visual inspections of the totes.	
Manual/Local	The Chemical Sump Butterfly Valve is operated manually in the field.	
Manual/Local	LOCAL/REMOTE status of the feed pumps is selected locally. The feed pumps are only intended to run in REMOTE.	
Manual/Local	The operator must confirm in the field that the pump valve arrangement matches the selected metering pump control mode in SCADA.	
Auto/Local	The combined weight of the tote and containment platform is monitored by weight transmitters. The sensors indicate the total weight locally at the transmitters.	
Manual/Remote	The operator manually selects the metering pump control mode between MANUAL and DOSAGE, at SCADA.	
Manual/Remote	The operator selects which pump to run at SCADA.	
Manual/Remote	In REMOTE-MANUAL the operator manually turns the	

	pump(s) ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	The operator manually turns the carrier water valve to OPEN or CLOSED at SCADA.	
Manual/Remote	The operator inputs d = desired dose of sodium bisulfite, specific gravity of sodium bisulfite (typically 1.34 [adjustable]) and the concentration of sodium bisulfite (typically 40% [adjustable]) at SCADA.	
Auto/Remote	In DOSAGE mode SCADA calculates the required feed rate based on operator inputs.	
Auto/Remote	In DOSAGE mode the carrier water valve is open when the feed pumps are running.	
Auto/Remote	SCADA monitors and reports the LOCAL/REMOTE status, ON/OFF status, FAIL condition, speed, flow rate, and discharge pressure of the Sodium Bisulfite Feed Pumps.	
Auto/Remote	The combined weight of the tote and containment platform is monitored by weight transmitters. The sensors indicate the total weight remotely at SCADA.	
NOTES: SCADA = supervisory control and data acquisition		

Startup Procedures

- Check tote weight and ensure connection to feed system.
- Verify analyzers are ready.
- Valves along system are OPEN.
- Initial dose is based on chlorine dose into the Chlorine Contact Basin. Dosage adjustments are based on plant effluent total chlorine residual results.
- Turn on lead pump per manufacturer's instructions (put in REMOTE-AUTO).
- Turn on carrier water to bisulfite pump discharge. Target value of 5 gpm at rotameter through throttling of v-ball valve.

Shutdown Procedures

- Turn off pumps per manufacturer's instructions

Abnormal Conditions

- Pump fail – modify operation
- Leak – refer to unloading/containment section.

Additional Control Features

- Change out of sodium bisulfite tote – see unloading section
- Calibration of chemical pump – see manufacturer's instructions

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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82 - Sodium Bisulfite

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Sodium Bisulfite Tote 1 LOW WEIGHT	Instrument (64WIT16001) has detected Low Weight in the Sodium Bisulfite Tote 1	Alarm on SCADA when Low Weight conditions are met. Alarm on SCADA if the instrument is held in Calibration mode greater than 2 hours.
Sodium Bisulfite Tote 1 LOW LOW WEIGHT	Instrument (64WIT16001) has detected Low Low Weight in the Sodium Bisulfite Tote 1	Alarm on SCADA when Low Low Weight conditions are met. Alarm on SCADA if the instrument is held in Calibration mode greater than 2 hours.
Sodium Bisulfite Tote 2 LOW WEIGHT	Instrument (64WIT16002) has detected Low Weight in the Sodium Bisulfite Tote 2	Alarm on SCADA when Low Weight conditions are met. Alarm on SCADA if the instrument is held in Calibration mode greater than 2 hours.
Sodium Bisulfite Tote 2 LOW LOW WEIGHT	Instrument (64WIT16002) has detected Low Low Weight in the Sodium Bisulfite Tote 2	Alarm on SCADA when Low Low Weight conditions are met. Alarm on SCADA if the instrument is held in Calibration mode greater than 2 hours.
Sodium Bisulfite Tote 1 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 1 Instrument (64WIT16001)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 1 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 1 Instrument (64WE16001A)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 1 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 1 Instrument (64WE16001B)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 1 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 1 Instrument (64WE16001C)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 1 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 1 Instrument (64WE16001D)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 2 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 2 Instrument (64WIT16002)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 2 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 2 Instrument (64WE16002A)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 2 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 2 Instrument (64WE16002B)	Alarm on SCADA when Instrument has failed.

ALARM	MEANING	RESPONSE OR ACTION
Sodium Bisulfite Tote 2 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 2 Instrument (64WE16002C)	Alarm on SCADA when Instrument has failed.
Sodium Bisulfite Tote 2 BAD QUALITY	PLC has detected Bad Quality in the Sodium Bisulfite Tote 2 Instrument (64WE16002D)	Alarm on SCADA when Instrument has failed.

83 - Citric Acid

Overview

Purpose

The Citric Acid Storage and Feed System consist of components that are used to clean the membranes during maintenance and recovery cleans.

Description

Storage of citric acid is provided by onsite delivery of supplier-provided chemical totes. The storage and feed portions of the system are located in the Chemical Room at the Membrane Building. Roll-up doors allow for maneuvering of totes into the Chemical Room.

The system is designed to deliver a concentration of 50 percent citric acid to the membranes. Citric acid cleans inorganic fouling from the membranes when it is injected into the backpulse water to clean the hollow-fiber membranes from the inside out.

All chemical areas are equipped with spill containment measures. Refer to the Chemical Unloading and Containment process control narrative. Exhibit 83-1 lists the components of the Citric Acid Storage and Feed System.

Design Criteria and Component List

EXHIBIT 83-1
Citric Acid Component List

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Citric Acid Tote	64TNK18101, 64TNK18102	Quantity: 2 Type: Polyethylene Volume (gal): 270
Citric Acid Feed Pump	64PMP73001,	Quantity: 2

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
	64PMP73002	Type: Diaphragm, Adjustable Speed Flow Rate (gph): 6.5
Chemical Sump Manual Valve	64VBF16389	Quantity: 1 Type: Butterfly Position: Normally Closed
NOTES: gal = gallons PID = process and instrumentation diagram gph = gallons per hour		

Process Control Variables

Control Variables

The Citric Acid Storage and Feed System operation is controlled by the GE/Zenon Membrane System.

Non Controllable Variables

Weight – Tote weight determines when the lead tote requires changing and switching to the lag tote for feed.

Flow rate – Pump flow rate is determined by the GE/Zenon Membrane System programming based on the cleaning cycle for either maintenance or recovery cleans.

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Operating Strategies

The Citric Acid Storage and Feed System is intended to operate remotely through the GE/Zenon master control panel and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes. Exhibit 83-2 lists the control modes for the Citric Acid Storage and Feed System.

EXHIBIT 83-2
Citric Acid Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The liquid level in each Citric Acid tote is monitored manually by plant operators, who perform periodic visual inspections of the totes.	
Manual/Local	The Chemical Sump Butterfly Valve is operated manually in the field.	
Auto/Local	The combined weight of the tote and containment platform is monitored by weight transmitters. The sensors indicate the total weight locally at the transmitters.	
Auto/Remote	The combined weight of the tote and containment platform is monitored by weight transmitters. The sensors indicate the total weight remotely through supervisory control and data acquisition (SCADA).	
	Refer to the GE W&PT/Zenon process control narrative provided with the packaged Membrane System.	

Startup Procedures

- Check tote weight and be sure it is connected to feed system.
- Manual valves along citric acid system are open.
- Manual valves for compressed air for citric acid pumps are open.

- Operation of the citric acid pumps are automated based on the maintenance or recovery clean sequence.
 - The operator initiates the recovery clean cycle from the GE/Zenon master control panel for each train.
 - Maintenance clean cycles are initiated automatically from the GE/Zenon master control panel.

Shutdown Procedures

- Verify maintenance and recovery cleans have been disabled if both citric acid pumps require shutdown.
- Close manual valves for compressed air to citric acid pump(s).
- Close manual valve from citric acid tote to citric acid pump(s).
- Close manual valve to citric acid discharge piping.
- Utilize manual drain valve to evacuate citric acid piping if necessary.

Abnormal Conditions

- Pump failure: Verify air supply to citric acid pumps and verify citric acid tote weight.
- Leak – refer to unloading/containment process control narrative.

Additional Control Features

- Change out of citric acid tote – see Chemical Receiving section for change out of chemical totes.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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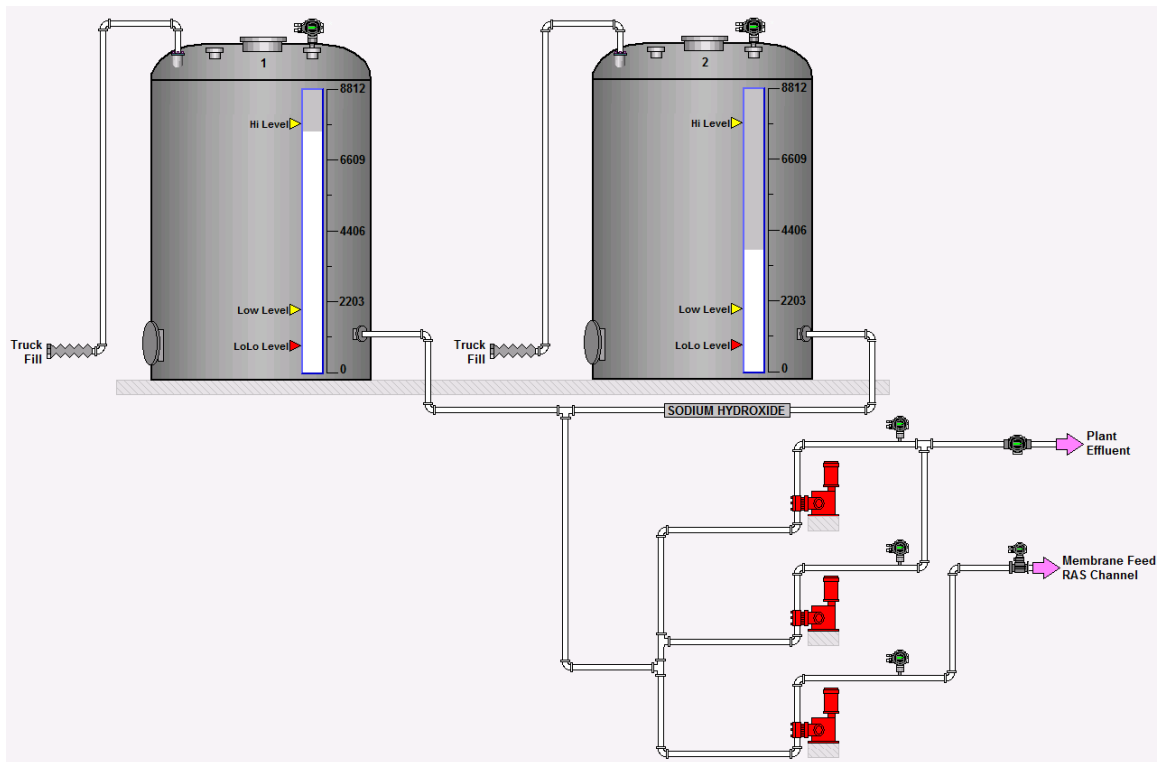
83 - Citric Acid

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Citric Acid Tote 1 LOW WEIGHT	Instrument (64WIT18101) Citric Acid Tote 1 has detected Low Weight.	Alarm on SCADA when Low Weight conditions are met. Alarm on SCADA if instrument is Calibration longer than 2 hours.
Citric Acid Tote 2 LOW WEIGHT	Instrument (64WIT18102) Citric Acid Tote 2 has detected Low Weight.	Alarm on SCADA when Low Weight conditions are met. Alarm on SCADA if instrument is Calibration longer than 2 hours.
Citric Acid Tote 1 BAD QUALITY	Citric Acid Tote 1 has detected Bad Quality on Instrument (64WIT18101).	Alarm on SCADA when instrument fails.
Citric Acid Tote 1 BAD QUALITY	Citric Acid Tote 1 has detected Bad Quality on Instrument (64WE18101A).	Alarm on SCADA when instrument fails.
Citric Acid Tote 1 BAD QUALITY	Citric Acid Tote 1 has detected Bad Quality on Instrument (64WE18101B).	Alarm on SCADA when instrument fails.
Citric Acid Tote 1 BAD QUALITY	Citric Acid Tote 1 has detected Bad Quality on Instrument (64WE18101C).	Alarm on SCADA when instrument fails.
Citric Acid Tote 1 BAD QUALITY	Citric Acid Tote 1 has detected Bad Quality on Instrument (64WE18101D).	Alarm on SCADA when instrument fails.
Citric Acid Tote 2 BAD QUALITY	Citric Acid Tote 2 has detected Bad Quality on Instrument (64WIT18102).	Alarm on SCADA when instrument fails.
Citric Acid Tote 2 BAD QUALITY	Citric Acid Tote 2 has detected Bad Quality on Instrument (64WE18102A).	Alarm on SCADA when instrument fails.
Citric Acid Tote 2 BAD QUALITY	Citric Acid Tote 2 has detected Bad Quality on Instrument (64WE18102B).	Alarm on SCADA when instrument fails.
Citric Acid Tote 2 BAD QUALITY	Citric Acid Tote 2 has detected Bad Quality on Instrument (64WE18102C).	Alarm on SCADA when instrument fails.
Citric Acid Tote 2 BAD QUALITY	Citric Acid Tote 2 has detected Bad Quality on Instrument (64WE18102D).	Alarm on SCADA when instrument fails.

84 - Sodium Hydroxide

Overview



Purpose

The Sodium Hydroxide Storage and Feed System consist of components that are used to adjust alkalinity in the RAS and adjust the pH of the plant effluent.

Description

The Sodium Hydroxide Storage and Feed System is designed to deliver a concentration of 25 percent sodium hydroxide solution to the RAS channel and Reclaimed Water Wet Well.

The bulk tank storage portion of the system is located outside at the Chemical Tank Farm Area east of the Membrane Facility. The chemical delivery truck

staging area is located outside, south of the chemical tanks, and is equipped with full hookups and controls for chemical deliveries to the tanks.

The injection/feed portion of the system is located at the Membrane Facility inside the northeast corner of the building. The indoor system includes chemical metering pumps that feed sodium hydroxide to the RAS channel and Reclaimed Water Wet Well.

All chemical areas are equipped with spill containment measures. Refer to the Chemical Unloading and Containment process control narrative. Exhibit 84-1 is a partial list of example components for the Sodium Hydroxide Storage and Feed System.

Design Criteria and Component List

EXHIBIT 84-1

Sodium Hydroxide Storage and Feed System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Sodium Hydroxide Storage Tank	64TNK12001, 64TNK12002	Quantity: 2 Type: FRP Volume (gal): 8700
Sodium Hydroxide Feed Pump	64PMP12501, 64PMP12502	Quantity: 2 Type: Diaphragm, Adjustable Speed Flow Rate (gph): 50 Power (hp): 1/2
Sodium Hydroxide Feed Pump	64PMP14501	Quantity: 1 Type: Diaphragm, Adjustable Speed Flow Rate (gph): 30 Power (hp): 1/2
Flow Meter	64FET13000	Quantity: 1 Type: Electromagnetic Flow Rate (gph): 50
Chemical Sump Manual Valve	64BFV16282	Quantity: 1 Type: Butterfly Position: Normally Closed
NOTES: FRP = fiberglass-reinforced plastic gal = gallons gph = gallons per hour		

Process Control Variables

Control Variables

Specific gravity – typical range is 1.28 for 25 percent sodium hydroxide

Concentration – typical value is 25 percent

RAS Channel Dose – typical range is 20 - 50 mg/L to increase alkalinity of RAS into the bioreactors

Plant Effluent Dose – typical range is 5 – 20 mg/L to maintain a pH of 7.0 to 9.0 standard units in the plant effluent

Pump Speed – In MANUAL mode, pump output is controlled by pump speed. Pump speed for the RAS channel sodium hydroxide feed is adjusted based on flowmeter readings. Pump speed for the plant effluent sodium hydroxide feed is adjusted based on readings derived from a draw down.

Non Controllable Variables

Tank Level – Level determines when the tank in service requires switching to lag tank for feed, and which tanks require filling for scheduling of chemical delivery.

RAS flow rate – Flow rate is measured by the four flowmeters on the discharge of the RAS Channel.

Plant effluent flow rate – Flow rate is measured by the flowmeter on the pipe at the discharge end of the Reclaimed Water Wet Well.

Plant effluent pH – pH is measured on the plant effluent discharge pipe downstream of the plant effluent flow meter.

Calculations

RAS Channel alkalinity adjustment

DOSAGE CONTROL MODE:

When operating in the DOSAGE control mode, the operator manually inputs the following parameters to SCADA:

- d = desired dose of sodium hydroxide (mg/L)
- SG = specific gravity of sodium hydroxide [(1.28 [adjustable])]
- C = concentration of sodium hydroxide (25% [adjustable])

SCADA provides the following parameters:

- Q = sum of RAS flow meters (mgd)
- q = calculated chemical feed rate (gph)

The calculated value for “q” is the setpoint for the chemical flow control loop. Once the calculation is performed, the PLC adjusts pump speed(s) until actual flow as measured by the chemical discharge magmeter matches the calculated flow setpoint. The calculation and pump speed adjustment occur continuously. An alarm is activated by SCADA if the actual measured chemical flow deviates from the calculated setpoint.

SCADA calculates the chemical feed rate based on the following equation:

- $q = Q \cdot d / SG \cdot C \cdot 24$

Plant effluent pH adjustment

DOSAGE CONTROL MODE:

When operating in the DOSAGE control mode, the operator manually inputs the following parameters to SCADA:

- d = desired dose of sodium hydroxide (mg/L)
- SG = specific gravity of sodium hydroxide [(1.28 [adjustable])]
- C = concentration of sodium hydroxide (25% [adjustable])

SCADA provides the following parameters:

- Q = sum of RAS flow meters (mgd)
- q = calculated chemical feed rate (gph)

The calculated value for “q” is the setpoint for the chemical flow control loop. Once the calculation is performed, the PLC adjusts pump speed according to an operator defined pump maximum output. The calculation and pump speed adjustment occur continuously.

SCADA calculates the chemical feed rate based on the following equation:

$$q = Q \cdot d / SG \cdot C \cdot 24$$

pH RESIDUAL MODE

When operating in the pH RESIDUAL mode, the operator manually inputs the following parameters into SCADA:

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Operating Strategies

The Sodium Hydroxide Storage and Feed System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

Sodium Hydroxide Storage

Two tanks provide approximately 10 days of storage at average flow and average dosing conditions. Each tank is equipped with a fill connection, outlet connection, tank drain, overflow nozzle, vent, and manway. Two nozzles are provided for installation of level instrumentation and two spare nozzles are provided to allow for future installation of immersion heating equipment.

The liquid level in each storage tank is monitored by a radar level transmitter mounted on top of the tank. The sensors indicate liquid levels locally at the transmitters and remotely at SCADA. Liquid levels are reported in volume of gallons.

During tank fill, the level transmitter indicates liquid level to SCADA with a level switch set for HIGH-HIGH level in each tank. When liquid volume reaches HIGH or HIGH-HIGH levels in either tank, an alarm is sent to SCADA and an alarm beacon is activated at the chemical delivery truck station.

During normal operation, the level transmitter indicates liquid level to SCADA. When liquid volume reaches LOW or LOW-LOW levels in either tank, an alarm is sent to SCADA. The alarm will give the operator an opportunity to acknowledge the low liquid elevation and switch over to the other storage tank. A LOW-LOW level alarm shuts down any sodium hydroxide pump(s) in operation.

The HIGH-HIGH level is not adjustable. The LOW, LOW-LOW, and HIGH level alarms have adjustable setpoints. Values are applicable to both tanks. The HIGH-HIGH level alarm is based on the level switch installed on each tank and set at 4 inches below the invert of the overflow nozzle. Exhibit 84-2 lists the control modes for sodium hydroxide storage.

MODE	DESCRIPTION	REFERENCES
Manual/Local	Upon a LOW or LOW-LOW alarm the operator switches over to another tank by closing a manual valve on the tank and opening the manual valve on another tank. The tanks can also be run to be hydraulically equal.	
Manual/Remote	The operator inputs LOW, LOW-LOW and HIGH level alarms through supervisory control and data acquisition (SCADA).	
Auto/Remote	The level transmitter indicates liquid level to SCADA. Liquid levels are also reported locally.	

Sodium Hydroxide Feed

Sodium hydroxide is pumped by metering pumps to an injection point in the RAS channel located at the Membrane Facility and to the overflow end of the Reclaimed Water Wet Well. The RAS channel alkalinity adjustment sodium hydroxide pump flow rate is paced from the sum of the individual RAS flow rates. The plant effluent pH adjustment sodium hydroxide pump flow rate is paced from the plant effluent flow rate.

There are three sodium hydroxide metering pumps. One pump is dedicated to the RAS channel alkalinity adjustment, one pump is dedicated to the plant effluent pH adjustment and the third pump can be manually valved to serve either system. The third pump (swing pump) is normally valved to the plant effluent pH adjustment and that system operates in a DUTY/STANDBY configuration. Each pump system includes calibration column, pulsation dampener, pressure gauge, flushing connections, and isolation valves. DC motors allow manual and remote speed adjustment. Local controls are located at the pumps in the Membrane Facility.

For RAS channel alkalinity adjustment, two metering pump control modes control sodium hydroxide feed rates: MANUAL, and DOSAGE. The operator manually selects the metering pump control mode at SCADA, and also selects which pump or combination of pumps to run. The operator must confirm in the field that the pump valve arrangement matches the selected metering pump control mode in SCADA. Exhibit 84-3 lists the control modes for RAS channel alkalinity adjustment sodium hydroxide feed.

For plant effluent pH adjustment, two metering pump control modes control sodium hydroxide feed rates: MANUAL, and DOSAGE-RESIDUAL. The operator manually selects the metering pump control mode at SCADA and also selects which pump to run. The operator must confirm in the field that the pump valve arrangement matches the selected metering pump control mode in SCADA. Exhibit 84-4 lists the control modes for plant effluent pH adjustment sodium hydroxide feed.

EXHIBIT 84-3**RAS Channel Alkalinity Adjustment Sodium Hydroxide Feed Control Modes**

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The operator selects to run the Sodium Hydroxide metering pumps in MANUAL or DOSAGE control modes at SCADA.	
Manual/Remote	When operating in the MANUAL control mode, the Operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	When operating in the DOSAGE control mode, the Operator manually inputs the desired dose of sodium hydroxide (mg/L), specific gravity of sodium hydroxide (1.28 [adjustable]) and the concentration of sodium hydroxide (25% [adjustable]) at SCADA.	
Auto/Remote	In DOSAGE control mode SCADA calculates the chemical feed rate based on operator inputs and RAS flow.	
Auto/Remote	SCADA monitors and reports the following for the feed pumps: LOCAL/REMOTE status, ON/OFF status, FAIL condition, speed, and discharge pressure.	
Auto/Remote	Sodium hydroxide flow to the RAS channel injection point is monitored and indicated by SCADA.	
NOTES: SCADA = supervisory control and data acquisition mg/L = milligrams per liter RAS = return activated sludge		

EXHIBIT 84-4**Plant Effluent pH Adjustment Sodium Hydroxide Feed Control Modes**

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The operator selects to run the Sodium Hydroxide metering pumps in MANUAL or DOSAGE control modes at SCADA.	
Manual/Remote	When operating in the MANUAL control mode, the Operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	When operating in the DOSAGE-RESIDUAL control mode, the Operator manually inputs the desired pH setpoint, specific gravity of sodium hydroxide (1.28 [adjustable]) and the concentration of sodium hydroxide (25% [adjustable]) at SCADA.	

Auto/Remote	In DOSAGE-RESIDUAL control mode SCADA calculates the chemical feed rate based on operator inputs and plant effluent flow. The SCADA system then calculates a dosage setpoint to achieve the pH set point. The SCADA system further trims the feed rate dosage to maintain a target pH as measured by the plant effluent pH analyzer.	
Auto/Remote	SCADA monitors and reports the following for the feed pumps: LOCAL/REMOTE status, ON/OFF status, FAIL condition, speed, and discharge pressure.	
Auto/Remote	Sodium hydroxide flow to the Reclaimed Water Wet Well is based on pump speed and is indicated on SCADA.	
NOTES: SCADA = supervisory control and data acquisition mg/L = milligrams per liter pH = a measure of acidity or alkalinity of an aqueous solution		

Startup Procedures

- Check tank in LEAD and be sure level is adequate for chemical feed.
- Valves along system are open.
- Set dose of sodium hydroxide.
- Set plant effluent pH target.
- Turn on lead pumps per manufacturer's instructions (put in REMOTE-AUTO mode).

Shutdown Procedures

- Turn all pumps off.
- Close isolation valves within system.
- If pumps will be down for a period of time, flush system with plant water.

Abnormal Conditions

- Pump fail – modify operation

- Leak – refer to unloading/containment process control narrative.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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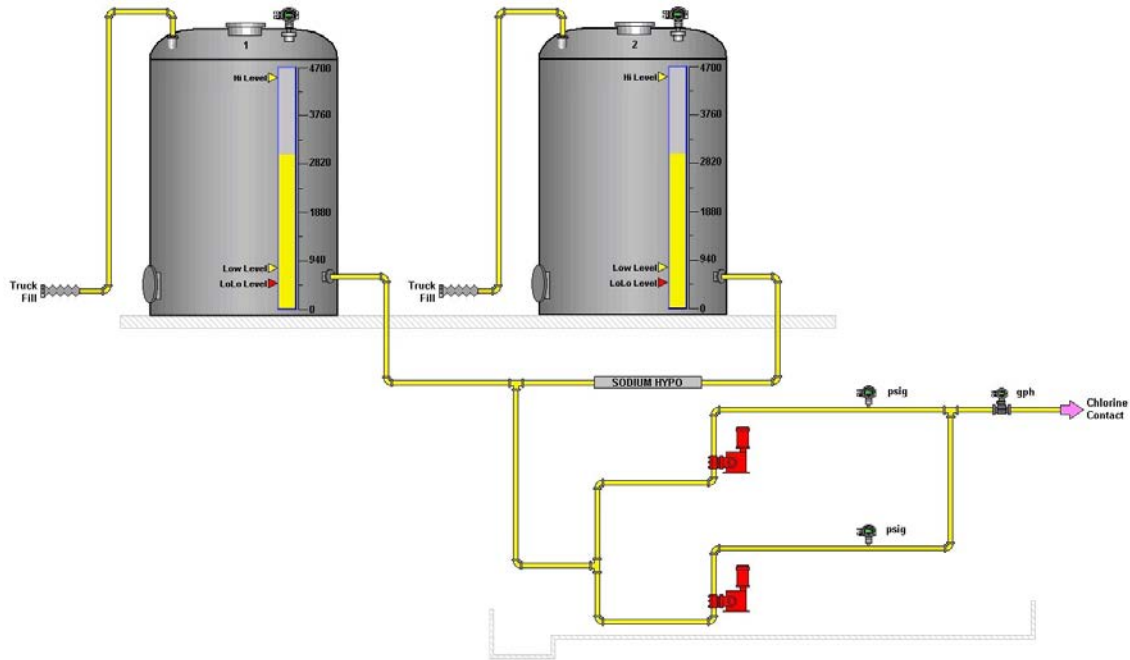
84 - Sodium Hydroxide

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Sodium Hydroxide Storage Tank 1 HIGH-HIGH LEVEL	Instrument 64LET12101 has detected High-High level in the Sodium Hydroxide Storage Tank 1.	Hard-coded SCADA alarm. Alarm beacon activates. Stop filling.
Sodium Hydroxide Storage Tank 1 HIGH LEVEL	Instrument 64LET12101 has detected High level in the Sodium Hydroxide Storage Tank 1.	Hard-coded SCADA alarm. Alarm beacon activates. Stop filling.
Sodium Hydroxide Storage Tank 1 LOW LEVEL	Instrument 64LET12101 has detected Low level in the Sodium Hydroxide Storage Tank 1.	Operator-adjustable SCADA alarm. Tank 1 needs more sodium hydroxide.
Sodium Hydroxide Storage Tank 1 LOW-LOW LEVEL	Instrument 64LET12101 has detected Low-Low level in the Sodium Hydroxide Storage Tank 1.	Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Sodium Hydroxide Storage Tank 1 HIGH LEVEL	Instrument 64LAH12200 has detected High level in the Sodium Hydroxide Storage Tank 1.	Alarm on SCADA.
Sodium Hydroxide Storage Tank 1 level Switch HIGH LEVEL	Instrument 64LSH12201 has detected High level in the Sodium Hydroxide Storage Tank 1.	Alarm on SCADA.
Sodium Hydroxide Storage Tank 2 HIGH-HIGH LEVEL	Instrument 64LET12102 has detected High-High level in the Sodium Hydroxide Storage Tank 2.	Hard-coded SCADA alarm. Alarm beacon activates. Stop filling.
Sodium Hydroxide Storage Tank 2 HIGH LEVEL	Instrument 64LET12102 has detected High level in the Sodium Hydroxide Storage Tank 2.	Hard-coded SCADA Alarm. Alarm beacon activates. Stop filling.
Sodium Hydroxide Storage Tank 2 LOW LEVEL	Instrument 64LET12102 has detected Low level in the Sodium Hydroxide Storage Tank 2.	Operator-adjustable SCADA alarm. Tank 2 needs more sodium hydroxide.
Sodium Hydroxide Storage Tank 2 LOW-LOW LEVEL	Instrument 64LET12102 has detected Low-Low level in the Sodium Hydroxide Storage Tank 2.	Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Sodium Hydroxide Storage Tank 2 HIGH LEVEL	Instrument 64LAH12200 has detected High level in the Sodium Hydroxide Storage Tank 2.	Alarm on SCADA.
Sodium Hydroxide Storage Tank 2 level Switch HIGH LEVEL	Instrument 64LSH12202 has detected High level in the Sodium Hydroxide Storage Tank 2.	Alarm on SCADA.

85 - Sodium Hypochlorite

Overview



Purpose

Sodium hypochlorite metering pumps pump to the permeate header upstream of the chlorine contact tanks for disinfection and to the discharge side of the backpulse pump for membrane cleaning cycles.

Description

The Sodium Hypochlorite Storage and Feed System consist of components that disinfect the plant effluent water and clean the membranes. The system is designed to deliver a concentration of 12.5 percent sodium hypochlorite solution to specified locations.

The bulk tank storage portion of the system is located outside at the Chemical Tank Farm Area east of the Membrane Facility. The chemical delivery truck staging area is located outside, south of the chemical tanks, and is equipped with full hookups and controls for chemical deliveries to the tanks.

The injection/feed portion of the system is located at the Membrane Facility inside the northeast corner of the building. The indoor system includes chemical metering pumps that feed sodium hypochlorite to the influent channel of the chlorine contact basin for disinfection of plant effluent, and to the backpulse pumps for membrane cleaning.

Off-gassing of sodium hypochlorite as the chemical degrades can be problematic. Large bubbles within the piping may expand and contract as the pump tries to displace liquid. Sodium hypochlorite degradation increases as a function of temperature and time. Measures are required to prevent gas binding from accumulating in the system. Passive vents are installed in the suction header of the chemical metering pumps to eliminate off-gas bubbles from collecting and constricting flow to the pump inlet. Automatic degassing valves are installed at high points in the discharge piping to eliminate off-gas bubbles.

All chemical areas are equipped with spill containment measures. Refer to the Chemical Unloading and Containment process control narrative. Exhibit 85-1 is a partial example component list for the Sodium Hypochlorite Storage and Feed System.

Design Criteria and Component List

EXHIBIT 85-1
Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Sodium Hypochlorite Storage Tank	64TNK14001, 64TNK14002	Quantity: 2 Type: FRP Volume (gal): 4,400
Feed Pump	64PMP14502, 64PMP14503	Quantity: 2 Type: Diaphragm, Adjustable Speed Flow Rate (gph): 5 Power (hp): 1/4
Feed Pump	64PMP70001, 64PMP70002	Quantity: 2 Type: Diaphragm, Pneumatic Flow Rate (gpm): 1.2
Flowmeter	64FET15000	Quantity: 1

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
		Type: Electromagnetic Flow Rate (gph): 20
Chemical Sump Manual Valve		Quantity: 1 Type: Butterfly Position: NORMALLY CLOSED
NOTES: FRP = fiberglass-reinforced plastic gal = gallons gph = gallons per hour gpm = gallons per minute		

Process Control Variables

Controllable Variables

Specific gravity – typical range is 1.21 for 12.5 percent sodium hypochlorite.

Concentration – typical value is 12.5 percent.

Disinfection Dose – typical range is 0.5 to 2.0 mg/L, to meet disinfection requirements for plant effluent and to maintain a chlorine residual in the plant water system.

Pump Speed – In MANUAL mode, pump output is controlled by pump speed. Pump speed is adjusted based on flowmeter readings.

Non Controllable Variables

Tank Level – Level determines when the tank in service requires switching to lag tank for feed, and which tanks require filling for scheduling of chemical delivery.

Chlorine Contact Basin Flow Rate – pump flow rate is measured by the flowmeter on the discharge of the pumps to the chlorine contact basin.

Membrane Flow Rate – Pump flow rate is determined by the GE/Zenon Membrane System programming based on the cleaning cycle, either maintenance or recovery.

Chlorine Contact Basin Chlorine Residual – chlorine residual concentrations are measured in the chlorine contact basin influent channel to verify adequate chlorine dose into the chlorine contact basin.

Plant Water Chlorine Residual – chlorine residual concentrations are measured in the discharge of the plant water pumps to verify adequate chlorine residual in the plant water system.

Calculations

DOSAGE CONTROL MODE:

When operating in the DOSAGE control mode, the operator manually inputs the following parameters to SCADA:

- d = desired dose of sodium hypochlorite (mg/L)
- SG = specific gravity of sodium hypochlorite (1.21 [adjustable])
- C = concentration of sodium hypochlorite (12.5% [adjustable])

SCADA provides the following parameters:

- Q = sum of permeate pump flow meters (mgd)
- q = calculated chemical feed rate (gph)

The calculated value for “ q ” is the setpoint for the chemical flow control loop. Once the calculation is performed, the PLC adjusts pump speed(s) until actual flow as measured by the chemical discharge magmeter matches the calculated flow setpoint. The calculation and pump speed adjustment occur continuously.

An alarm is activated by SCADA if the actual measured chemical flow deviates from the calculated setpoint.

SCADA calculates the chemical feed rate based on the following equation:

$$q = Q \cdot d / SG \cdot C \cdot 24$$

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Sodium Hypochlorite

Operating Strategies

The Sodium Hypochlorite Storage and Feed System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

Sodium Hypochlorite Storage

Two tanks provide approximately 45 days of storage at average flow and average dosing conditions. Each tank is equipped with a fill connection, outlet connection, tank drain, overflow nozzle, vent, and manway. Two nozzles are provided for installation of level instrumentation and two spare nozzles are provided to allow for future installation of immersion heating equipment.

The liquid level in each storage tank is monitored by a radar level transmitter mounted on top of the tank. The sensors indicate liquid levels locally at the transmitters and remotely at SCADA. Liquid levels are reported in volume of gallons.

During tank fill, the level transmitter indicates liquid level to SCADA with a level switch set for HIGH-HIGH level in each tank. When liquid volume reaches HIGH or HIGH-HIGH levels in either tank, an alarm is sent to SCADA and an alarm beacon is activated at the chemical delivery truck station.

During normal operation, the level transmitter indicates liquid level to SCADA. When liquid volume reaches LOW or LOW-LOW levels in either tank, an alarm is sent to SCADA. The alarm will give the operator an opportunity to acknowledge the low liquid elevation and switch over to the other storage tank. A LOW-LOW level alarm shuts down any sodium hypochlorite pump(s) in operation.

The HIGH-HIGH level alarm is based on the level switch installed on each tank and set at 4 inches below the invert of the overflow nozzle. The HIGH-HIGH level is not adjustable. The LOW, LOW-LOW, and HIGH level alarms have adjustable setpoints. Values are applicable to both tanks. Actual liquid levels and equivalent storage volumes should be verified with final approved tank shop drawings. Exhibit 85-2 lists the control modes for sodium hydroxide storage.

EXHIBIT 85-2
Sodium Hydroxide Storage Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Upon a LOW or LOW-LOW alarm the operator switches over to another tank by opening and closing manual valves. Tanks can be run to be hydraulically equal.	
Manual/Remote	The operator inputs LOW, LOW-LOW, and HIGH level alarms through supervisory control and data acquisition (SCADA).	
Auto/Remote	The level transmitter indicates liquid level to SCADA. Liquid levels are also reported locally.	

Sodium Hypochlorite Feed – Secondary Effluent

Sodium hypochlorite is pumped by metering pumps to an injection point on the secondary effluent line located inside the Membrane Facility. The sodium hypochlorite pump flow rate is paced from the sum of the individual permeate pump flow rates. Residual trim control of chlorine dosing is provided by a signal from chlorine residual monitoring in the first leg of the chlorine contact tanks.

Three metering pump control modes control sodium hypochlorite feed rates: MANUAL, DOSAGE, and DOSAGE-RESIDUAL. The operator manually selects the metering pump control mode at SCADA, and selects which pump or combination of pumps to run. The operator must confirm in the field that the pump valve arrangement matches the selected metering pump control mode in SCADA. Exhibit 85-3 lists the control modes for sodium hydroxide feed.

EXHIBIT 85-3
Sodium Hydroxide Feed Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The operator selects to run the sodium hypochlorite metering pumps in MANUAL, DOSAGE or DOSAGE-RESIDUAL control modes at SCADA.	
Manual/Remote	When operating in the MANUAL control mode, the operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	When operating in the DOSAGE control mode, the operator manually inputs the desired dose of sodium hypochlorite (mg/L), specific gravity of sodium hypochlorite (1.21 [adjustable]) and the concentration of sodium hypochlorite (12.5% [adjustable]) at SCADA.	
Auto/Remote	In DOSAGE control mode SCADA calculates the chemical feed rate based on operator inputs and	

	permeate flow.	
Auto/Remote	When operating in the DOSAGE-RESIDUAL control mode, the operator inputs the dosage to SCADA as described above. The SCADA system further trims the feed rate dosage to maintain a target chlorine residual setpoint as measured by the chlorine analyzer.	
Auto/Remote	SCADA monitors and reports the following for the feed pumps: LOCAL/REMOTE status, ON/OFF status, FAIL condition, speed, and discharge pressure.	
Auto/Remote	Sodium hypochlorite flow to the secondary effluent injection point is also monitored and indicated by SCADA.	
NOTES: SCADA = supervisory control and data acquisition mg/L = milligrams per liter		

Sodium Hypochlorite Feed – Membrane System

Refer to the GE W&PT/Zenon process control narrative provided with the packaged Membrane System.

Startup Procedures

- Check tank in LEAD and be sure level is adequate for chemical feed.
- Valves along system to the injection point into the permeate header are open.
- Manual valves along the system for the membrane cleaning cycles are open.
- Set dose/flow rate of sodium hypochlorite for disinfection.
- Turn on lead pumps for disinfection per manufacturer's instructions (put in REMOTE-AUTO mode)
- Membrane cleaning pumps are operated by GE/Zenon's master control panel.

Shutdown Procedures

- Turn off pumps, following manufacturer's equipment vendor manual instructions.

Abnormal Conditions

- Pump fail – modify operation
- Leak – refer to unloading/containment process control narrative.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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85 - Sodium HypoChlorite

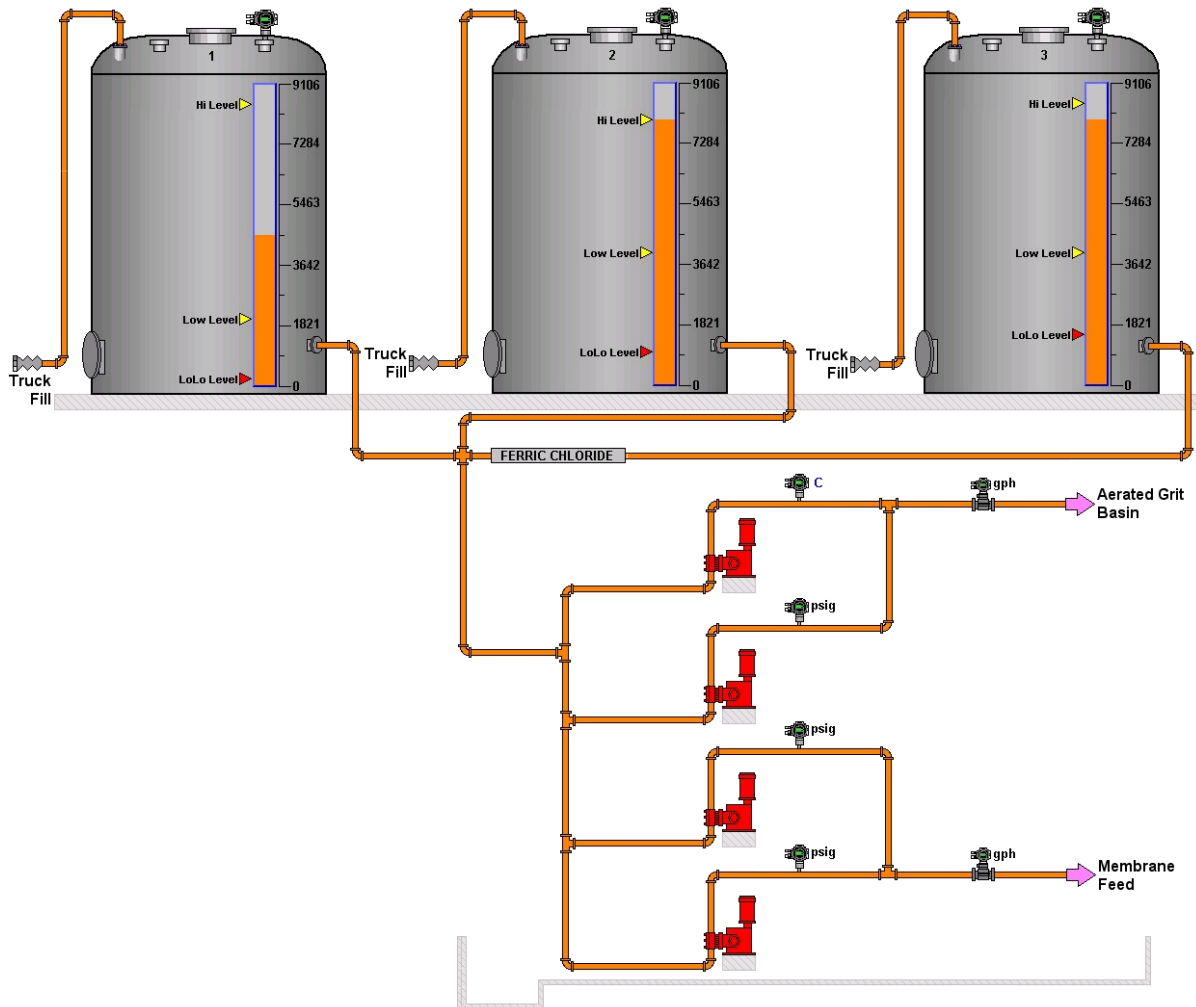
Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Sodium Hypochlorite Tank 1 HIGH-HIGH LEVEL	Instrument (64LET14101) has detected High-High level in the Sodium Hypochlorite Tank 1.	Hard-coded setpoint. Alarm on SCADA. Activate alarm beacon. Stop filling tank.
Sodium Hypochlorite Tank 1 HIGH LEVEL	Instrument (64LET14101) has detected High level in the Sodium Hypochlorite Tank 1.	Hard-coded setpoint. Alarm on SCADA. Activate alarm beacon. Stop filling tank.
Sodium Hypochlorite Tank 1 LOW LEVEL	Instrument (64LET14101) has detected Low level in the Sodium Hypochlorite Tank 1.	Operator-adjustable setpoint. Alarm on SCADA.
Sodium Hypochlorite Tank 1 LOW-LOW LEVEL	Instrument (64LET14101) has detected Low-Low level in the Sodium Hypochlorite Tank 1.	Operator-adjustable setpoint. Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Sodium Hypochlorite Tank 1 above level switch High	Instrument (64LAH14101) has detected High level switch in the Sodium Hypochlorite Tank 1.	Alarm on SCADA.
Sodium Hypochlorite Tank 1 above level switch High	Instrument (64LSH14201) has detected High level switch in the Sodium Hypochlorite Tank 1.	Alarm on SCADA.
Sodium Hypochlorite Tank 2 HIGH-HIGH LEVEL	Instrument (64LET14102) has detected High-High level in the Sodium Hypochlorite Tank 2.	Hard-coded setpoint. Alarm on SCADA. Activate alarm beacon. Stop filling tank.
Sodium Hypochlorite Tank 2 HIGH LEVEL	Instrument (64LET14102) has detected High level in the Sodium Hypochlorite Tank 2.	Operator-adjustable coded setpoint. Alarm on SCADA. Activate alarm beacon. Stop filling tank.
Sodium Hypochlorite Tank 2 LOW LEVEL	Instrument (64LET14102) has detected Low level in the Sodium Hypochlorite Tank 2.	Operator-adjustable setpoint. Alarm on SCADA.
Sodium Hypochlorite Tank 2 LOW-LOW LEVEL	Instrument (64LET14102) has detected Low-Low level in the Sodium Hypochlorite Tank 2.	Operator-adjustable setpoint. Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Sodium Hypochlorite Tank 2 above level switch High	Instrument (64LAH14102) has detected High level switch in the Sodium Hypochlorite Tank 2.	Alarm on SCADA.
Sodium Hypochlorite Tank 2 above level switch High	Instrument (64LSH14202) has detected High level switch in the Sodium Hypochlorite Tank 2.	Alarm on SCADA.

ALARM	MEANING	RESPONSE OR ACTION
Sodium Hypochlorite Tank 1 above level switch High	Instrument (64LAH14101) has detected High level switch in the Sodium Hypochlorite Tank 1.	Alarm on SCADA. Reset at HMI.
Sodium Hypochlorite Tank 2 above level switch High	Instrument (64LSH14202) has detected High level switch in the Sodium Hypochlorite Tank 2.	Alarm on SCADA. Reset at HMI.

86 - Ferric Chloride

Overview



Purpose

Ferric chloride is used with the addition of anionic polymer for CEPT to improve solids removal in the Primary Clarifiers. Ferric chloride mixes with the primary influent to achieve chemical precipitation and settling of phosphorus at the clarifiers.

Ferric chloride is also delivered to the membrane feed channel to achieve chemical precipitation of phosphorus in the MBR. The precipitate will not pass through the membranes and will remain in the mixed liquor and eventually be removed in the WAS stream.

Description

The Ferric Chloride Storage and Feed System consist of components that provide chemical phosphorus removal at the plant influent and membranes. The system is designed to deliver a concentration of 40 percent ferric chloride solution.

The bulk tank storage portion of the system is located outside at the Chemical Tank Farm Area east of the Membrane Facility. The chemical delivery truck staging area is located outside, south of the chemical tanks, and is equipped with full hookups and controls for chemical deliveries to the tanks.

The injection/feed portion of the system is located at the Membrane Facility inside the northeast corner of the building. The indoor system includes chemical metering pumps that feed ferric chloride to the given locations.

All chemical areas are equipped with spill containment measures. The outdoor tank farm provides containment through the double-walled chemical storage tanks. Residual chemical from truck unloading procedures and spilled chemical at the truck bay located south of the tank farm collect into one of two below grade containment vaults. Containment at the pumps is provided by a containment sump located with the pumps at the southeast corner of the pump gallery in the Membrane Facility. Refer to the Chemicals Unloading and Containment process control narrative. Exhibit 86-1 is a partial component list for the Ferric Chloride Storage and Feed System.

Design Criteria and Component List

EXHIBIT 86-1

Ferric Chloride Storage and Feed System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Ferric Chloride Storage Tank	64TNK10001, 64TNK10002,	Quantity: 3 Type: FRP

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
	64TNK10003	Volume (gal): 8,700
Ferric Chloride Feed Pump (To Headworks)	64PMP10501, 64PMP10502	Quantity: 2 Type: Diaphragm, Adjustable Speed Flow Rate (gph): 75 Power (hp): 3/4
Ferric Chloride Feed Pump (To Membrane Influent)	64PMP10503, 64PMP10504	Quantity: 2 Type: Diaphragm, Adjustable Speed Flow Rate (gph): 40 Power (hp): 1/2
Chemical Sump Manual Valve	64VBF16082	Quantity: 1 Type: Butterfly Position: NORMALLY CLOSED
Strainer		Quantity: 1 Type: Basket Duplex
Flowmeter (Headworks)	64FET10900	Quantity: 1 Type: Electromagnetic
Flowmeter (Membranes)	64FET11000	Quantity: 1
NOTES: FRP = fiberglass-reinforced plastic gal = gallons gph = gallons per hour		

Process Control Variables

Control Variables

Specific gravity – typical range is 1.43 for 40 percent ferric chloride.

Concentration – typical value is 40 percent.

Headworks Dose – typical range is 10 to 60 mg/L, to precipitate soluble phosphorus for settling in the Primary Clarifiers.

Membrane Dose – typical range is 6 to 40 mg/L, to precipitate soluble phosphorus for removal via membranes.

Pump Speed – In MANUAL mode, pump output is controlled by pump speed. A table correlating flow and pump speed, developed during startup, should be used based on the desired flow rate. Pump speed is adjusted based on flowmeter readings.

Non Controllable Variables

Tank Level – Level determines when the tank in service requires switching to lag 1 tank for feed, and which tanks require filling for scheduling of chemical delivery.

Headworks flow rate – pump flow rate is measured by the flowmeter on the discharge of the pumps to the Headworks Facility.

Membrane flow rate – pump flow rate is measured by the flowmeter on the discharge of the pumps to the Membrane Influent Channel.

Calculations

DOSAGE CONTROL MODE:

When operating in the DOSAGE control mode, the operator manually inputs the following parameters to SCADA:

- d = desired dose of ferric chloride (mg/L)
- SG = specific gravity of ferric chloride (1.43 [adjustable])
- C = concentration of ferric chloride (40% [adjustable])

SCADA provides the following parameters:

- Q = sum of plant influent flow meters (mgd)
- q = calculated chemical feed rate (gph)

The calculated value for “q” is the setpoint for the chemical flow control loop. Once the calculation is performed, the PLC adjusts pump speed(s) until actual flow as measured by the chemical discharge magmeter matches the calculated flow setpoint. The calculation and pump speed adjustment occur continuously. An alarm is activated by SCADA if the actual measured chemical flow deviates from the calculated setpoint.

SCADA calculates the chemical feed rate based on the equation given below:

$$q = Q \cdot d / SG \cdot C \cdot 24$$

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Operating Strategies

The Ferric Chloride Storage and Feed System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes.

Ferric Chloride Storage

Three tanks provide approximately 30 days of storage at average plant flow for average dosage conditions. Each tank is equipped with a fill connection, outlet connection, tank drain, overflow nozzle, vent, and manway. A nozzle is provided for visual leak detection of the outer tank wall. Two nozzles are provided for installation of level instruments and two spare nozzles are provided to allow for future installation of immersion heating equipment.

The liquid level in each storage tank is monitored by a radar level transmitter mounted on top of the tank. The sensors indicate liquid levels locally at the transmitters and remotely at SCADA. Liquid levels are reported in volume of gallons.

During tank fill, the level transmitter indicates liquid level to SCADA with a level switch set for HIGH-HIGH level in each tank. When liquid volume reaches HIGH or HIGH-HIGH levels in either tank, an alarm is sent to SCADA and an alarm beacon is activated at the chemical delivery truck station.

During normal operation, the level transmitter indicates liquid level to SCADA. When liquid volume reaches LOW or LOW-LOW levels in any tank, an alarm is sent to SCADA. The alarm will give the operator an opportunity to acknowledge the low liquid elevation and switch over to another storage tank. A LOW-LOW level alarm shuts down any ferric chloride pump(s) in operation.

The HIGH-HIGH level alarm is based on the level switch installed on each tank and set at 4 inches below the invert of the overflow nozzle. The HIGH-HIGH level is not adjustable. The LOW, LOW-LOW, and HIGH level alarms have adjustable setpoints. Values are applicable to all tanks. Exhibit 86-2 lists the control modes for ferric chloride storage.

Ferric Chloride Storage Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Upon a LOW or LOW-LOW alarm the operator switches over to another tank by manipulating local manual valves. Tanks can be run to be hydraulically equal if necessary	
Manual/Local	The operator manually opens the Chemical Sump Butterfly Valve and gravity drains the containment vault. There is no remote operation by supervisory control and data acquisition (SCADA).	
Manual/Remote	The operator inputs LOW, LOW-LOW and HIGH level alarms at SCADA.	
Auto/Remote	The level transmitter indicates liquid level to SCADA. Liquid levels are also reported locally.	

Ferric Chloride Feed

Ferric chloride is pumped by metering pumps to an injection point on the primary influent channel located inside the Headworks Facility prior to the grit basin, and to an injection point on the membrane influent channel located at the Membrane Facility.

There are two sets of pumps. Each set has one duty pump and one standby pump. Each pump system includes calibration column, pulsation dampener, pressure gauge, pressure sustaining valve, flushing connections, and isolation valves. DC motors allow manual and remote stroke adjustment.

Two metering pump control modes control ferric chloride feed rates: MANUAL, and DOSAGE. The operator manually selects the metering pump control mode at SCADA and also selects which pump or combination of pumps to run. The operator must confirm in the field that the pump valve arrangement matches the selected metering pump control mode in SCADA. Exhibit 86-3 lists the control modes for ferric chloride feed.

EXHIBIT 86-3
Ferric Chloride Feed Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Remote	The operator selects to run the ferric chloride metering pumps in MANUAL or DOSAGE control modes at SCADA.	
Manual/Remote	When operating in the MANUAL control mode, the operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	

Manual/Remote	When operating in the DOSAGE control mode, the operator manually inputs the desired dose of ferric chloride (mg/L), specific gravity of ferric chloride (1.43 [adjustable]) and the concentration of ferric chloride (40% [adjustable]) at SCADA.	
Auto/Remote	In DOSAGE control mode SCADA calculates the chemical flow rate based on operator inputs. Once the calculation is performed, the PLC adjusts pump speed(s) until actual flow as measured by the chemical discharge magmeter matches the calculated flow setpoint.	
Auto/Remote	SCADA monitors and reports the following for the feed pumps: LOCAL/REMOTE status, ON/OFF status, FAIL condition, speed, and discharge pressure.	
Auto/Remote	Ferric chloride flow to the primary influent injection point is monitored and indicated by SCADA.	
Auto/Remote	Ferric chloride flow to the membrane influent channel injection point is monitored and indicated by SCADA.	
NOTES: SCADA = supervisory control and data acquisition mg/L = milligrams per liter PLC = programmable logic controller		

Startup Procedures

- Check tank in LEAD and be sure level is adequate for chemical feed.
- Valves along system are open, but isolating each injection point with the lead pump.
- Turn on lead pumps for each injection point per manufacturer's instructions (put in REMOTE-AUTO mode).

Shutdown Procedures

- Turn off pumps based on manufacturer's equipment vendor manual instructions

Abnormal Conditions

- Pump fail – modify operation

- Leak – refer to unloading/containment process control narrative.

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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Ferric Chloride System

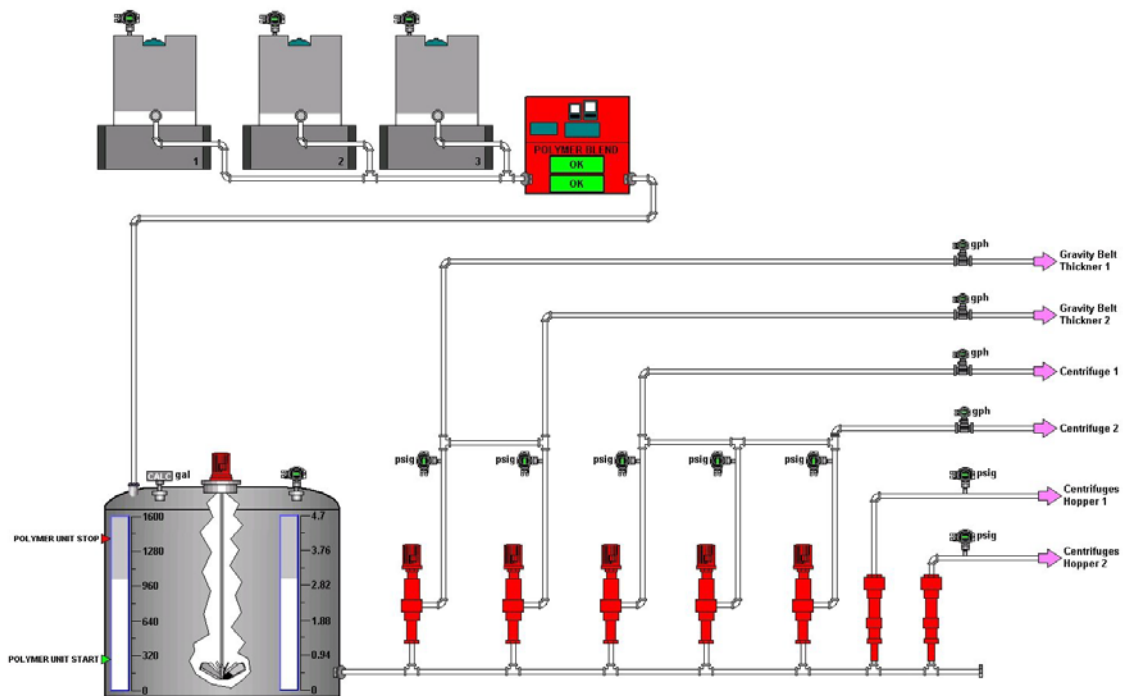
Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Ferric Chloride Storage Tank 1 HIGH-HIGH Level	Instrument (64LET10101) has detected a High-High Level in the Ferric Chloride Storage Tank 1.	Hard-coded setpoint. Alarm on SCADA. Activate alarm beacon.
Ferric Chloride Storage Tank 1 HIGH Level	Instrument (64LET10101) has detected High Level in the Ferric Chloride Storage Tank 1.	Operator-adjustable setpoint. Alarm on SCADA. Activate alarm beacon.
Ferric Chloride Storage Tank 1 LOW Level	Instrument (64LET10101) has detected Low Level in the Ferric Chloride Storage Tank 1.	Operator-adjustable setpoint. Alarm on SCADA.
Ferric Chloride Storage Tank 1 LOW-LOW Level	Instrument (64LET10101) has detected Low-Low Level in the Ferric Chloride Storage Tank 1.	Operator-adjustable setpoint. Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Ferric Chloride Storage Tank 1 Level Switch High	Instrument (64LAH10200) has detected Level switch High in the Ferric Chloride Storage Tank 1.	Alarm on SCADA.
Ferric Chloride Storage Tank 1 Level Switch High	Instrument (64LSH10200) has detected Level switch High in the Ferric Chloride Storage Tank 1.	Alarm on SCADA. Reset at HMI.
Ferric Chloride Storage Tank 2 HIGH-HIGH Level	Instrument (64LET10102) has detected High-High Level in the Ferric Chloride Storage Tank 2.	Hard-coded setpoint. Alarm on SCADA. Activate alarm beacon.
Ferric Chloride Storage Tank 2 HIGH Level	Instrument (64LET10102) has detected High Level in the Ferric Chloride Storage Tank 2.	Operator-adjustable setpoint. Alarm on SCADA. Activate alarm beacon.
Ferric Chloride Storage Tank 2 LOW Level	Instrument (64LET10102) has detected Low Level in the Ferric Chloride Storage Tank 2.	Operator-adjustable setpoint. Alarm on SCADA.
Ferric Chloride Storage Tank 2 LOW-LOW Level	Instrument (64LET10102) has detected a Low-Low Level in the Ferric Chloride Storage Tank 2.	Operator Adjustable setpoint. Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Ferric Chloride Storage Tank 2 Level Switch High	Instrument (64LAH10202) has detected Level switch High in the Ferric Chloride Storage Tank 2.	Alarm on SCADA.
Ferric Chloride Storage Tank 2 Level Switch High	Instrument (64LSH10202) has detected Level switch High in the Ferric Chloride Storage Tank 2.	Alarm on SCADA. Reset at HMI.

ALARM	MEANING	RESPONSE OR ACTION
Ferric Chloride Storage Tank 3 HIGH-HIGH Level	Instrument (64LET10103) has detected High-High Level in the Ferric Chloride Storage Tank 3.	Hard-coded setpoint. Alarm on SCADA. Activate alarm beacon.
Ferric Chloride Storage Tank 3 HIGH Level	Instrument (64LET10103) has detected High Level in the Ferric Chloride Storage Tank 3.	Operator-adjustable setpoint. Alarm on SCADA. Activate alarm beacon.
Ferric Chloride Storage Tank 3 LOW Level	Instrument (64LET10103) has detected Low Level in the Ferric Chloride Storage Tank 3.	Operator-adjustable setpoint. Alarm on SCADA.
Ferric Chloride Storage Tank 3 LOW-LOW Level	Instrument (64LET10103) has detected Low-Low Level in the Ferric Chloride Storage Tank 3.	Operator-adjustable setpoint. Alarm on SCADA. Stop all feed and transfer pumps when tank valve open.
Ferric Chloride Storage Tank 3 Level Switch High	Instrument (64LAH10203) has detected Level switch High in the Ferric Chloride Storage Tank 3.	Alarm on SCADA.
Ferric Chloride Storage Tank 3 Level Switch High	Instrument (64LSH10203) has detected Level switch High in the Ferric Chloride Storage Tank 3.	Alarm on SCADA. Reset at HMI.

87 - Cationic Polymer

Overview



Purpose

The Cationic Polymer Storage and Feed System located at the Solids Facility consists of three cationic polymer storage totes, polymer blend unit, polymer aging tank with mixer, and seven polymer feed pumps. Cationic polymer is used to aid in sludge thickening prior to anaerobic and aerobic digestion, aid in sludge dewatering prior to offsite disposal, and provide slip feed to the dewatered sludge pumps.

Description

Three totes provide polymer storage. One 50-gallons-per-hour (gph) polymer blend unit is used to pump and activate neat polymer from the totes and convey

the 0.5 – 1.0 percent polymer solution to the polymer aging tank. The polymer aging tank is equipped with a vertical mixer to aid in the activation and aging of polymer prior to metering. From the polymer aging tank, cationic polymer can be fed to all of the three systems: thickening at the GBTs, sludge dewatering at the centrifuges, and dewatered cake slip at the sludge cake pumps.

Each feed pump is sized to feed one of the thickening or dewatering pieces of equipment in the Solids Handling Facility: two for GBT (78PMP19504 and 78PMP19505), three for centrifuges (78PMP19501, 78PMP19502 and 78PMP19503), and two for dewatering sludge pumps (78PMP13501 and 78PMP13502).

Cationic polymer is pumped from the aging tank and can be blended with post-dilution water and injected upstream of the GBTs to aid in thickening. An injection ring (78MXR02101 and 78MXR2102) upstream of the GBTs helps to provide adequate mixing of the cationic polymer solution with the blended sludge.

Cationic polymer is pumped from the aging tank and can be blended with post-dilution water and injected upstream of the centrifuge units for aid in dewatering. The three polymer injection points for the centrifuge units include one at the centrifuge feed tube, one 25 feet prior to the centrifuges on the sludge feed piping, and one 50 feet prior to the centrifuges on the sludge feed piping.

The equipment redundancy is in the solids handling equipment. After the flow is measured, post-dilution water can be added to provide additional volume to aid in providing homogeneous mixing with sludge.

The polymer blend unit is controlled by the level in the polymer aging tank. The plant PLC controls batch operation of the polymer blend unit based on low and high level setpoints. Exhibit 87-1 is a partial example component list for the Cationic Polymer Storage and Feed System.

Design Criteria and Component List

EXHIBIT 87-1

Cationic Polymer Storage and Feed System Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Cationic Polymer Tote	78TNK18001, 78TNK18002, 78TNK18003	Quantity: 3 Type: Polyethylene, Intermediate Bulk Containment Volume (gal): 270
Cationic Polymer Feed Pump to GBT	78PMP19504, 78PMP19505	Quantity: 2 Type: Progressing Cavity, Adjustable Speed

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
		Rated Flow (gph): 250 Power (hp): 3
Cationic Polymer Feed Pump to Centrifuge	78PMP19501, 78PMP19502, 78PMP19503	Quantity: 3 Type: Progressing Cavity, Adjustable Speed Rated Flow (gph): 1485 Power (hp): 1
Sludge Cake Polymer Pump	78PMP13501, 78PMP13502	Quantity: 2 Type: Progressing Cavity, Adjustable Speed Rated Flow (gpm): 1 Power (hp): 1/2
Cationic Polymer Blending Unit	78PBU18800, 79PMP18300	Quantity: 1 Type: Adjustable Batch Flow, Progressive Cavity Metering Rated Flow (gph): 50 Power (hp): 1/2
Static Mixers (GBT)	78MXR20103, 78MXR20104	Quantity: 2
Cationic Polymer Aging Tank	78TNK18900	Quantity: 1 Type: Polyethylene Volume (gal): 14500
Aging Tank Mixer	78MXR19000	Quantity: 1 Type: Vertical Mixer Power (hp): 1.5
NOTES: gal = gallons gph = gallons per hour gpm = gallons per minute		

Process Control Variables

Controllable Variables

Polymer Dosage – This is for each pump:

- GBT: 6 to 15 pounds per ton (lb/ton) dry solids under normal operating conditions; 6 to 20 under recuperative thickening up to capacity of polymer pump
- Centrifuge: 10 to 30 lb/ton dry solids

Polymer slip: 1 gpm (this is what is recommended by sludge cake pump vendor)

Polymer Solution Strength – Typically 0.5 to 1.0 percent, the solution strength is determined by operator or vendor jar testing.

Specific Gravity of Polymer – The specific gravity of the polymer solution affects the feed pump speed and is typically set at 1 but is adjustable.

Non Controllable Variables

Weight – Tote weight determines when lead tote requires changing and switching to lag tote for feed.

Sludge Feed To Centrifuge – this is controlled elsewhere, but used to calculate polymer to centrifuge, also true for GBT feed.

Dilution Water – 3 to 60 gpm; used by polymer blend unit to achieve 0.5 percent polymer solution

Post-dilution water – GBT: 6 gpm, Centrifuge: 30 gpm

Calculations

$$PS = PO * Q / SG * C * 24$$

Where:

Operator input values:

- PO = Polymer Dosage, (lbs/ton dry solids [DS])
- SG = Specific Gravity of Polymer (1.00 [adjustable])
- C = Polymer Solution Strength (0.5% [adjustable])

SCADA provides the following parameters:

- Q = Sludge Feed to Centrifuge (ton DS/day)
- PS = Calculated Polymer Feed Rate (gph)

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87 - Cationic Polymer

Operating Strategies

The Cationic Polymer Storage and Feed System is intended to operate remotely through SCADA and is not intended to operate in a LOCAL-MANUAL mode. The only local controls associated with this equipment are for testing, maintenance, and startup purposes. The Cationic Polymer Storage and Feed System consist of the following subsystems:

Cationic Polymer Blending Unit

As needed, polymer is pumped from storage totes into the blending unit where it is activated by dilution water and then conveyed to the polymer aging tank. In normal operation the blending unit is controlled automatically by SCADA to maintain the level of the aging tank. Exhibit 87-2 lists the control modes for the cationic polymer blending unit.

EXHIBIT 87-2
Blending Unit Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The operator sets the blending unit to LOCAL-MANUAL or REMOTE at the LCP.	
Manual/Local	In LOCAL-MANUAL the operator turns the blending unit ON or OFF and inputs pump speed at the LCP.	
Manual/Remote	At SCADA the operator selects REMOTE-MANUAL or REMOTE-AUTO-LEVEL control mode.	
Manual/Remote	In REMOTE-MANUAL mode the operator turns the polymer blending unit ON or OFF. Pump speed is set at the LCP of the blending unit.	
Auto/Remote	In REMOTE-AUTO-LEVEL the ON and OFF controls of the blending unit is controlled automatically to maintain minimum and maximum levels in the cationic polymer aging tank. Pump speed is set at the LCP of the blending unit.	
NOTES: LCP = local control panel SCADA = supervisory control and data acquisition		

Cationic Polymer Aging Tank and Mixer

The cationic polymer is held in a storage tank where it is activated and aged with the assistance of a vertical mixer. The level of the tank is monitored by SCADA. When the tank reaches (HIGH SET POINT) SCADA will send a STOP command to the polymer blending unit. When the tank reaches (LOW SET POINT) SCADA will send a START command to the polymer blending unit. In normal operation the mixer is operated manually through SCADA. Exhibit 87-3 lists the control modes for the cationic polymer aging tank and mixer.

EXHIBIT 87-3
Cationic Polymer Aging Tank and Mixer Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The LOCAL-MANUAL or REMOTE-MANUAL control mode of the polymer aging tank mixer is set locally by the operator.	
Manual/Local	In LOCAL-MANUAL the operator turns the mixer ON or OFF at the LCS.	
Manual/Remote	In REMOTE-MANUAL the operator turns the mixer ON or OFF at SCADA	
Auto/Remote	SCADA monitors the polymer aging tank level	
Auto/Remote	SCADA monitors LOCAL/REMOTE status, ON/OFF status, and motor run time of the aging tank mixer.	
Auto/Remote	In REMOTE-AUTO-LEVEL control mode a START command is sent to the polymer blending unit when the aging tank reaches a set low point.	
Auto/Remote	In REMOTE-AUTO-LEVEL control mode a STOP command is sent to the polymer blending unit when the aging tank reaches a set high point.	
NOTES: LCS = local control station SCADA = supervisory control and data acquisition		

Cationic Polymer Feed Pumps for GBT

The pump operation mode is set by the operator locally. In normal operation the operator chooses which pump to run through SCADA and this pump is run automatically based on DOSAGE calculations done by SCADA. The operator

inputs values for polymer dosage, specific gravity, and solution strength at SCADA. Exhibit 87-4 lists the control modes for the cationic polymer feed pumps for GBT.

EXHIBIT 87-4
Cationic Polymer Feed Pumps for GBT Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The operator must confirm in the field that the pump valve arrangement matches the selected pump.	
Manual/Local	Operators set the LOCAL-MANUAL, REMOTE-MANUAL or REMOTE-AUTO operating status of the feed pumps at the LCS.	
Manual/Local	In the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON or OFF and inputs pump speed at the LCS.	
Manual/Remote	In the REMOTE-MANUAL control mode, the operator chooses which pump to run.	
Manual/Remote	In the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	Operator inputs values for the polymer dosage, specific gravity, and solution strength at SCADA.	
Auto/Remote	SCADA provides the sludge feed rate and uses a calculated polymer feed rate to determine the pump speed setpoint and sends a speed command to the pumps based on this setpoint.	
Auto/Remote	SCADA monitors the LOCAL/REMOTE status, ON/OFF status, FAIL condition, motor run time, motor voltage, motor current, power consumed, and speed of polymer feed pumps.	
NOTES: LCS = local control station SCADA = supervisory control and data acquisition		

Cationic Polymer Feed Pumps for Centrifuge

The pump operation mode is set by the operator locally. In normal operation the operator chooses which pump to run through SCADA and this pump is run automatically based on DOSAGE calculations done by SCADA. The operator inputs values for polymer dosage, specific gravity, and solution strength at SCADA. Exhibit 87-5 lists the control modes for the cationic polymer feed pumps for the Centrifuge.

EXHIBIT 87-5
Cationic Polymer Feed Pumps for Centrifuge Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	The operator must confirm in the field that the pump valve arrangement matches the selected pump.	
Manual/Local	Operators set the LOCAL-MANUAL, REMOTE-MANUAL or REMOTE-AUTO operating status of the feed pumps at the LCS.	
Manual/Local	In the LOCAL-MANUAL control mode, the operator manually turns the pump(s) ON or OFF and inputs pump speed at the LCS.	
Manual/Remote	In the REMOTE-MANUAL control mode, the operator chooses which pump to run.	
Manual/Remote	In the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	
Manual/Remote	Operator inputs values for the polymer dosage, specific gravity, and solution strength at SCADA.	
Auto/Remote	SCADA provides the sludge feed rate and uses a calculated polymer feed rate to determine the pump speed setpoint and sends a speed command to the pumps based on this setpoint.	
Auto/Remote	SCADA monitors the LOCAL/REMOTE status, ON/OFF status, FAIL condition, motor run time, motor voltage, motor current, power consumed, and speed of polymer feed pumps.	
NOTES: LCS = local control station SCADA = supervisory control and data acquisition		

Sludge Cake Polymer Pumps

The operator locally sets the operation mode of the sludge cake polymer pumps. In normal operation the pumps are controlled automatically through SCADA but can also be operated locally at the LCP. The operator selects the pump speed and SCADA sends an ON or OFF signal based on the discharge pressure of the sludge cake pumps. Exhibit 87-6 lists the control modes for the sludge cake polymer pumps.

EXHIBIT 87-6
Sludge Cake Polymer Pumps Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Operators set the LOCAL-MANUAL or REMOTE-MANUAL operating status of the feed pumps at the LCS.	

Manual/Local	In the LOCAL-MANUAL control mode, the Operator manually turns the pump(s) ON or OFF at the LCS.	
Manual/Remote	In the REMOTE-MANUAL control mode, the operator chooses which pump to run.	
Manual/Remote	In the REMOTE-MANUAL control mode, the operator manually turns the pump(s) ON or OFF at SCADA.	
Auto/Remote	In the REMOTE-AUTO control mode, the operator manually selects a pump speed. SCADA turns the pump(s) ON or OFF according to an operator inputted sludge cake pipe pressure setpoint.	
Auto/Remote	SCADA monitors the LOCAL/REMOTE status, ON/OFF status, FAIL condition, motor run time, motor voltage, motor current; power consumed, and speed of the sludge cake polymer pumps.	
NOTES: LCS = local control station SCADA = supervisory control and data acquisition		

Startup Procedures

- Check polymer weight and check the connection to polymer blend system.
- Water valve to polymer blend system is opened.
- Turn on polyblend system per manufacturer's instructions (put in REMOTE-AUTO mode)
- Turn on mixer in aging tank.
- Turn on polymer pumps (REMOTE-AUTO)
- If needed, set post-dilution water flow to 6 gpm for GBT polymer pumps (typically only one operating at a time) and 30 gpm for centrifuge polymer feed pumps (typically only two operating at a time) at rotameter by throttling globe valve.
- Once the calculation has been performed, the PLC will adjust the speed of the pump until it matches the calculated flow setpoint. The calculation and pump speed adjustment will occur continuously.

Shutdown Procedures

- Reverse of startup

Abnormal Conditions

- Change out of polymer tote
- Pump fail – modify operation

Additional Control Features

- Calibration of polymer transfer pump – see manufacturer's instructions

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Cationic Polymer Tote 1 LOW-LOW WEIGHT	Instrument (78WIT18001) has detected Low-Low Weight in the Cationic Polymer Tote 1.	Alarm shows on SCADA when low weight conditions are met.
Cationic Polymer Tote 2 LOW-LOW WEIGHT	Instrument (78WIT18002) has detected Low-Low Weight in the Cationic Polymer Tote 2.	Alarm shows on SCADA when low weight conditions are met.
Cationic Polymer Tote 3 LOW-LOW WEIGHT	Instrument (78WIT18003) has detected Low-Low Weight in the Cationic Polymer Tote 3.	Alarm shows on SCADA when low weight conditions are met.
Cationic Polymer Tote 1 LOW WEIGHT	Instrument (78WIT18001) has detected Low Weight in the Cationic Polymer Tote 1.	Alarm shows on SCADA when low weight conditions are met.
Cationic Polymer Tote 2 LOW WEIGHT	Instrument (78WIT18002) has detected Low Weight in the Cationic Polymer Tote 2.	Alarm shows on SCADA when low weight conditions are met.
Cationic Polymer Tote 3 LOW WEIGHT	Instrument (78WIT18003) has detected Low Weight in the Cationic Polymer Tote 3.	Alarm shows on SCADA when low weight conditions are met.
Polymer Blending Unit LOSS of POLYMER	Instrument (78PBU18800) has detected Loss of Polymer in the Polymer Blending Tank	Alarm shows on SCADA when Loss of Polymer conditions are met.
Polymer Blending Unit LOSS of WATER	Instrument (78PBU18800) has detected loss of Water in the Polymer Blending Tank	Alarm shows on SCADA when Loss of Water conditions are met.
Polymer Aging Tank Mixer FAIL-TO-START	Polymer Blending Tank Mixer (78MXR19000) has Failed to Start	Alarm shows on SCADA. Inspect the Mixer.
Polymer Aging Tank Mixer FAIL-TO-STOP	Polymer Blending Tank Mixer (78MXR19000) has Failed to Stop	Alarm shows on SCADA. Inspect the Mixer.
Cationic Feed Pump 4 FAIL-TO-START	Cationic Feed Pump 4 (78PMP19504) has Failed to Start	Alarm shows on SCADA. Inspect the Cationic Feed Pump 4.
Cationic Feed Pump 5 FAIL-TO-START	Cationic Feed Pump 5 (78PMP19505) has Failed to Start	Alarm shows on SCADA. Inspect the Cationic Feed Pump 5.

ALARM	MEANING	RESPONSE OR ACTION
Cationic Feed Pump 4 FAIL-TO-STOP	Cationic Feed Pump 4 (78PMP19504) has Failed to Stop	Alarm shows on SCADA. Inspect the Cationic Feed Pump 4.
Cationic Feed Pump 5 FAIL-TO-STOP	Cationic Feed Pump 5 (78PMP19505) has Failed to Stop	Alarm shows on SCADA. Inspect the Cationic Feed Pump 5.
Cationic Polymer Feed Pump 4 HIGH PRESSURE	Instrument (78PIT119604) has detected High Pressure in the Cationic Polymer Feed Pump 4.	Alarm shows on SCADA. Cationic Feed Pump 4 Stops.
Cationic Polymer Feed Pump 5 HIGH PRESSURE	Instrument (78PIT119605) has detected High Pressure in the Cationic Polymer Feed Pump 5.	Alarm shows on SCADA. Cationic Feed Pump 5 Stops.
Cationic Feed Pump 1 FAIL-TO-START	Cationic Feed Pump 1 (78PMP19501) has Failed to Start	Alarm shows on SCADA. Inspect the Cationic Feed Pump 1.
Cationic Feed Pump 2 FAIL-TO-START	Cationic Feed Pump 2 (78PMP19502) has Failed to Start	Alarm shows on SCADA. Inspect the Cationic Feed Pump 2.
Cationic Feed Pump 3 FAIL-TO-START	Cationic Feed Pump 3 (78PMP19503) has Failed to Start	Alarm shows on SCADA. Inspect the Cationic Feed Pump 3.
Cationic Feed Pump 1 FAIL-TO-STOP	Cationic Feed Pump 1 (78PMP19501) has Failed to Stop	Alarm shows on SCADA. Inspect the Cationic Feed Pump 1.
Cationic Feed Pump 2 FAIL-TO-STOP	Cationic Feed Pump 2 (78PMP19502) has Failed to Stop	Alarm shows on SCADA. Inspect the Cationic Feed Pump 2.
Cationic Feed Pump 3 FAIL-TO-STOP	Cationic Feed Pump 3 (78PMP19503) has Failed to Stop	Alarm shows on SCADA. Inspect the Cationic Feed Pump 3.
Cationic Polymer Feed Pump 1 HIGH PRESSURE	Instrument (78PIT119601) has detected High Pressure in the Cationic Polymer Feed Pump 1	Alarm shows on SCADA. Cationic Feed Pump 1 Stops.
Cationic Polymer Feed Pump 2 HIGH PRESSURE	Instrument (78PIT119602) has detected High Pressure in the Cationic Polymer Feed Pump 2	Alarm shows on SCADA. Cationic Feed Pump 2 Stops.
Cationic Polymer Feed Pump 3 HIGH PRESSURE	Instrument (78PIT119603) has detected High Pressure in the Cationic Polymer Feed Pump 3	Alarm shows on SCADA. Cationic Feed Pump 3 Stops.
Sludge Cake Polymer Pump 1 FAIL-TO-START	Sludge Cake Polymer Pump 1 (78PMP13501) has Failed to Start	Alarms shows on SCADA. Inspect Sludge Cake Polymer Pump 1.
Sludge Cake Polymer Pump 2 FAIL-TO-START	Sludge Cake Polymer Pump 2 (78PMP13502) has Failed to Start	Alarms shows on SCADA. Inspect Sludge Cake Polymer Pump 2.

ALARM	MEANING	RESPONSE OR ACTION
Sludge Cake Polymer Pump1 FAIL-TO-STOP	Sludge Cake Polymer Pump 1 (78PMP13501) has Failed to Stop.	Alarms shows on SCADA. Inspect Sludge Cake Polymer Pump 1.
Sludge Cake Polymer Pump 2 FAIL-TO-STOP	Sludge Cake Polymer Pump 2 (78PMP13502) has Failed to Stop.	Alarms shows on SCADA. Inspect Sludge Cake Polymer Pump 2.
Sludge Cake Polymer Pump1 HIGH PRESSURE	Instrument (78PIT13701) has detected High Pressure in the Sludge Cake Polymer Pump 1.	Alarm shows on SCADA. Sludge Cake Polymer Pump 1 Stops.
Sludge Cake Polymer Pump 2 HIGH PRESSURE	Instrument (78PIT13702) has detected High Pressure in the Cationic Polymer Feed Pump 2.	Alarm shows on SCADA. Sludge Cake Polymer Pump 2 Stops.

Overview

Purpose

Chemical receiving is addressed in separate documents under each chemical title specifically at the tank farm. Containment for each chemical protects the surrounding environment and the aquifer below. This overview describes containment for each chemical and how it is monitored and handled once or if a leak or spill occurs.

Description

Chemical areas are equipped with spill containment measures. This section addresses unloading and containment of ferric chloride, sodium hydroxide, sodium hypochlorite, sodium bisulfite, and citric acid. Polymer is not addressed in this operations section because it is not an irritant or oxidant that requires separate hazardous materials handling. The outdoor tank farm provides containment with double-walled chemical storage FRP tanks. Residual chemical from truck unloading procedures and spilled chemical at the truck apron, located south of the tank farm, collect in one of two below grade containment vaults.

Containment at the chemical pumps is provided by containment sumps located inside the Membrane Building within the vicinity of the pumps. Chemical totes stored inside the Membrane Building are located on tote containment platforms. Each containment sump has an isolation valve that is normally closed. The valve is manually turned to the open position to allow washdown water and chemical to flow to the containment vault. Each containment sump is piped to a single containment vault to maintain separation between incompatible chemicals. Ferric chloride and citric acid containment drains are piped to Containment Vault 1 while sodium hydroxide, sodium hypochlorite, and sodium bisulfite containment drains are piped to Containment Vault 2.

Each containment vault has an isolation valve that is normally closed. The valve is manually turned to the open position to allow stormwater drainage from the vault to the plant drain pump station. The valve remains closed to contain any

chemical spills that may occur during transfer of chemicals between the trucks and the tanks. If a vault fills with chemicals, a disposal truck is notified to come pump the spilled chemicals and transport them to an offsite disposal facility. The Plant Drain Pump Station is protected with chemical-resistant coatings in case a valve is accidentally not closed when it should have been, in case there is a tank overflow that makes its way to the stormwater catch basins, or if dilute chemical spills from other locations are accidentally drained to the pump station. Exhibit 88-1 is a partial list of components for chemical containment and receiving.

Design Criteria and Component List

EXHIBIT 88-1

Chemical Containment and Receiving Example Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Containment Vault		Quantity: 2
Containment Vault Drain Valve	64BFV16182, 64BFV16183	Quantity: 2 Type: Butterfly Position: Normally Closed

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Operating Strategies

Containment vault valves are operated manually. There is no remote operation by SCADA. If chemicals or washdown water spill into the containment area and fill the containment vault, the high level switch in the vault alarms to SCADA. Personnel are required to inspect the liquid in either vault and determine whether a chemical truck is required to pump liquid out of either vault for offsite disposal.

Leak detection of the double-walled FRP tanks is performed manually via the leak detection nozzle located on the outer containment wall of the tank. Opening the ball valve at the nozzle and visually inspecting for chemical draining from piping will verify integrity of chemical containment of the FRP tanks. Exhibit 88-2 lists some example control modes for chemical receiving and containment.

EXHIBIT 88-2
Chemical Receiving and Containment Example Control Modes

MODE	DESCRIPTION	REFERENCES
Manual/Local	Manually open either of the butterfly valves and gravity drain either vault to the plant drain pump station if storm water, <u>not</u> chemical, has collected in the vault.	
Manual/Local	Open ball valve at the outer containment of the fiberglass-reinforced plastic (FRP) tanks to check integrity of the chemical containment.	
Manual/Local	If a vault fills with chemicals, the operator notifies a disposal truck to come pump the spilled chemicals and transport them to an offsite disposal facility.	

Startup Procedures

- Make sure that all drain valves are closed on tanks prior to filling.
- Check containment vaults for any collected liquids. If any liquids are present, determine if it is stormwater or chemicals.
- Drain vaults accordingly
- Fill tanks according to tank filling procedure

Safety

All safety-related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan, or consult the hard copy in the Operations Building.

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88 - Chemical Receiving and Containment

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Chemical Unloading Containment Sump HIGH LEVEL	Instrument (64LSH12301) has detected Chemical Unloading Containment Sump HIGH LEVEL.	Alarm on SCADA. Reset at HMI.
Chemical Unloading Containment Sump HIGH LEVEL	Instrument (64LSH12302) has detected Chemical Unloading Containment Sump HIGH LEVEL.	Alarm on SCADA. Reset at HMI.
Chemical Unloading Containment Vault HIGH LEVEL	Instrument (64LSH12301) has detected Chemical Unloading Containment Vault HIGH LEVEL.	Alarm on SCADA. Reset at HMI.
Chemical Unloading Containment Vault HIGH LEVEL	Instrument (64LSH12302) has detected Chemical Unloading Containment Vault HIGH LEVEL.	Alarm on SCADA. Reset at HMI.
Ferric Chloride Containment Sump HIGH LEVEL	Instrument (64LSH10300) has detected Ferric Chloride Containment Sump HIGH LEVEL	Alarm on SCADA. Reset at HMI.
Sodium Hydroxide/Hypochlorite Containment Sump HIGH LEVEL	Instrument (64LSH14400) has detected Sodium Hydroxide/Hypochlorite Containment Sump HIGH LEVEL.	Alarm on SCADA. Reset at HMI.
Sodium Bisulfite Containment Sump HIGH LEVEL	Instrument (64LSH16900) has detected Sodium Bisulfite Containment Sump HIGH LEVEL.	Alarm on SCADA. Reset at HMI.
Citric Acid Containment Sump HIGH LEVEL	Instrument (64LSH18200) has detected Citric Acid Containment Sump HIGH LEVEL.	Alarm on SCADA. Reset at HMI.

90 - Potable and Non-Potable Water Systems

Overview

The City of Spokane provides potable water to the site which is separated from the city system by a reduced pressure type backflow preventer and then distributed throughout the site as W1.

W2 is also City water, but it is considered non-potable, and separated from the W1 by another reduced pressure type backflow preventer at each building where it is provided.

Purpose

The potable water system (W1) provides the water treatment plant with potable water for the following uses:

- Plumbing fixtures
- Drinking fountains
- Emergency Safety Showers
- Emergency Eyewashes
- Service Sinks
- Maintenance building hose valves

The non-potable water system (W2) is a continuation of the potable water system. Non-potable water provides the water treatment plant with non-potable water for the following uses:

- Boiler make-up Water
- Make-up water for evaporative coolers

Description

The potable and non-potable water systems are generated from a 4" tap with a 2" meter off the city water main on Freya Street at the West end of the property. The potable water system is looped around the site with a 4" diameter loop. It is distributed to each building with at least a 1" tap. The Membrane building has a 2" tap because it is used for a tempered water system for several safety showers. The non-potable water systems branch off of the potable water system at each building where required and includes a backflow prevention device prior to being supplied to its uses. The W1 and W2 water systems also include associated piping, valves, and end use devices (i.e. hose valves, plumbing fixtures, & safety shower).

Design Criteria

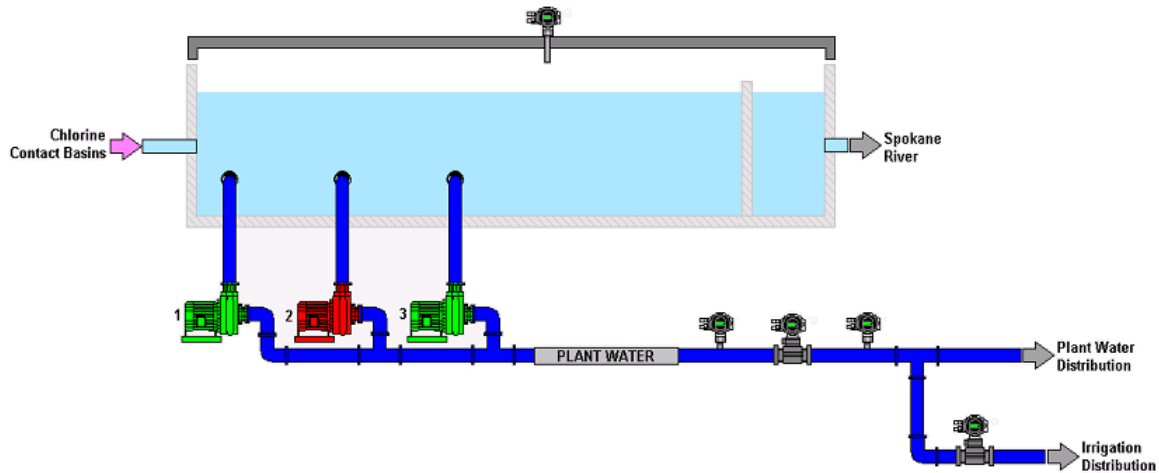
NONE

Component List

NONE

91 - W3 System

Overview



Purpose

The W3 reclaimed water system is critical for daily operation and maintenance of the Spokane County Regional Water Reclamation Facility (RWRF). While not directly related to the wastewater treatment process, the water systems are responsible for assuring proper treatment and adherence to effluent quality standards.

Reclaimed water (W3) is used throughout the plant for various purposes. Reclaimed water is treated, disinfected wastewater. It is used for chemical solution make-up at the Membrane Building 64, Headworks building 59, and at the Solids building 78. It is also used as spray water for numerous types of equipment and processes at facilities 59, 60, 63, 64, 78, 82, and 85. W3 is used for all washdown of outdoor and indoor process areas except for a few sanitary hose bibs at the maintenance building, the Treatment Operations Facility 10, and at the Water Resource Center 98. Reclaimed water is also distributed throughout the site as irrigation water.

Description

The W3 (Plant Water) Pumping System is located on the North side of the Membrane Building, facility number 64. The system consists of three variable speed horizontal split case pumps and associated controls which draw water from the Reclaimed Water Wet Well for distribution throughout the site. The Plant Water system serves hose stations and various continuous and intermittent process demands.

Phase 1 plant water flow demands, will vary from approximately 350 gpm to 1350 gpm. During Phase 2, estimated flow demands are expected to vary from 490 gpm to 1540 gpm. The pumps are optimized for Phase 1 flows, but may be acceptable for phase 2 without modification depending on what other process changes occur in the intervening years.

The irrigation water is metered separately on a branch off the Plant Water System. Design irrigation flow is 190 gpm, but does not add to the total because it occurs during off-peak hours.

The system is designed to operate at a continuous 75 psig (162') of pressure, as measured at the pressure transmitter on the main header, regardless of flow. Therefore pump speed will be controlled by pressure.

Design Criteria and Component List

EXHIBIT 91-1
W-3 Component List (partial list)

ITEM	EQUIPMENT NAME & TAGNUMBER	DESIGN CRITERIA & COMPONENT INFORMATION
Plant Water Pumps	64PMP20201, 64PMP20202, 64PMP20203	Quantity: 3 Type: Horizontal Split Case, Adjustable Speed Flow Rate (GPM): 700 Pressure (TDH FT): 162 Power (hp): 50
Plant Water Flow Meter	64FE/FIT20400	Quantity: 1 Type: Magnetic Flowmeter Size: 3 inch
Irrigation Water Flow Meter	64FET20600	Quantity: 1 Type: Magnetic Flowmeter Size: 8 inch

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91 - W3 Pumping System

Operating Strategies

The W3 Pumps are each sized for about 50 percent of the system peak flow or 700 gpm each and operate best near their peak design flow. Therefore the pumps will be staged as follows:

- Flow drops below 40% of a pumps design. – Shutdown a pump.
- Flow exceeds 95% of a pumps design. – Startup an additional pump.

Because the treatment plant must operate for at least 8 hours during a power outage, all three of the pumps have been provided with standby power.

Double check valves located on the irrigation piping will be drained at the end of each season to avoid pipes freezing in the winter months.

The Pumping System is intended to operate automatically and is not intended to operate in a LOCAL MANUAL mode. The manual controls associated with this equipment is for testing, maintenance, and startup purposes.

EXHIBIT 91-2
W3 Pumping Control Modes Table

MODE	DESCRIPTION	REFERENCES
Manual/Local	The operator selects the ON-OFF-REMOTE status of the W3 Pumps at the local control panel for each.	
Manual/Local	When operating the pump(s) in the LOCAL control mode, the Operator manually turns the pump(s) ON or OFF at the local control station.	
Manual/Remote	When operating the pump(s) in the REMOTE-MANUAL control mode, the Operator manually turns the pump(s) ON or OFF and inputs pump speed at SCADA.	
Auto/Remote	When operating the pump(s) in the REMOTE-AUTO control mode, the pump(s) will receive a START or STOP command in order to maintain a certain system pressure.	
Auto/Remote	When in the REMOTE-AUTO control, a LEAD-LAG-STANDBY control of the pumps is provided. Should the DUTY or LAG pump FAULT, the STANDBY pump shall automatically start.	

Startup Procedures

AFD to mimic a soft-start during start-up. Pump should start on minimum speed, and ramp up until design flow and pressure is achieved.

Shutdown Procedures

AFD to mimic a soft-start during shut-down. Pump should ramp down during shut-down to avoid water hammer

Safety

All safety related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan or the hard copy in the Operations Building.

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91 - W3 Pumping System

Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Distribution of W3 Plant Water Pump FAIL-TO-START	Distribution of W3 Plant Water Pump (64PMP20201) has Failed to Start.	Alarm shows on SCADA. Inspect the Water Pump.
Distribution of W3 Plant Water Pump FAIL-TO-STOP	Distribution of W3 Plant Water Pump (64PMP20201) has Failed to Stop.	Alarm shows on SCADA. Inspect the Water Pump.
Distribution of W3 Plant Water Pump FAIL-TO-START	Distribution of W3 Plant Water Pump (64PMP20202) has Failed to Start.	Alarm shows on SCADA. Inspect the Water Pump.
Distribution of W3 Plant Water Pump FAIL-TO-STOP	Distribution of W3 Plant Water Pump (64PMP20202) has Failed to Stop.	Alarm shows on SCADA. Inspect the Water Pump.
Distribution of W3 Plant Water Pump FAIL-TO-START	Distribution of W3 Plant Water Pump (64PMP20203) has Failed to Start.	Alarm shows on SCADA. Inspect the Water Pump.
Distribution of W3 Plant Water Pump FAIL-TO-STOP	Distribution of W3 Plant Water Pump (64PMP20203) has Failed to Stop.	Alarm shows on SCADA. Inspect the Water Pump.
Distribution of W3 Plant Water Pump HIGH PRESSURE	Instrument (64PIT20500) has detected High Pressure in Distribution of W3 Plant Water.	Alarm shows on SCADA. Inspect the Water Pump. Inspect Instrument.
Distribution of W3 Plant Water Pump LOW PRESSURE	Instrument (64PIT20500) has detected Low Pressure in Distribution of W3 Plant Water.	Alarm shows on SCADA. Inspect the Water Pump. Inspect Instrument.

Overview

This section covers electrical distribution and emergency power for the Spokane County Water Reclamation Facility. Refer to site electrical drawings 08-E-2001 through 08-E-2008 for site routing information. Refer to 08-E-2000, the Overall One-Line Diagram in the drawing set, for the overall electrical distribution system layout.

Purpose

The purpose of the electrical distribution system at the Spokane County RWRF is to provide a reliable power source to the facility. To comply with Ecology requirements for redundancy, all critical facilities are provided with redundant power supplies.

Description

High Voltage Distribution System

Incoming Service

A single utility feed, provided by Avista, enters the plant from N. Julia St. and serves as the primary power source to the reclamation facility. The service feeds Pad Mount Switch No.1 (08PMS90101) at the north end of the plant. Pad Mount Switch No.1 feeds Pad Mount Switch No. 2 which, in turn, feeds Pad Mount Switch No. 3 in the center and southern ends of the plant respectively. This provides a 13.2kV backbone in which power is distributed throughout the site.

The pad mount switches then feed pad-mount transformers at each building which step the voltage down from 13.2kV to 480V. 08PMS90101 feeds transformers at the Headworks Building and Treatment Operations Facility. 08PMS90102 feeds a transformer at the Solids Building and 08PMS90103 feeds a transformer at the Membrane Facility.

Pad-mounted Transformers 10MVT90100, 59MVT91100, 64MVT91100, 78MVT91100

Pad-mounted transformers are located at the Treatment of Operations Facility (10MVT90100), the Headworks Building (59MVT91100), the Membrane Facility (64MVT91100), and the Solids Building (78MVT91100). Each transformer is 13.2 kV – 480Y, 3 phase.

Transformer Sizes are as follows:

- 10MVT90100: 225kVA
- 59MVT91100: 500kVA
- 64MVT91100: 2000kVA
- 78MVT91100: 750kVA

Under normal conditions, the transformers will be energized and delivering electricity from the Avista utility service to the electrical equipment inside the nearest building.

Low Voltage Distribution System

Overview

Everything downstream of the pad-mounted transformers is part of the low voltage distribution system; that is, under 600 volts.

Treatment Operation Facility and Water Resource Center

Panel M is in the electrical room located at the southern end of the Treatment Operation Facility. This panelboard provides power to the Treatment Operation Facility and Water Resource Center. Emergency backup power is provided for the SCADA rack via an uninterruptible power supply.

Headworks Facility

59MCC91101/2 is located in the 2nd story electrical room. This MCC provides power to the Headworks Facility, the Primary Clarifiers, the Odor Control Facility, and the Maintenance Building. 59MCC91101 is fed from transformer 59MVT91100 through an 800A fused disconnect switch. Under normal operating conditions 59MVT91100 will energize 59MCC91101 which will energize 59MCC91102 through a normally closed tie circuit breaker.

In circumstances where utility power is lost emergency power will be fed from 59GEN91100 through a 600A fused disconnect switch to 59MCC91102. 59GEN91100 is a Cummins Power, 300kW, 480V, 3 phase diesel engine standby generator set with outdoor weatherproof enclosure. When utility power is lost, an automatic transfer controller (ATC) in the motor control center will sense

the loss of power and open the main circuit breaker in 59MCC91101. The ATC will then close the main breaker in 59MCC91102, switching the connected source from the utility to the generator. When utility power is restored the ATC will sense that voltage has returned on the utility side and after a preset time delay the ATC will transfer power back to the utility source.

59PND91500 is additionally fed from a 10kVA uninterruptible power supply (UPS). This allows 59PND91500 to remain energized immediately after utility power is lost, before the generator can provide the facility with standby power. 59PND91500 feeds critical loads such as the fire alarm and security control panels, the network and instrumentation control panels, the septage operator interface panel, and the operator workstations.

Membrane Facility

64SBD91101/2 is located in the electrical room at the lower East end of the Membrane Facility. This switchboard provides power to the Membrane Facility, the Blower equipment, the Aeration Basin, and the Plant Drain Pump Station. 64SBD91101 provides power to 64MCC91101 and 64SBD91102 provides power to 64MCC91102 as part of the distribution system. 64SBD91102 is fed from transformer 64MVT91100. Under normal operating conditions 64MVT91100 will energize 64SBD91102 which will energize 64SBD91101 through a normally closed tie circuit breaker.

In circumstances where utility power is lost, emergency power will be fed from 64GEN91100 to 64SBD91101. 64GEN91100 is a Cummins Power, 1500kW, 480V, 3 phase diesel engine standby generator set with outdoor weatherproof enclosure. When utility power is lost, an automatic transfer controller (ATC) in the switchboard will sense the loss of power and open the main circuit breaker in 64SBD91102. The ATC will then close the main breaker in 64SBD91102, switching the connected source from the utility to the generator. When utility power is restored the ATC will sense that voltage has returned on the utility side and after a preset time delay the ATC will transfer power back to the utility source.

64PND91501 is additionally fed from a 15kVA uninterruptible power supply (UPS). This allows 64PND91501 to remain energized immediately after utility power is lost, before the generator can provide the facility with standby power. 64PND91501 feeds critical loads such as the fire alarm and security control panels, the network and instrumentation control panels, and the control room receptacles.

Solids Facility

78MCC91100 is located in the electrical room at the West end of the Solids Facility. This MCC provides power to the Solids Facility, the Anaerobic and Aerobic Digesters, and the Co-Generation and Gas Conditioning/Storage system. 78MCC91100 is a single ended MCC fed from transformer 78MVT91100.

Emergency power is provided to panelboard 78PND91500 which feeds the Solids Facility critical loads. During normal operation this panelboard will be fed from 78MCC91100. When utility power is lost, an automatic transfer switch will switch the source from 78MCC91100 to 59MCC91101/2 via the Maintenance Facility panelboard 97PND90100. To maintain power to the panelboard during the time when power is being transferred, 78UPS91501, a 15kVA UPS, will provide backup power to 78PND91500. When utility power is restored the transfer switch will change the source back to 78MCC91100 after a time delay.

Maintenance Facility

97PND91100 is located in the electrical closet toward the northeast portion of the facility. This panelboard provides power to the Maintenance Facility, the outdoor sump pumps, Odor Control Facility lights and receptacles, and relays emergency power to the Solids Building critical load panelboard from 59MCC91101/2.

UPS backup is provided to 97NIP001 and network server loads.

Safety

All safety related information is located in the Facility Safety Plan. Refer to the eFIM menu system for a link to the Safety Plan or the hard copy in the Operations Building.

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Overview

Purpose

The HVAC system provides the Spokane County RWRF with air heating, ventilating, and cooling.

Description

Headworks Facility 59

The facility HVAC equipment consists of two makeup air units with natural gas fired heating and evaporative cooling (59MAU80100 and 59MAU80200), four relief louvers (59REL80901, 59REL80902, 59REL80903, and 59REL80904), two gas fired unit heaters (59GUH80501 and 59GUH80502), and exhaust fan (59EXF80100) that provide heating, cooling and ventilation to the facility. Two split system air conditioners (59AHU80301 and 59AHU80301) provide cooling to the electrical room.

Membranes Facility 64

The facility HVAC system consists of a makeup air unit with evaporative cooling and natural gas heating (64MAU80100) with control panel (64HCP80100), two exhaust fans (64EXF80201 and 64EXF80202) and relief louver (64REL80901). The electrical room is cooled via two split system air conditioners (64AHU80301 and 64AHU80302) with corresponding control panels (64HCP80301 and 64HCP80302). The control room is heated and cooled via a ductless split system heatpump (64AHU80303) with control panel (64HCP80303).

Solids Facility 78

The facility HVAC system consists of a makeup air unit with evaporative cooling and natural gas heating (78MAU80100) with control panel (78HCP80100), exhaust fan (78EXF80200), two supply fans (78SUF80201 and 78SUF80202) and relief louvers (78REL80901, 78REL80902, and 78REL80903). The electrical room is cooled via one split system air conditioner (78AHU80300) with control panel (78HCP80300). The polymer room and boiler rooms are heated by a hot water unit heater (78HUH80501 and 78HUH80502) and the truck bay is heated with two gas unit heaters (78GUH80603 and 78GUH80604).

Maintenance Facility 97

The maintenance facility HVAC system consists of a makeup air unit with evaporative cooling and natural gas heating (97MAU80100) with control panel (97HCP80100), exhaust fans (97EXF80201, 97EXF80202, 97EXF80203, and 97EXF80204), relief louver (97REL80901). The server room and office are

cooled via two ductless split system air conditioners (97AHU80301 and 97AHU80302) with corresponding control panels (97HCP80301 and 97HCP80302). The control room is heated and cooled via a ductless split system heat pump (64AHU80303) with control panel (64HCP80303). The maintenance shop is heated by two infrared radiant heaters (97GIH80501 and 97GIH80502).

Component List

EXHIBIT 92.1

HVAC Component List

Spokane RWRF Operations Manual

ITEM	EQUIPMENT NAME AND TAG NUMBER	COMPONENT INFORMATION
Air-cooled Condensing Unit	59CCU80301 59CCU80302 64CCU80301 78CCU80300	Quantity: 4 Manufacturer: Carrier Type: Split System Outdoor Condensing Unit Function: Cooling Air
Air-cooled Condensing Unit	64CCU80302 97CCU80301 97CCU80302	Quantity: 3 Manufacturer: Sanyo Type: Split System Outdoor Condensing Unit Function: Heating and Cooling Air
Air Handling Unit	59AHU80301 59AHU80302 64AHU80301 78AHU80300	Quantity: 4 Manufacturer: Carrier Type: Natural Gas Function: Heating and Cooling Air
Air Handling Unit	64AHU80302 97AHU80301 97AHU80302	Quantity: 3 Manufacturer: Sanyo Type: Ductless Air Handling Units Function: Heat and Cooling Air
Makeup Air Unit	59MAU80100 59MAU80200 64MAU80100 78MAU80100 97MAU80100	Quantity: 5 Manufacturer: Absolute Air Type: Makeup Air Handling Unit with Evap Cooling and NG Heat Function: Heating and Cooling Air
Exhaust Fan	59EXF80100 64EXF80201 64EXF80202 78EXF80200 97EXF80201 97EXF80202 97EXF80203	Quantity: 8 Manufacturer: Greenheck Type: Centrifugal Inline Function: Exhaust Air

EXHIBIT 92.1
HVAC Component List
Spokane RWRF Operations Manual

ITEM	EQUIPMENT NAME AND TAG NUMBER	COMPONENT INFORMATION
	97EXF80204	
Supply Fans	78SUF80201 78SUF80202	Quantity: 2 Manufacturer: Greenheck Type: Centrifugal Inline Function: Supply Air
HVAC Control Panel	20HCP9901, 32HCP9901 95HCP9901	Quantity: 3 Manufacturer: Trane/Honeywell Type: Control Panel Function: Control
Gas Unit Heater	59GUH80501 59GUH80502 78GUH80503 78GUH80504	Quantity: 4 Manufacturer: Reznor Type: Gas Unit Heaters Function: Heating Air
Gas Infrared Heater	64GIH80500 97GIH80501 97GIH80502	Quantity: 3 Manufacturer: Reznor Type: Infrared Gas Unit Heaters Function: Heating Air
Hot Water Unit Heater	78HUH80501 78HUH80502	Quantity: 2 Manufacturer: Reznor Type: Hot Water Unit Heaters Function: Heating Air

SCADA Points List

EXHIBIT 92.2

SCADA Points List

Spokane RWRf Operations Manual

FACILITY	EQUIPMENT NAME AND TAG NUMBER	SIGNAL SOURCE	SCADA CONNECTION INFORMATION
59 Headworks Facility	59CCU80301/59AHU80301	System HCP	System Alarm
	59CCU80302/59AHU80302	System HCP	System Alarm
	59MAU80100	System HCP	System Alarm
	59MAU80200	System HCP	System Alarm
	59EXF80100	System VFD	Fan Failure Alarm
64 Membranes Facility	64CCU80301/64AHU80301	System HCP	System Alarm
	64CCU80302/64AHU80302	System HCP	System Alarm
	64MAU80100	System HCP	System Alarm
	64EXF80201	System VFD	Fan Failure Alarm
	64EXF80202	System VFD	Fan Failure Alarm
78 Solids Facility	78CCU80300/78AHU80300	System HCP	System Alarm
	78MAU80100	System HCP	System Alarm
	78EXF80200	System VFD	Fan Failure Alarm
	78SUF80201	System VFD	Fan Failure Alarm
	78SUF80202	System VFD	Fan Failure Alarm
97 Maintenance Facility	97CCU80301/97AHU80301	System HCP	System Alarm
	97CCU80302/97AHU80302	System HCP	System Alarm
	97MAU80100	System HCP	System Alarm
	97EXF80201	System VFD	Fan Failure Alarm

Operating Strategies

Operating Procedures

Reference vendor equipment manuals for operating procedures for each piece of equipment.

Headworks Facility 59

The Screening Room, Screenings Grit Container Room, and Septage Receiving Room are continuously ventilated for code compliance and heated for freeze protection to 44 degrees Fahrenheit (F) via a makeup air unit. Evaporative cooling can be manually enabled when temperatures rise above 104 degrees F. The odor control systems exhaust the air from these spaces. Relief louvers open upon failure of any associated fan system to allow continual ventilation.

The Grit Pump Room, Mechanical Room and Corridor are continuously ventilated for code compliance and heated for freeze protection to 44 degrees F via a makeup air unit. Evaporative cooling can be manually enabled when temperatures rise above 104 degrees F. An exhaust fan exhausts the makeup air from these spaces. Relief louvers open upon failure of any associated fan system to allow continual ventilation.

Electrical rooms are cooled by split system air conditioners to an indoor temperature of 80 degrees F for equipment protection. The systems are in duty/standby configuration. Systems operate in economizer mode when outdoor temperatures are favorable.

The East and West Stairwells are heated for freeze protection to a maximum of 44 degrees F by two gas fired unit heaters.

Membranes Facility 64

The Pump Room and Chemical Room are continuously ventilated for code compliance and heated for freeze protection to 44 degrees F via a makeup air unit. Evaporative cooling can be manually enabled when temperatures rise above 104 degrees F. Two exhaust fans exhaust air from each of these spaces. Relief louvers open upon failure of any associated fan system to allow continual ventilation. A gas infrared radiant heater provides supplemental heat to the Chemical Room.

The Electrical Room is cooled by split system air conditioners to an indoor temperature of 80 degrees F for equipment protection. The systems are in duty/standby configuration. Systems operate in economizer mode when outdoor temperatures are favorable.

The Control Room is conditioned via a ductless split system heat pump. The system fan operates continuously during occupied hours and cycles on demand during unoccupied hours to meet heating and cooling temperature setpoints.

Solids Facility 78

The Solids Room, Polymer Room and Mechanical Room are continuously ventilated for code compliance and heated for freeze protection to 44 degrees F via a makeup air unit. Evaporative cooling can be manually enabled when temperatures rise above 104 degrees F. A central exhaust fan exhausts the air. Relief louvers open upon failure of any associated fan system to allow continual ventilation. The Polymer Room has supplemental heat from a hot water unit heater. The Truck Bay receives ventilation from a transfer fan from the Solids Room and has supplemental heat from two gas unit heaters.

The Boiler Room is provided with space ventilation cooling via a supply fan and relief louvers to maintain space below 104 degrees F. Freeze protection to 44 degrees F is provided by a gas unit heater.

The Electrical Room is cooled by split system air conditioners to an indoor temperature of 80 degrees F for equipment protection. The systems are in duty/standby configuration. Systems operate in economizer mode when outdoor temperatures are favorable.

Maintenance Facility 97

The Maintenance Shop, Instrument Shop, Tool Storage, Welding Room, Restroom, Recycling Room, and Oil Storage are conditioned and ventilated via a makeup air unit during occupied hours. Supplemental heating is available from the gas infrared heaters in the Maintenance Shop when rollup doors are open. Evaporative cooling can be manually enabled when temperatures rise above 80 degrees F. The central exhaust fan operates when the makeup air unit is operating. Relief louvers open upon failure of any associated fan system to allow continual ventilation.

The welding shop fan is manually operated when required for welding. The Oil Storage Room fan operates continuously for ventilation. The Restroom fan turns on with the space light switch.

The Office, Electrical Room and Server Room are conditioned via a ductless split system heat pump. The system fan operates continuously during occupied hours and cycles on demand during unoccupied hours to meet heating and cooling

temperature setpoints. An additional ductless split system provides additional conditioning to the Server Room.

Safety

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Alarm List

ALARM	MEANING	RESPONSE OR ACTION
Headworks Facility Air Handling Unit 1 SIGNAL FAIL	Headworks Facility Air Handling Unit 1 (59AHU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Compressor Condensing Unit 1 SIGNAL FAIL	Headworks Facility Compressor Condensing Unit 1 (59CCU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Air Handling Unit 2 SIGNAL FAIL	Headworks Facility Air Handling Unit 2 (59AHU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Compressor Condensing Unit 2 SIGNAL FAIL	Headworks Facility Compressor Condensing Unit 2 (59CCU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Air Handling Unit 1 SIGNAL FAIL	Membrane Facility Air Handling Unit 1 (64AHU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Compressor Condensing Unit 1 SIGNAL FAIL	Membrane Facility Compressor Condensing Unit 1 (64CCU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Air Handling Unit 2 SIGNAL FAIL	Membrane Facility Air Handling Unit 2 (64AHU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Compressor Condensing Unit 2 SIGNAL FAIL	Membrane Facility Compressor Condensing Unit 2 (64CCU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Air Handling Unit 3 SIGNAL FAIL	Membrane Facility Air Handling Unit 3 (64AHU80303) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Compressor Condensing Unit 3 SIGNAL FAIL	Membrane Facility Compressor Condensing Unit 3 (64CCU80303) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Solids Handling Facility Air Handling Unit 1 SIGNAL FAIL	Solids Handling Facility Air Handling Unit 3 (78AHU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Solids Handling Facility Compressor Condensing Unit 1 SIGNAL FAIL	Solids Handling Facility Compressor Condensing Unit 1 (78CCU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.

ALARM	MEANING	RESPONSE OR ACTION
Maintenance Facility Air Handling Unit 1 SIGNAL FAIL	Maintenance Facility Air Handling Unit 1 (97AHU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Maintenance Facility Compressor Condensing Unit 1 SIGNAL FAIL	Maintenance Facility Compressor Condensing Unit 1 (97CCU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Maintenance Facility Air Handling Unit 2 SIGNAL FAIL	Maintenance Facility Air Handling Unit 2 (97AHU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Maintenance Facility Compressor Condensing Unit 2 SIGNAL FAIL	Maintenance Facility Compressor Condensing Unit 2 (97CCU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Air Handling Unit 1 Fire Alarm Control Emergency Shutdown	Headworks Facility Air Handling Unit 1 (59AHU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock.
Headworks Facility Compressor Condensing Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Headworks Facility Compressor Condensing Unit 1 (59CCU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Headworks Facility Air Handling Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Headworks Facility Air Handling Unit 2 (59AHU80302) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Headworks Facility Compressor Condensing Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Headworks Facility Compressor Condensing Unit 2 (59CCU80302) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Membrane Facility Air Handling Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Air Handling Unit 1 (64AHU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Membrane Facility Compressor Condensing Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Compressor Condensing Unit 1 (64CCU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Membrane Facility Air Handling Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Air Handling Unit 2 (64AHU80302) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Membrane Facility Compressor Condensing Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Compressor Condensing Unit 2 (64CCU80302) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Membrane Facility Air Handling Unit 3 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Air Handling Unit 3 (64AHU80303) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock

ALARM	MEANING	RESPONSE OR ACTION
Membrane Facility Compressor Condensing Unit 3 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Compressor Condensing Unit 3 (64CCU80303) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Solids Handling Facility Air Handling Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Solids Handling Facility Air Handling Unit 3 (78AHU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Solids Handling Facility Compressor Condensing Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Solids Handling Facility Compressor Condensing Unit 1 (78CCU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Maintenance Facility Air Handling Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Air Handling Unit 1 (97AHU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Maintenance Facility Compressor Condensing Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Compressor Condensing Unit 1 (97CCU80301) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Maintenance Facility Air Handling Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Air Handling Unit 2 (97AHU80302) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Maintenance Facility Compressor Condensing Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Compressor Condensing Unit 2 (97CCU80302) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected FCP to HCP.	Verify Fire Alarm Control Panel Emergency Shutdown signal from FCP to HCP. No local SCADA interlock
Headworks Facility Makeup Air Unit 1 SIGNAL FAIL	Headworks Facility Makeup Air Unit 1 (59MAU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Makeup Air Unit 2 SIGNAL FAIL	Headworks Facility Makeup Air Unit 2 (59MAU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Makeup Air Unit 1 SIGNAL FAIL	Membrane Facility Makeup Air Unit 1 (64MAU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Makeup Air Unit 2 SIGNAL FAIL	Membrane Facility Makeup Air Unit 2 (64MAU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Makeup Air Unit 3 SIGNAL FAIL	Membrane Facility Makeup Air Unit 3 (64MAU80303) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Solids Handling Facility Makeup Air Unit 1 SIGNAL FAIL	Solids Handling Facility Makeup Air Unit 3 (78MAU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.

ALARM	MEANING	RESPONSE OR ACTION
Maintenance Facility Makeup Air Unit 1 SIGNAL FAIL	Maintenance Facility Makeup Air Unit 1 (97MAU80301) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Maintenance Facility Makeup Air Unit 2 SIGNAL FAIL	Maintenance Facility Makeup Air Unit 2 (97MAU80302) SIGNAL FAIL detected on SCADA.	Verify signal fail alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Makeup Air Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Headworks Facility Makeup Air Unit 1 (59MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Makeup Air Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Headworks Facility Makeup Air Unit 2 (59MAU80200) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Makeup Air Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Makeup Air Unit 1 (64MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Makeup Air Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Makeup Air Unit 2 (64MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Membrane Facility Makeup Air Unit 3 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Makeup Air Unit 3 (64MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Solids Handling Facility Makeup Air Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Solids Handling Facility Makeup Air Unit 3 (78MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Maintenance Facility Makeup Air Unit 1 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Makeup Air Unit 1 (97MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Maintenance Facility Makeup Air Unit 2 FIRE ALARM EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Makeup Air Unit 2 (97MAU80100) FIRE ALARM EMERGENCY SHUTDOWN SIGNAL detected from FCP to HCP.	Verify Fire Alarm Emergency Shutdown Signal alarm on SCADA coincides with HCP alarm. Inspect HCP.
Headworks Facility Exhaust Fan SIGNAL FAIL	Headworks Facility Exhaust Fan 1 (59EXF80100) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Membrane Facility Exhaust Fan SIGNAL FAIL	Membrane Facility Exhaust Fan 1 (64EXF80201) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Membrane Facility Exhaust Fan SIGNAL FAIL	Membrane Facility Exhaust Fan 2 (64EXF80202) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.

ALARM	MEANING	RESPONSE OR ACTION
Solids Facility Exhaust Fan SIGNAL FAIL	Solids Facility Exhaust Fan 1 (64EXF80201) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Solids Facility Supply Fan SIGNAL FAIL	Solids Facility Supply Fan 1 (64SUF80201) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Solids Facility Supply Fan SIGNAL FAIL	Solids Facility Supply Fan 2 (64SUF80202) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 1 SIGNAL FAIL	Maintenance Facility Exhaust Fan 1 (64EXF80201) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 2 SIGNAL FAIL	Maintenance Facility Exhaust Fan 2 (64EXF80202) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 3 SIGNAL FAIL	Maintenance Facility Exhaust Fan 3 (64EXF80203) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 4 SIGNAL FAIL	Maintenance Facility Exhaust Fan 4 (64EXF80204) has detected SIGNAL FAIL from the HCP to SCADA	Verify common alarm Fail signal from HCP to SCADA.
Headworks Facility Exhaust Fan FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Headworks Facility Exhaust Fan 1 (59EXF80100) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Membrane Facility Exhaust Fan FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Exhaust Fan 1 (64EXF80201) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Membrane Facility Exhaust Fan FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Membrane Facility Exhaust Fan 2 (64EXF80202) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Solids Facility Exhaust Fan FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Solids Facility Exhaust Fan 1 (64EXF80201) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Solids Facility Supply Fan FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Solids Facility Supply Fan 1 (64SUF80201) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Solids Facility Supply Fan FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Solids Facility Supply Fan 2 (64SUF80202) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 1 FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Exhaust Fan 1 (64EXF80201) has detected FIRE ALARM CONTROL PANEL	Verify common alarm Fail signal from HCP to SCADA.

ALARM	MEANING	RESPONSE OR ACTION
	EMERGENCY SHUTDOWN SIGNAL.	
Maintenance Facility Exhaust Fan 2 FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Exhaust Fan 2 (64EXF80202) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 3 FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Exhaust Fan 3 (64EXF80203) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Maintenance Facility Exhaust Fan 4 FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL	Maintenance Facility Exhaust Fan 4 (64EXF80204) has detected FIRE ALARM CONTROL PANEL EMERGENCY SHUTDOWN SIGNAL.	Verify common alarm Fail signal from HCP to SCADA.
Headworks Facility Relief Damper 1 EMERGENCY OPEN DAMPER	Headworks Facility Relief Damper 1 (59REL80901) EMERGENCY OPEN DAMPER signal from FCP	Verify Headworks Facility Relief Damper 1 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Headworks Facility Relief Damper 2 EMERGENCY OPEN DAMPER	Headworks Facility Relief Damper 2 (59REL80902) EMERGENCY OPEN DAMPER signal from FCP	Verify Headworks Facility Relief Damper 2 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Headworks Facility Relief Damper 3 EMERGENCY OPEN DAMPER	Headworks Facility Relief Damper 3 (59REL80903) EMERGENCY OPEN DAMPER signal from FCP	Verify Headworks Facility Relief Damper 3 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Headworks Facility Relief Damper 4 EMERGENCY OPEN DAMPER	Headworks Facility Relief Damper 4 (59REL80904) EMERGENCY OPEN DAMPER signal from FCP	Verify Headworks Facility Relief Damper 4 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Membrane Facility Relief Damper 1 EMERGENCY OPEN DAMPER	Membrane Facility Relief Damper 1 (64REL80901) EMERGENCY OPEN DAMPER signal from FCP	Verify membrane Facility Relief Damper 1 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Solids Facility Relief Damper 1 EMERGENCY OPEN DAMPER	Solids Facility Relief Damper 1 (78REL80901) EMERGENCY OPEN DAMPER signal from FCP	Verify Solids Facility Relief Damper 1 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Solids Facility Relief Damper 2 EMERGENCY OPEN DAMPER	Solids Facility Relief Damper 2 (78REL80902) EMERGENCY OPEN DAMPER signal from FCP	Verify Solids Facility Relief Damper 2 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Solids Facility Relief Damper 3 EMERGENCY OPEN DAMPER	Solids Facility Relief Damper 3 (78REL80903) EMERGENCY OPEN DAMPER signal from FCP	Verify Solids Facility Relief Damper 3 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Maintenance Facility Relief Damper 1 EMERGENCY OPEN DAMPER	Maintenance Facility Relief Damper 1 (78REL80901) EMERGENCY OPEN DAMPER signal from FCP	Verify Maintenance Facility Relief Damper 1 EMERGENCY OPEN DAMPER Signal from FCP. No Local-SCADA Interlock.
Headworks Facility HIGH Room Temperature Alarm for MAU 1	Instrument (59TIT81100) has detected Headworks Facility HIGH Room Temperature for MAU 1 Evaporator Cooling Mode.	Verify visible alarms at SCADA. Inspect MAU.

ALARM	MEANING	RESPONSE OR ACTION
Headworks Facility HIGH Room Temperature Alarm for MAU 2	Instrument (59TIT81200) has detected Headworks Facility HIGH Room Temperature for MAU 2 Evaporator Cooling Mode.	Verify visible alarms at SCADA. Inspect MAU.
Membrane Facility HIGH Room Temperature Alarm for MAU 1	Instrument (64TIT81000) has detected Membrane Facility HIGH Room Temperature for MAU 1 Evaporator Cooling Mode.	Verify visible alarms at SCADA. Inspect MAU.
Solids Facility HIGH Room Temperature Alarm for MAU 1	Instrument (78TIT81100) has detected Solids Facility HIGH Room Temperature for MAU 1 Evaporator Cooling Mode.	Verify visible alarms at SCADA. Inspect MAU.
Maintenance Facility HIGH Room Temperature Alarm for MAU 1	Instrument (97TIT81100) has detected Maintenance Facility HIGH Room Temperature for MAU 1 Evaporator Cooling Mode.	Verify visible alarms at SCADA. Inspect MAU.

Administration and staffing

Overview

The CH2M HILL Spokane County RWRF staffing plan addresses facility needs to perform in the most effective and efficient manner while maintaining compliance with all local, state, federal, and safety standards. A copy of the NPDES permit will be kept in the operations control room allowing access to the operations staff at all times. All key staff members will be familiar with its content.

Assumptions and conclusions

The following assumptions regarding operations and maintenance (O&M) are made to provide the best service to Spokane County:

- The staff is empowered to perform the duties of their positions in a professional and expeditious manner.
- The staff is cross-trained and not limited to strict job descriptions. For example, the operations staff is expected to assist with performing general maintenance and preventive maintenance. Likewise, the maintenance staff is expected to assist with facility operations.
- All operations staff positions have the ability and knowledge to assist with laboratory sample collection and are trained in process control laboratory analysis.

Shift Schedule

Although the facility is designed with complete automation and control, which includes remote access through notebook computers, this plan requires personnel on-site seven days per week and an on-call operator when the facility is not staffed. This coverage is necessary for two reasons. First, daily oversight reduces the City's and public's risk of water quality problems that can arise from an unattended facility. Additionally, an on-call operator decreases facility vulnerability and offers rapid notification of off-site facility staff in case of an emergency.

The staffing plan involves 8-hour operator shifts and a 40-hour workweek. Weekend/holiday shifts are staffed by an operator with certification of at least Grade I who monitors and maintains plant production activities. An operator with a certification of at least Grade III will be in responsible charge for all regularly scheduled shifts. This includes weekend/holiday shifts where the operator in responsible charge can be off site

as long as they have remote access to the SCADA system and the ability to respond to the site if needed. All non-emergency process changes and normal plant maintenance are performed during weekday shift hours. If necessary a staggered shift may be enacted to meet operational needs more effectively. All process decisions are to be made by an operator with a certification of at least a Grade III.

The plant design has built-in redundancies available to the operations staff, which allows equipment shutdown and standby equipment startup with no impact to the facility's ability to produce permit quality effluent. These redundancies support the decision of an on-call operator for after-hours monitoring rather than staffing the facility 24 hours per day, 7 days per week.

Staffing currently consists of a Project Manager, Operations Supervisor, Maintenance Supervisor, Lead Operator, (3) Operators, Laboratory Analyst, IPP Specialist, and (2) Mechanics 8 hours per day, 7 days per week. Staff is not limited to the type of responsibilities that are assigned and more than one position can be filled by one individual (i.e. the Lead Operator can also be the IPP Specialist).

Staff Responsibilities

Job descriptions and responsibilities for each staff member are listed below. These offer a brief overview of the responsibilities for each staff position. As noted above, the staff is not limited to the type of responsibilities that are assigned and is expected to be cross-trained in all aspects of facility operation.

Project Manager

(WA Wastewater Group IV)

The Project Manager is in charge of day-to-day operations and maintenance of the facility and performs the following duties:

- Holds and maintains state wastewater operator certification (WA Grade IV or higher);
- Determines and sets production rates;
- Determines facility process operating strategies;
- Supervises facility staff;
- Determines shift assignments;
- Determines maintenance needs and schedules accordingly;
- Compiles and submits records and reports;
- Maintains facility safety program;

- Prepares, supervises and manages the annual budget;
- Determines and maintains facility treatment chemical inventory;
- Determines and maintains facility equipment spare parts;
- Directs and maps operations of the facility's supervisory control and data acquisition/programmable logic controller (SCADA/PLC).

Maintenance Supervisor

The Maintenance Supervisor reports directly to the Project Manager and is responsible for facility equipment maintenance and repair. Under supervision, the Maintenance Supervisor performs the following duties:

- Maintains the facility's computerized maintenance management system (CMMS);
- Schedules facility preventative maintenance (PM) tasks;
- Maintains the facility equipment spare parts inventory;
- Oversees and monitors instrumentation and control (I&C), electrical, and landscaping contractors;
- Performs various equipment repairs;
- Maintains field instrument calibrations;
- Oversees SCADA/PLC maintenance and upgrades;
- Assists with preparing the annual maintenance budget.

Operations Supervisor

(WA Wastewater Group III)

The Operation Supervisor assists the Project Manager with daily facility operations. Under supervision, the Operation Supervisor performs the following duties:

- Holds and maintains state wastewater operator certification (WA Grade III or higher);
- Performs as acting Project Manager when required;
- Sets and monitors production rates;
- Sets and monitors facility processes;
- Performs process control water quality tests;
- Performs scheduled preventive maintenance tasks;

- Performs general equipment inspections and cleaning;
- Assists with preparing facility records and reports;
- Performs special facility projects as required;
- Supports the Maintenance Supervisor in repairing facility equipment;
- Performs general housekeeping duties in process/equipment areas and the maintenance shop area;
- Maintains spare parts storage areas and assists with parts inventory;
- Performs other duties as assigned.

Lead Operator

(WA Wastewater Group III)

The Lead Operator assists the Operation Supervisor and the Project Manager with daily facility operations. Under direct supervision, the Lead Operator performs the following duties:

- Holds and maintains state wastewater operator certification (WA Grade III or higher);
- Performs as acting Operations Supervisor when required;
- Sets and monitors production rates;
- Sets and monitors facility processes;
- Performs process control water quality tests;
- Performs scheduled preventive maintenance tasks;
- Performs general equipment inspections and cleaning;
- Assists with preparing facility records and reports;
- Performs special facility projects as required;
- Supports the Maintenance Supervisor in repairing facility equipment;
- Performs general housekeeping duties in process/equipment areas and the maintenance shop area;
- Maintains spare parts storage areas and assists with parts inventory;
- Performs other duties as assigned.

Operator (3 Positions)

(WA Wastewater Group I-III)

The Operator assists the Project Manager, Lead Operator and Operations Supervisor with daily facility operations. Under direct supervision, the Operator performs the following duties:

- Sets and monitors production rates;
- Sets and monitors facility processes;
- Performs process control water quality tests;
- Performs scheduled PM tasks;
- Performs general equipment inspections and cleaning;
- Assists with preparing facility records and reports;
- Performs special facility projects as required;
- Supports the Electrical/Mechanical Technician in repairing facility equipment;
- Performs general housekeeping duties in process/equipment areas and the maintenance shop area;
- Maintains spare parts storage areas and assists with parts inventory;
- Performs other duties, as assigned.

Laboratory Analyst

(WA Wastewater Group III)

The Laboratory Analyst position is a position focusing on the organization and quality of the laboratory analytical testing. Under direct supervision, the laboratory analyst position performs the following duties:

- Conducts analysis according to specified methodology;
- Conducts the required amount of quality control tests;
- Checks results to ensure the analytical process is correct;
- Investigates, identifies, and corrects causes of errors; also, takes immediate corrective action when the process is not within normal operating parameters;
- Administers CH2M HILL's intra-laboratory quality control plans as routine in-house activity to ensure the integrity and validity of analytical data;
- Trains personnel in quality control procedures;
- Reviews data prior to reporting to the Project Manager;

- Determines the precision and accuracy of analytical results based on the quality control information provided by the individual analyst;
- Provides a permanent record of instrument and analyst performance as a basis for evaluating data;
- Evaluates and discusses the results of the quality control program with the individuals involved;
- Takes appropriate corrective action when an analytical discrepancy is noted or other concern exists;
- Maintains and provides upon request quality control charts and graphs.

Mechanic (2 Positions)

The Mechanic will assist the Maintenance Supervisor with daily facility operations and maintenance. The Mechanic is a position with the understanding the employee will work towards and receive operator certification. Under direct supervision, the Mechanic performs the following duties:

- Performs general equipment inspections and cleaning;
- Assists in process control water quality tests;
- Assists in scheduled preventive maintenance tasks;
- Performs special facility projects as required;
- Supports the Maintenance Supervisor in repairing facility equipment;
- Performs general housekeeping duties in process/equipment areas and the maintenance shop area;
- Maintains spare parts storage areas and assists with parts inventory;
- Performs other duties as assigned.

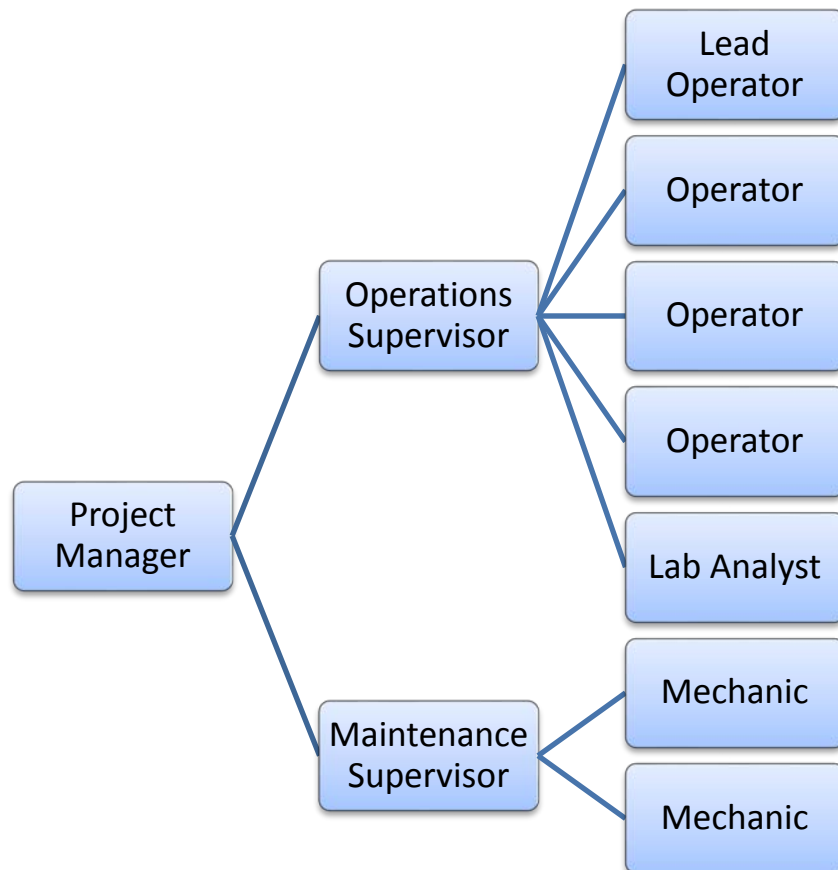
IPP Specialist

The IPP Specialist organizes and maintains the Industrial Pretreatment Program as set by the County of Spokane. The IPP Specialist assists the IPP director in other tasks as requested. Under direct supervision, the IPP Specialist performs the following tasks:

- Maintains the Industrial Pretreatment Program's computerized database system;
- Reviews monitoring reports submitted by the industries;
- Conducts required industry inspections;
- Conducts required industry samplings;
- Maintains a record of industry correspondences;
- Performs other duties as assigned.

All employees are encouraged to enter the Operations program and obtain an Operator-in-Training certificate. Pursuit of certification, along with continued cross training, will provide employees with a better understanding of the Spokane County Regional Water Reclamation Facility process and control procedures as well as the interaction of the various jobs.

Spokane County RWRF Organization Chart



Sampling and Reporting Plan

Sampling Objective

The purpose of sampling is to collect a representative aliquot of sample and handle it so that no significant change in composition occurs before testing. To meet this objective, it is imperative to establish sampling protocols for each analyte of interest.

Sampling Locations

The following locations will be the primary sampling locations for process control and compliance reporting:

- Headworks (INF-001) samples to be taken after screening
- Primary Clarifier effluent (PRI-001)
- Aeration Basin x 4 points (AB-001)
- Plant Effluent after disinfection and de-chlorination (EFF-001)
- Dewatered Sludge Effluent (Dry Cake) X 2 (DSE-001)

The following constituents will be monitored for process control and permit compliance purposes:

- | | |
|----------------------------|-----------------------------|
| • Flow | • Nitrogen, Total (as N) |
| • BOD | • Total Residual Chlorine |
| • Total Suspended Solids | • Metals |
| • Settable Solids | • Total Phosphorus |
| • Total Coliform | • Total Kjeldahl Nitrogen |
| • pH | • Orthophosphate |
| • Temperature | • Cyanide |
| • Dissolved Oxygen | • Mercury |
| • Alkalinity/Volatile Acid | • COD |
| • Turbidity | • Volatile Suspended Solids |
| • TOC | |
| • Ammonia, Total (as N) | |
| • Nitrate-N | |
| • Nitrite-N | |

Frequency of Testing

Frequency of testing will be determined by process control needs, permit regulations, and other information to be determined. Constituents that are permit-required but sampled more frequently than permit requirements are reported to the regulatory agency. For example, phosphorus is included in the General Minerals section of the permit and is required to be analyzed at a specified frequency. If phosphorus is tested more frequently, all phosphorus results will be reported to the regulatory agency regardless of permit requirements for frequency. This method of practice prevents the illusion of “selective sampling” or “cherry picking” the results. This procedure is applicable to all permit compliance constituents.

Analysis required to be conducted to demonstrate compliance with an applicable law or the occurrence of an “uncontrollable circumstance” must be conducted by a laboratory certified by the appropriate governmental agency, i.e. Washington State Department of Ecology (DOE). All testing provided by this laboratory is performed in accordance with Standard Methods or other governmental body-approved procedures.

Sampling Procedures and Equipment

The purpose of sampling is to collect a representative aliquot of sample and handle it so that no significant change in composition occurs before testing. To meet this objective, it is imperative to establish sampling protocols for each analyte of interest.

It should be noted that all NPDES/Compliance monitoring and testing requirements shall be conducted at a laboratory certified for such analyses by the Washington State Department of Ecology.

This section contains the requirements for the following:

- Sample site selection
- Sample types
- Sample containers, preservation methods and maximum holding times
- Sampling equipment
- Cleaning procedures for containers and equipment
- Calibration of instrument measurements
- Sampling protocols
- Automatic and manual sampling
- Special sample collection handling techniques.

Site Selection

Sample collection sites are selected based on program objectives, analytical parameters of interest, permit requirements, sample types and obtaining representative sample flow. Samples collected for the laboratory are either routine or non-routine in nature. Routine samples are selected to represent water quality before, during, and after the treatment process. Sampling frequency is based on the following:

- Natural and unnatural occurrences that cause water quality changes in the source waters
- What is necessary to control the treatment processes
- What is required to describe the water quality in the distribution system
- What is necessary to meet federal and state regulations.

Sample Types

Most samples collected within the treatment system are grab (or discrete) samples. These samples are collected at a particular time and place and represent the composition of the water at that time and place. The frequency of sampling necessary to describe the parameters of interest or to control the treatment process is a function of the expected source variability. Often additional samples are collected when evidence indicates greater variability or unexpected changes.

A composite sample is a series of discrete samples taken during a period of time that are mixed and treated as one sample. Composite samples can be collected as flow or time proportional or taken at several sample points mixed to make one sample for analysis. Typically, composite samples taken for CH2M HILL projects are flow proportional during a set time period such as 8 or 24 hours. The type selected must conform exactly to permit/regulatory requirements specific to each site.

Composite samples at the Spokane County RWRF are flow proportioned.

Analysis of composite samples are restricted to components shown to be stable over time and do not exceed the sample holding times given in the latest approved Standard Methods edition.

Sample Containers, Preservation Methods, and Maximum Holding Time

Located at the end of this document, **Table 1** lists the requirements for sample containers, preservation procedures, and the maximum holding times for specific analytes. The table's notes and key are located at the end of the table.

Sampling Equipment

Sampling equipment varies depending on the nature and location of the sample.

Located at the end of this document, **Table 2** lists the equipment types and construction materials, samples types and permissible parameters, which can be analyzed from the sample.

Cleaning Procedures for Containers and Equipment

These procedures have been designed to chemically clean equipment and sample containers for a specific parameter group. In most cases, the laboratory analyses are conducted to determine trace amounts of requested compounds exist. Therefore, detergent types, cleaning solvents, and cleaning equipment have been specified, and all procedures must be strictly followed to eliminate sample contamination by the sample bottles. When practical certified pre-cleaned bottles will be purchased and utilized for sample collection. If bottles are to be reused they shall be cleaned in the following manner:

Nutrients, Demands, Nonmetal Analysis, and Radiological

Bottle type: Plastic or glass, minimum 250 milliliters (mL) size

Soap: Sparkleen or equivalent (phosphate and ammonia free)

- Wash bottles and caps in hot, soapy water; rinse liberally with water until soap suds are no longer present.
- Rinse bottles and caps with 1 + 1 hydrochloric acid. Rinse with deionized water at least three to five times.
- Drain, air dry and store tightly capped until used.

Metals

Bottle type: 1-liter plastic bottle and lid

Soap: Metal free, Sparkleen or equivalent

- Rinse bottles and caps five times with tap water or until suds are gone.
- Rinse bottles and caps with 1 + 1 hydrochloric acid. Rinse with tap water.
- Rinse all components with 1 + 1 nitric acid. Rinse three times with liberal amounts of deionized water.
- Drain bottles, air dry and cap tightly until used.

Purgeable Organics (Volatile Organic Solvents)

Bottle type: 40-mL glass vials or 100-mL glass bottles with Teflon lined septum:

- Wash caps, liners, and vials in same detergent as organics
- Rinse liberally with tap water and deionized water

- Rinse with pesticide grade isopropanol
- Dry caps, septa, and vials in oven at 105°C for at least 60 minutes
- Cool in an inverted position and cap immediately after bottles are cool enough to handle

Extractable Organics

Bottle type: 1-liter narrow necked glass bottle with Teflon lined caps (Plastic bottles and plastic or rubber lined caps are not acceptable.)

Soap: Sparkleen or equivalent (Do not use liquid or powdered detergent that has been stored in plastic containers.)

- Wash bottles and caps in hot soapy water. Do not use brushes with rubber or plastic parts. The use of gloves while washing or rinsing organic bottles is not recommended as they can be a source of contamination.
- Rinse bottles and caps five times with tap water or until suds are gone.
- Rinse each bottle with 10 mL of pesticide grade isopropanol. Cap tightly and shake approximately 10 seconds.
- Rinse with organic-free water. There should be no isopropanol odor in the bottle. This means rinsing at least five times.
- Drain bottles, air dry and cap until used.

Auto-sampler Strainer and Sample Tubing

Generally sample tubing will not be cleaned it shall be replaced with new NSF approved tubing. In the rare event that the tubing needs to be cleaned the following procedures shall be employed:

- Remove suction hose and strainer from sample port. Remove debris from strainer. With pump running, flush strainer and tubing with tap water in a clean container.
- Use the auto-sampler pump to draw at least 1 liter of detergent water and/or 1 + 10 hydrochloric acid through tubing. Stop pump. Let solution(s) remain in tubing for 15 to 20 minutes. Follow with 1 to 2 liters of tap water.
- Final rinse should be with 2 to 3 liters of deionized water.
- Restore strainer and tubing to operating position.
- Label/record when (date) washed.

Teflon Bailer

The cleaning procedures are geared toward taking organic samples:

- Wash exterior and interior of bailer with hot, soapy water. (Use Alconox or

equivalent)

- Rinse liberally with tap water until no soap remains (five to seven times)
- Rinse interior and exterior with 1 + 1 Nitric Acid followed by a tap water rinse
- Rinse interior and exterior with pesticide grade isopropanol
- Final rinse is with organic free water (five times)
- Note: While some handling is unavoidable, the bailer should be handled as little as possible
- Drain and wrap in clean, white butcher paper or aluminum foil. Secure with tape, date and initial with date cleaned

Well Sounders or Tapes Used to Measure Groundwater Levels

- Wash with laboratory detergent and hot tap water
- Rinse with tap water
- Rinse three times with analyte - free water
- Place equipment in a polyethylene bag or wrapped with polyethylene film to prevent contamination during storage and transit

Sampling Protocols

A sample for laboratory analyses is based on the assumption that the sample obtained is representative of the whole, which is being measured. This idea is most important, because if the sample is not truly representative, all subsequent conclusions, decisions, and actions will be affected by the errors in sampling. Samples must be collected so that nothing is added or lost, and that no changes occur during the time between collection and laboratory examination. The design and successful operation of any water reclamation facility is dependent upon the results of laboratory analyses. Sampling is one of the most crucial steps, and the one that typically introduces the greatest amount of error in the operation.

The validity of the laboratory analyses will depend upon the attention paid to the following details:

- Ensure the sample and sampling point are representative of the nature and flow of the matrix to be tested.
- Use correct sampling techniques.
- Use the correct sample container and, if applicable, preservative.

The following procedures will be employed by CH2M HILL personnel in the collection of samples for laboratory analysis:

Sample Ports

As part of sample collection, the location for pulling the sample, the materials of construction, and the proper protocol for use need to be considered. The sample location impacts the sample's ability to be representative of the general flow.

The following questions should be asked prior to determining sample collection:

- Is the sample being drawn from the middle, top, or bottom of the pipeline
- Is it very difficult to obtain a sample representative of the flow because the tap is connected to the main through a large diameter dead-end

Construction materials can result in sample contamination. Copper plumbing can contribute copper to the sample. Plastics can contribute plasticizers as well as other organic compounds causing false positives or method interference. Sampling protocol described later in this plan must be followed.

Distribution Sample Taps

Before collection of a sample from a distribution system sampling tap, the line must be flushed sufficiently to ensure that the sample is representative of the supply. The diameter, velocity of flow, and length of the line is considered in determining the length of time for a sufficient flush. Also, the temperature and/or the chlorine residual are good indications of how long flushing should be continued before sampling. When samples are collected from residential systems, the instructions provided with the sample bottle must be closely followed. If the faucet or tap has an aerator, it should be removed before collecting the sample.

Automatic and Manual Sampling

Automatic Samplers

Automatic samplers are used to collect composite samples or grab samples that are required to be collected repeatedly at short intervals. The samplers are designed to be programmable and will automatically collect and chill samples from a liquid source. They are generally appropriate for collection of samples for general wet chemistry, metals, and toxic pollutant analysis. In composite mode, samples may be collected in a single, large container with each subsequent volume collected being mixed with the previous volumes. In the discrete mode, up to 24 samples may be collected at intervals and deposited into individual glass or plastic bottles. The sample container or bottles are located either in a refrigerated cabinet or, in the case of portable samplers, in an insulated, double-walled base section, which is an integral part of the sampler. Portable samplers must have ice placed in the sample compartment or be a refrigerated unit to maintain temperature (document temperatures in logbook).

~~Samples are collected with either a time or flow proportional protocol when used in conjunction with a flow meter. In the time mode, the interval between samples is controlled by an internal clock with the interval set by the sampling personnel. Generally, the interval may be set from 1 to 9,999 minutes in one-minute increments.~~

In the flow-proportioned mode, the interval may be set from 1 to 9,999 flow pulses, in one-pulse increments, where each pulse represents a specific flow volume. In both modes, the sampler will usually display the number of minutes or a pulse remaining until the next sample is collected.

Two categories of samples are commonly used - flow-through models and models that draw up the sample volume using either a peristaltic or a vacuum pump. The type of system will determine the maintenance required to ensure that they are in proper working order.

Manual Sampling

Manual sampling is typically used for the collection of grab samples and/or for immediate field measurements. In some circumstances, i.e. when automatic samplers are out of service, manual sampling is used to collect composite samples.

The best method to manually collect a sample is to use the sample container that will be used to transport the sample to the laboratory. This eliminates possible contamination of the sample with an intermediate collection container. The actual sampling container must always be used for oil and grease and bacterial analyses.

Samples are manually collected by completely submersing the sample container under water in an inverted position and returning it to an upright position while it is still submerged. The container must be pointed facing upstream. The container should be rinsed utilizing this procedure several times before the sample is collected except in the case of oil and grease and bacteria samples, which requires no rinsing. If the water is shallow or preservatives have been added to the sample container, samples should be collected using a glass or Teflon dipper. Care must be taken not to bias the sample by collecting from the top of a body of water. The sampler should be aware that the most desirable sampling location is a well-mixed zone.

Special Sample Collection Handling Techniques

These procedures give details of sample collection and handling techniques by analyte category. Requirements for container and preservation are given in **Table 1**, which is located at the end of this section.

Bacterial

Samples for bacterial analysis must always be collected directly into the prepared glass or plastic container. The sample container should be kept unopened until it is to be filled. The amount of sample taken must leave a 1-inch air space in the container. Care is taken to protect the sample from contamination. This includes making sure the sample tap is clean and permitting only the sample to contact the

Potable Water

Samples are collected directly into the appropriate container after the water system has been purged for a suitable length of time. The bottle is held in one hand and the cap in the other, using care not to touch the inside of the cap. The faucet should not touch the inside or the lip of the bottle. When sampling at a water treatment plant, samples are collected from both the raw water supply and the finished product.

Soil Samples

Soil samples are collected in accordance with US EPA Standard Operating Procedures Quality Assurance Manual methodology. A well-mixed composite sample is collected and placed into a wide-mouthed sample container with a Teflon lid. The samples are then refrigerated for transit.

Sludge Samples

The collection technique used for sludge samples is dependent on the solids concentration of the material. If in liquid form, the sludge will be sampled similarly to water. If in solid form, soil sampling techniques will be used.

Purgeable Organics

Collect grab samples in 40 mL septum vials. The procedure for filling and sealing sample containers is as follows:

- Slowly fill each container to overflowing.
- Carefully set the container on a level surface.
- Place the septum Teflon side down on the convex sample meniscus.
- Seal the sample with the screw cap.
- Invert the sample and lightly tap the lid on a solid surface to ensure that the sample has been properly sealed. The absence of entrapped air bubbles indicates a proper seal.
- If air bubbles are present, open the bottle, add additional sample, and reseal in the same manner as stated above.
- The sample must remain hermetically sealed until it is analyzed.
- Maintain samples at 4°C (39°F) during transport and storage prior to analysis.

If the sample is taken from a water tap, turn on the water and permit the system to flush. When the temperature of the water has stabilized, adjust the flow to about

500 mL/minute and collect samples as outlined above.

Extractable Organics

Collect grab samples in glass containers. Conventional sampling practices should be followed except that the bottle must not be pre-washed with the sample before

~~collection. Composite samples should be collected in refrigerated glass containers in~~ accordance with the requirements of the program. Automatic sampling equipment must be free of tygon or other potential sources of organic contamination.

Metals

Samples requesting metal analysis using US EPA methods published in *Methods for Chemical Analysis of Water and Wastes, US EPA 600/4-79-020*, revised March 1983, require special treatment depending on whether the analysis is for dissolved metals, suspended metals, total metals, or total recoverable metals.

Dissolved Metals

The sample must be filtered through a 0.45 micron membrane filter as soon as possible after collection, and the filtrate must be acidified with 1:1 redistilled nitric acid to a pH of less than 2. If hexavalent chromium is to be included in the analysis, a portion of the filtrate should be transferred to another container before acidification and analyzed as soon as possible.

Suspended Metals

The unpreserved sample must be filtered through a 0.45 micron membrane filter, and the filter is retained for analysis.

Total Metals

Samples are acidified with redistilled nitric acid to a pH of less than 2.0 at the time of sample collection.

Samples for trace metal analysis are preserved with nitric acid to a pH of 2 or less. For samples collected in the field, the acid is added as soon as possible after the sample is received in the laboratory.

Sample Transportation

It is essential that the samples are kept cold from the time of collection until received at the laboratory. This is best done by keeping the samples in an ice chest cooled by sufficient reusable freezing gels, "Blue Ice," or ice contained in plastic bottles rather than loose ice to keep the temperature close to 4°C. Samples must not be placed directly in ice, since the ice may melt and contaminate the sample.

Field Quality Control Blanks

Blank samples are introduced into the laboratory analyses at a recommended frequency of once per quarter. This frequency is chosen as a means to control and evaluate the level of contamination and variability of results contributed by potential interference arising at any point in the measurement process. For field sample collection activity, the types of blank samples are equipment, field, and travel blanks, which are defined below. They are designed to measure:

- The integrity of the sample container and sample equipment cleaning
- The actual sample collection process
- The purity of sample preservation or additive reagents

• The influence of site environmental conditions (contamination) 1E SAMPLING AND REPORTING PLAN/LABORATORY QA/QC PLAN

- Cross-contamination of samples
- Indeterminate artifacts introduced during the transport of samples, sample and shipping containers, sample preservatives, cleaning agents, and sampling equipment

Equipment, field, and travel blanks are required at a minimum rate of 5 percent per parameter group per day. These blanks must be composed of the same source water.

Equipment (Rinsate) Blank

The equipment (rinsate) blank is designed to address cross-contamination in the field between sample sources to address deficient field cleaning procedures. This blank also addresses field preservation procedures, environmental site interference, integrity of the source blank for field cleaning, and those concerns raised by the travel blank.

An equipment (rinsate) blank is prepared for each parameter group sampled where a particular piece of sampling equipment is employed for sample collection and is subsequently decontaminated in the field for use in additional sampling. The equipment blank is composed in the field by collecting in the appropriate container for the parameter group a blank water rinse from the equipment (bailer, pump tubing, spoon, auger, corer, etc.) after execution of the last step of the proper field decontamination protocol. Preservatives or additives must be added to the equipment blank when appropriate for the parameter group.

Field Blank

Field blanks are used to evaluate the sample container filling procedure, the effects of environmental contaminants at the site, the purity of preservatives or additives, and those concerns raised by the travel blank.

Field blanks are composed on-site in the field by filling sample containers (appropriate for the parameter group) using fresh, source blank water. Preservatives or additives are added, if necessary, and the blank sample container is then sealed. The field blank is then grouped, transported and stored with the actual samples collected for the same parameter group.

Travel (Trip) Blank

The travel blank is designed to address interferences derived from improper sample container cleaning preparation, contaminated source blank water, sample cross-contamination during storage or transport, and extraneous environmental conditions affecting the sampling event to and from the site, including delivery to the analytical laboratory.

Travel blanks are composed in the appropriate sample container using source blank water. Preservatives or additives are added, if required, for that parameter group.

~~Travel blanks are then sealed and stored in the ice chest where actual samples are~~ stored and transported. Travel blanks must originate at the facility providing the blank water for the equipment and field blanks.

Data Handling and Recordkeeping

To obtain meaningful data, the sample collector must obtain a representative sample and deliver it unchanged for analysis. The analyst must perform the proper analysis in the prescribed fashion, complete calculations, and convert the results to the final form for permanent recording in exact terms.

Records are an integral part of the quality assurance program. They provide documented evidence that the program is functioning. Also, they provide the necessary information for performance evaluation and quality assurance audits. (Sloppy records and poor maintenance records are likely to reflect poor quality control in other areas of the laboratory operation.)

Although, inadvertent errors in data processing cannot be eliminated, they can be minimized. The following list represents common errors encountered in laboratory operations.

- Improper identification of samples
- Mistakes in reading instrument data or volumetric measurements
- Mistakes in recording data such as transposition of digits and incorrect location of decimal points
- Errors in calculating results
- Mistakes in transposing data between records

Significant Figures

To indicate the uncertainty in a quantity, the correct number of significant figures must be selected. For instance, if a graduated cylinder is used to measure a certain volume of water, the reported result might be 41 mL, which is two significant figures.

If a burette is used, the result might be 42.21 mL, which is four significant figures. If the water is weighed on a top-loading balance, the result might be 41.206 mL, which is five significant figures. In each case, no fewer digits should be used and no more are justified.

Confusion may arise in the selection of significant figures where zeros are involved. To avoid ambiguity, remember that any zero needed to locate the decimal point is not a significant figure. Thus, 0.005 has one significant figure, but 2.0400 has five significant figures.

If possible, avoid rounding in calculations until the final answer is obtained. If needed, round to at least one digit more than the required significant figure until the final answer is obtained.

To determine how many significant figures for a calculation result, count the number

of significant figures found in the value with the smallest number of significant figures. For example, 81.2 million gallons (MG) of a substance is placed in a 1-liter volumetric flask diluted. Then 5.6 mL is pipetted with a transfer pipette. How does one express the mass that was pipetted? In the calculation, the weight is taken from a scale that measures to the nearest 0.1 MG, the volume is taken from a transfer pipette, which measures to the nearest .1 mL, and the original liter flask used to prepare the solution measures to the nearest .001 mL. The final answer, therefore, is given with two significant figures because the pipette measurement only has two significant figures.

Data Verification

To safeguard against errors in data processing, 10 percent of all generated data must be verified prior to reporting. Daily calculations must be checked by the analyst performing the analysis and by a second individual to ensure correctness. The individual rechecking calculations must initial the bench sheet once the data are checked on both the bench sheet and the computer input form. If, mistakes are found during the verification process, then all calculations for that day must be rechecked.

Bound Books

Reporting of data into loose or ring binder forms is a means of allowing easy addition of new sheets and removal of older data. The ease of addition or removal also permits loss or misplacement of sheets, mix-up in data sequence, and ultimately, questionable status of the data for formal display or presentation as courtroom evidence.

The use of bound books is an improvement in data recording that tends to result in a chronological sequence of data. Numbering of pages encourages the use of data in sequence and also aids in referencing data through a table of contents according to type of analysis, date, and book number. Sample validation can be strengthened by providing a space for the laboratory supervisor to witness the date, completion of analysis and verification of correct calculations.

CH2M provides each of its laboratories with bound and numbered bench sheets. Each sheet has an identification number, located in the lower left hand corner. This number is used for reordering bound books from the corporate office. All bound books are formatted to provide the following information:

- Method of analysis
- Instrument used
- Dates of collection and analysis
- Analyst identification
- Project and location identification
- Information on the analyte
- Analytical conditions and results
- Remarks
- Example of calculations, if applicable

To ensure that valid data are produced by the laboratory, it is essential that the results are reproducible, and the quality of the sample is measured accurately. As a part of the CH2M intra-laboratory analytical quality control program, the laboratory must develop precision and accuracy criteria for each parameter required. The data are gathered by using the following controls or checks:

- Blank - contamination
- Reference Standards - accuracy of the method
- Duplicate Samples - precision or repeatability
- Spike Samples - recovery

The precision and accuracy limits for each method should be updated quarterly. The US EPA recommends that 10 to 20 percent of analyses be for quality control purposes with 5 percent assigned to field QC.

Reporting

All raw data and final results are recorded by the analysts on the appropriate data forms or computerized reports directly from the instrument. These forms are reviewed by the respective supervisors and then filed in numerical order according to test parameters.

The results are recorded by the supervisor on the laboratory work sheet and submitted to the Facility Manager for approval. The enforcement of the entire QC program described in the QAQC plan is the criteria used to validate data from collection to reporting. This criterion includes:

- Chain-of-custody procedures
- Analyses of blanks
- Analyses of duplicates
- Check samples and spikes
- Monitoring of recoveries
- RPDs
- Internal and external audit

There are numerous factors that influence data, and each must be constantly monitored to ensure valid results.

To ensure valid data, constantly monitored the following:

- Sample preparation and treatment
- Analytical operations
- Calibration procedures
- Instrumental conditions and adjustments
- Data handling
- Calculations, corrections, adjustments to standard conditions, computer programs
- Statistical procedures used to report data
- Checks for internal consistency

TABLE 1

Requirements for Sample Containers, Preservation Procedures, and Maximum Sample Holding Times

TEST	CONTAINER (A)	PRESERVATION (B)	MAXIMUM HOLDING TIME (C)
Acidity	P, G	Cool, 4°C	14
Alkalinity	P, G	Cool, 4°C	14
Ammonia	P, G	Cool, 4°C H ₂ SO ₄ to pH<2	28 days
BOD	P, G	Cool, 4°C	48 hours
Coliform, Fecal and Total	P, G	Cool, 4°C 0.008 percent Na ₂ S ₂ O ₃	6 hours
Chlorine, Total Residual	P, G	None required	Analyze immediately
Cyanide, Total and Amenable	P, G	Cool, 4°C NaOH to pH>12 0.6g Ascorbic Acid	14 days
Dissolved Oxygen Probe	G bottle/top	None required	Analyze immediately
Winkler	G bottle/top	Fix onsite and store in dark	8 hours
Hardness	P, G	HNO ₃ to pH<2 or H ₂ SO ₄ to pH<2	6 months
Hydrogen Ion (pH)	P, G	None required	Analyze immediately
Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C H ₂ SO ₄ to pH<2	28 days
Metals (d)	P,G	Filter on site HNO ₃ to PH<2	6 months
Nitrate	P, G	Cool, 4°C	48
Nitrate-Nitrite	P, G	Cool, 4°C H ₂ SO ₄ to pH<2	28 days
Nitrite	P, G	Cool, 4°C	48
Orthophosphate	P, G	Filter onsite Cool, 4°C	48 hours
Phosphorous Total	P, G	Cool, 4°C H ₂ SO ₄ to pH<2	28 days
Residue, Total	P, G	Cool, 4°C	7 Days
Residue, Filterable	P, G	Cool, 4°C	7 Days
Residue, Non- filterable (TSS)	P, G	Cool, 4°C	7 Days
Residue, Settleable	P, G	Cool, 4°C	48 Hours
Residue, Volatile	P, G	Cool, 4°C	7 Days
Temperature	P, G	None Required	Analyze Immediately
Turbidity	P, G	Cool, 4°C	48 Hours

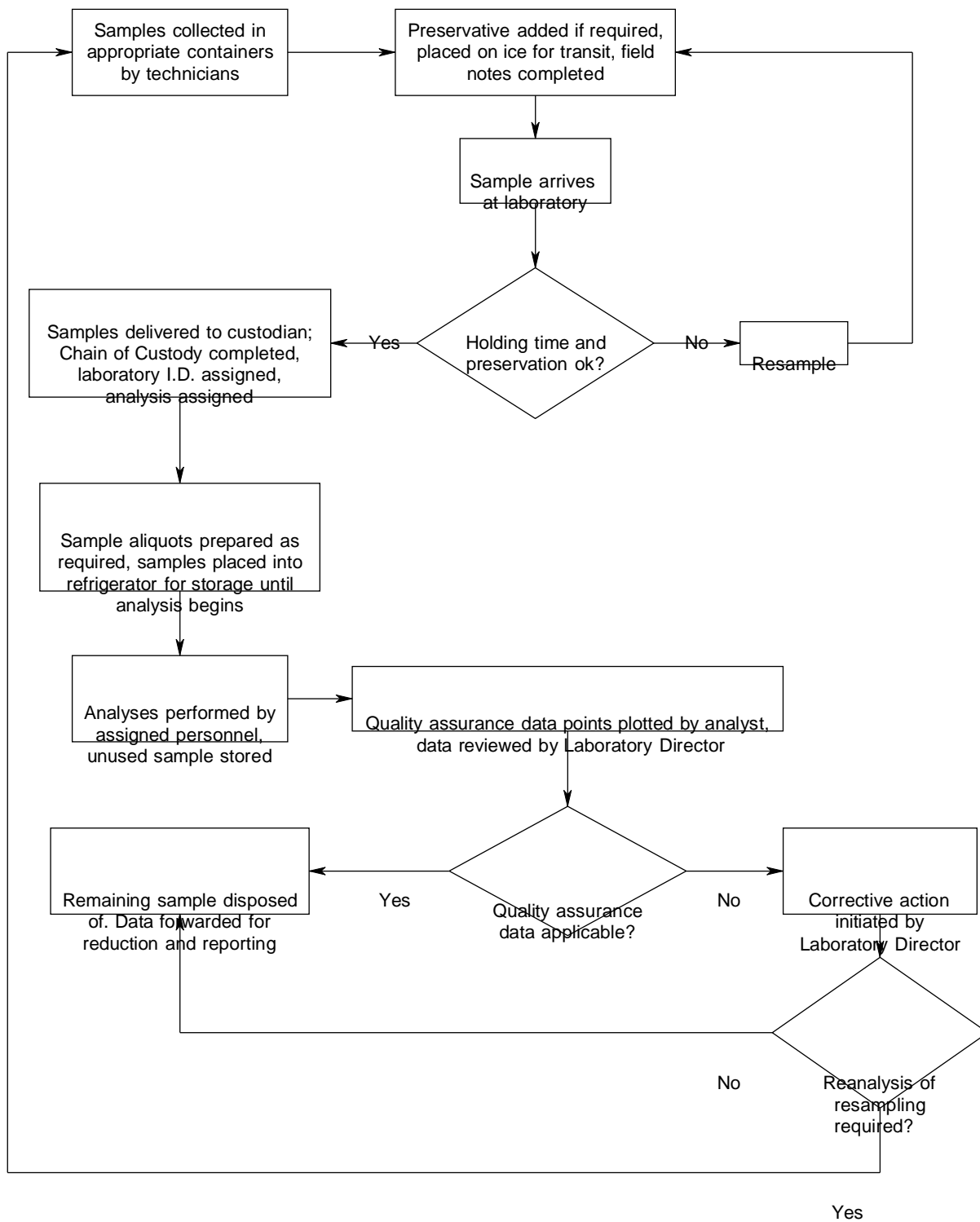
TABLE 2
Equipment Type, Sample Type, and Parameters

EQUIPMENT TYPE AND CONSTRUCTION MATERIAL	USE	PERMISSIBLE PARAMETER GROUP
Water Sampling Groundwater		
Stainless steel submersible pump s and Teflon check valve to prevent backflow	Purging only wells < 30 feet	All parameters
Stainless steel bladder pump and silicone tubing or Teflon tubing if purging for organics	Purging and sampling	All parameters - if not dedicated, must be cleaned between wells
Peristaltic pump, silicone tubing (dedicated) or Teflon tubing if purging for organics	Purging and sampling	All parameters; demands/metals/classic; inorganics and non-metals
Teflon bailer	Purging and sampling	All parameters
Disposable polyethylene bailer	Metals, inorganics and non-metals	Dedicated to one well, then disposed
Whirlpack thiobags	Sampling	Bacteria
Surface Water		
Teflon dipper	Sampling	All parameters
Whirlpack thiobags	Sampling	Bacteria
Stainless steel kemmerer	Sampling	All parameters
Drinking Water		
Direct collection in sample containers	n/a	n/a
Field		
pH meters	pH	All parameters
Conductivity meter	Conductivity	All parameters
Temperature	Temperature	All parameters
Water level	Depth	All parameters
DO meter	n/a	All parameters
Auto samplers with silicone tubing	Composite sampling	Inorganics
Solid Sampling Sediments/Soils		
Mixing tray and stainless steel scoop	Composite sampling	All parameters; VOCs are not homogenized or composited

Exhibit 1. Chain of Custody Record

Date												
Sample Date												
Facility												
Location												
Sample ID No.												
Time Sample Was Collected												
Time Received In Lab												
Sample Type	Comp ____Hrs or Grab		Comp ____Hrs or Grab		Comp ____Hrs or Grab		Comp ____Hrs or Grab		Comp ____Hrs or Grab		Comp ____Hrs or Grab ____	
Container Type	Glass ____or Plastic		Glass ____or Plastic		Glass ____or Plastic		Glass ____or Plastic		Glass ____or Plastic		Glass ____or Plastic ____	
Preservation												
Collected By:												
Delivered By:												
Received By:												
Circle or Note Analyses Required	BOD	CBOD	BOD	CBOD	BOD	CBOD	BOD	CBOD	BOD	CBOD	BOD	CBOD
	SBOD	COD	SBOD	COD	SBOD	COD	SBOD	COD	SBOD	COD	SBOD	COD
	SETT	TURB	SETT	TURB	SETT	TURB	SETT	TURB	SETT	TURB	SETT	TURB
	TSS	VSS	TSS	VSS	TSS	VSS	TSS	VSS	TSS	VSS	TSS	VSS
	TS	TKN	TS	TKN	TS	TKN	TS	TKN	TS	TKN	TS	TKN
	NH3-N	O&G	NH3-N	O&G	NH3-N	O&G	NH3-N	O&G	NH3-N	O&G	NH3-N	O&G
	VA/ALK	ALK	VA/ALK	ALK	VA/ALK	ALK	VA/ALK	ALK	VA/ALK	ALK	VA/ALK	ALK
	CL	CL2	CL	CL2	CL	CL2	CL	CL2	CL	CL2	CL	CL2
	EC	PO4	EC	PO4	EC	PO4	EC	PO4	EC	PO4	EC	PO4
	NO2	NO3	NO2	NO3	NO2	NO3	NO2	NO3	NO2	NO3	NO2	NO3
	COLI	T.COLI	COLI	T.COLI	COLI	T.COLI	COLI	T.COLI	COLI	T.COLI	COLI	T.COLI
pH		pH		pH		pH		pH		pH		
Other												
Metals											1E-38	
Checked/Disposed	by: _____ / _____		by: _____ / _____		by: _____ / _____		by: _____ / _____		by: _____ / _____		by: _____ / _____	
Comments												

Exhibit 2
Sample Flow Chart



Data Reduction, Validation, and Reporting

Data Handling and Recordkeeping

To obtain meaningful data, the sample collector must obtain a representative sample and deliver it unchanged for analysis. The analyst must perform the proper analysis in the prescribed fashion, complete calculations, and convert the results to the final form for permanent recording in exact terms.

Records are an integral part of the quality assurance program. They provide documented evidence that the program is functioning. Also, they provide the necessary information for performance evaluation and quality assurance audits. (Sloppy records and poor record maintenance are likely to reflect poor quality control in other areas of the laboratory operation).

Rules for record retention are specified in the NPDES discharge permit. Guidelines should be established and followed according to the specific rules of the permit at each of the OMI projects.

Inadvertent errors in data processing cannot be eliminated entirely, although they can be minimized. The following list represents common errors encountered in laboratory operations:

- Improper identification of samples

- Mistakes in reading instrument data or volumetric measurements

- Mistakes in recording data such as transposition of digits and incorrect location of decimal points

- Errors in calculation of results

- Mistakes in transposing data between records

Significant Figures

To indicate the uncertainty in a quantity, the correct number of significant figures must be selected. For instance, if a graduated cylinder is used to measure a certain volume of water, the reported result might be 41 mL—two significant figures. If a buret is used, the result might be 42.21 mL—four significant figures. If the water is weighed on a top-loading balance, the result might be 41.206 mL—here, five significant figures are appropriate. In each case, no fewer digits should normally be used and no more are justified.

Confusion may arise in the selection of significant figures where zeros are involved. To avoid ambiguity, remember that any zero needed to locate the decimal point is not a

significant figure. Thus, 0.005 has one significant figure, but 2.0400 has five. If confusion is likely, numbers should be written in exponential form. For instance, 6.00×10^{10} is not ambiguous; it has 3 significant figures. The number 40,000 has but one significant figure because the four zeros are necessary to locate the decimal point that is understood to be present after the last zero; to prevent ambiguity, it can be written 4×10^4 .

When rounding off numbers, if the quantity being rounded off is less than 5, drop it; if it is greater than 5, increase the last significant figure by 1; if it is 5, round to the nearest even number.

For example, 4.25, 6.35, and 1.05 are rounded off to 4.2, 6.4, and 1.0. During calculations, at least one digit more than the allowed significant figure should be carried along for rounding-off purposes. If possible, avoid rounding off in calculations until the final answer is obtained.

When determining how many significant figures are justified after a calculation, count the number of known significant figures used for each measurement in the calculation, and use the number of significant figures found in the value with the smallest number of figures. For example 81.2 milliliters (mL) of substance was placed in a 1-liter volumetric flask and diluted to 1-liter, then 5.6 mL was pipetted with a transfer pipette. How does one express the mass that was pipetted? In the calculation, the weight of the pipetted mass was taken from a scale that measures to 0.1 mg, the volume was taken with a transfer pipette that measures to the nearest 1/10 of a milliliter, and the original flask used to prepare the solution measures to the nearest 1/100 of a milliliter. The final value, therefore, is given with two significant figures because the pipette measurement only has two significant figures.

Data Verification

To safeguard against errors in data processing, 10 percent of all generated data must be verified prior to reporting. Daily calculations must be checked by the analyst performing the analysis and by a second individual to ensure correctness. The individual rechecking calculations must initial the bench sheet once the data are checked on both the bench sheet and the computer input form. If, during the verification of the 10 percent, mistakes are found then all of the calculations for that day must be rechecked.

Bound Books

Reporting of data onto loose or ring binder forms is a means of allowing easy addition of new sheets and removal of older data. The ease of addition or removal also permits loss or misplacement of sheets, mix-up in data sequence, and ultimately, questionable status of the data for formal display or presentation as courtroom evidence.

The use of bound books is an improvement in data recording that tends to result a chronological sequence of data insertion. Numbering of pages encourages the use of data in sequence and also aids in referencing data through a table of contents according to type of analysis, date, and book number. Sample validation can be strengthened by providing a space for the laboratory supervisor to witness the date, completion of analysis, and verification of correct calculations.

CH2M HILL OMI provides each of its laboratories with bound and numbered bench sheets. Each sheet has an identification number located in the lower left-hand corner. This number is used for reordering the bound books from the corporate office. All bound books are formatted to provide method of analysis, instrument used, dates collected and analyzed, analyst identification, project and location identification, information on the analyte, analytical conditions and results, remarks, and an example of calculations (if any).

To assure that valid data is being produced by the laboratory, it is essential that the results are reproducible and that the actual quality of the sample is measured accurately. As a part of the intralaboratory analytical quality control program, the laboratory must develop precision and accuracy criteria for each parameter required by the NPDES discharge permit. This data is gathered by using the following controls:

Blank—to check for contamination

Reference Standards—to check for accuracy of the method

Duplicate Samples—to check for precision or repeatability

Spiked Samples—to check for recovery

The precision and accuracy limits for each method should be updated quarterly. The U.S. EPA recommends that 10 to 20 percent of analyses be for quality control purposes with 5 percent assigned to field QC.

Reporting All raw data and final results are recorded by the analysts on specific data forms or computerized reports directly from the instrument. These forms are reviewed by the respective supervisors and then filed in numerical order according to test parameters.

The final results are recorded by the supervisor on the laboratory work sheet and submitted to the Laboratory Manager for their approval. The enforcement of the entire Quality Control program described in this document is the criteria used to validate data from collection to reporting. This criteria includes chain-of-custody procedures, analysis of blanks, duplicates, check samples and spikes, monitoring of recoveries and RPD's, and internal and external audits. There are numerous factors that influence data and each must be constantly monitored to ensure valid results.

Some of the data which must be constantly monitored to ensure valid data are:

- Sample preparation and treatment
- Analytical operations

- Calibration procedures
- Instrumental conditions and adjustments
- Data handling:
 - Calculations, corrections, adjustments to standard conditions, computer programs
 - Statistical procedures used to report data
 - Checks for internal consistency

Sample Forms

Below are examples of forms that will be used at the facility. They include:

- Alkalinity
- Chlorine Residual
- Nitrogen
- pH
- Turbidity



Alkalinity

Method: _____

Sample Type: _____

[illegible]



Total Chlorine

Method : _____

Sample Type: Grab

[illegible]



Ammonia or Kjeldahl Nitrogen

Method: _____

Sample Type: _____

[illegible]



pH

Method: _____

Sample Type: Grab

[illegible]



Turbidity
Method_____

[illegible]

MAINTENANCE MANAGEMENT PROGRAM

The maintenance management program at the Spokane County RWRf consists of five functions: routine maintenance (RM), preventative maintenance (PM), predictive maintenance (PdM) or condition-based maintenance, corrective maintenance (CM), and emergency maintenance. These functions are controlled through the computerized maintenance management system (CMMS). The effectiveness and performance of the maintenance system is measured using a quality assurance/quality control (QA/QC) matrix.

Computerized Maintenance Management System (CMMS)

For the CMMS, the Spokane County RWRf has chosen Maintenance Connect®. It is accessible from computers that have internet access. The CMMS includes the following:

- Detailed records of repair and replacement for the managed assets;
- Scheduling, monitoring and reporting PdM, PM, RM and CM;
- Accountability of task completion;
- Database to track and predict equipment performance and potential failures;
- Complete equipment and spare parts inventory;
- Work order and purchase order issuance;
- Warranty repair tracking;
- Automatic equipment status reports, and equipment priority reports;

CMMS Operations and Maintenance

- All PM and PdM tasks entered into the CMMS meet manufacturers' recommendations and include the use of elapsed-time readings on the equipment for scheduling and enforcement of the warranties.
- Comprehensive equipment records are maintained by the CMMS. These records include, but are not limited to, equipment information data, cost histories and modifications, as well as PdM, PM and CM work. As part of the equipment information data, service reports identify the equipment being serviced, current conditions, performed work, actual and planned hours for maintenance work, and identification of the technician performing the work.
- The CMMS also is used for control of spare parts inventory. Spare parts are maintained to foster uninterrupted service and to support scheduled inspections and overhaul. Documentation includes a list of critical spare parts, stocking levels, delivery times, and reorder quantities. Spare parts are identified in a manner that cross-references them to all equipment for which they can be used.
- As part of this implementation, the CH2M HILL staff is trained to enter CMMS data and verify it for accuracy and completeness. They also gather additional information that is determined to be necessary to achieve maximum system benefits.

General Policy Statement

CH2M HILL associates are entitled to a safe and healthful work environment. It is CH2M HILL's intent to provide this environment, and in the process, comply with the laws, rules, and regulations of federal, state, and local governments regarding safe practices, and to reduce CH2M HILL's exposure to public liability or property damage losses. The Global Leadership Team has charged the Corporate Safety Manager with the responsibility of developing and implementing those programs and procedures necessary for compliance with this policy. The programs and procedures set forth in the *Safety Manual* provide the foundation for the CH2M HILL Safety Program.

The safety of every associate of CH2M HILL is of vital importance, and associate accountability is fundamental in an effective safety program. Therefore, CH2M HILL's policy emphasizes the need for associates at all levels to accept full responsibility for safety and to perform their job duties in a manner that will most closely assure the complete safety of all CH2M HILL associates and the public at all times.

Associates must be aware of the hazards associated with the work they assign and/or perform and must be properly trained to perform job duties safely. It is each associate's responsibility to follow proper procedures and to maintain constant awareness of potential safety hazards. The Project Manager or other senior onsite manager provides the guidance for and is ultimately responsible for the success of the safety program at any CH2M HILL-operated facility.

CH2M HILL's management shall direct the enforcement of safety regulations with emphasis on proactive incident prevention rather than after-the-fact incident investigation. Incident investigations shall seek to determine reasons for failings rather than an accounting of the failures themselves. The overall safety program shall offer opportunities for associates to improve safety performance through counseling and constructive criticism.

In addition to the companywide Safety Manual, each CH2M HILL-operated facility shall maintain a *Site Specific Safety Manual*. The programs and procedures presented in these manuals have been designed to keep CH2M HILL facilities properly maintained and operated in a safe working condition. The Project Manager or other senior onsite manager at each CH2M HILL-operated facility is required to furnish safe tools, equipment, layout, and materials. Managers, Supervisors, and Project Safety Team Leaders (PSTLs) also must provide adequate education and training in accepted safety procedures. These manuals provide a firm foundation for that training. The *Safety Manuals* are not to be considered all-inclusive. Safety regulations may be expanded, supplemented, and modified from time to time by the Corporate Safety Manager to conform to the most recent legislation or CH2M HILL requirements. Each chemical that is on site or has been on site will have a corresponding Material Safety Data Sheet. Each MSDS will be reviewed annually at a minimum. Additionally, with each task

undertaken at the Project that entails chemical use the MSDS for that chemical(s) will be reviewed prior to starting task.

The CH2M HILL Spokane County Regional Water Reclamation Facility *safety manuals* will be located in the Maintenance Building control room and in the Treatment Operations Facility control room.

Spare Parts Management Program

Overview

The computerized maintenance management system (CMMS) program at the Spokane County RWRf site is Maintenance Connect®. The CMMS program documents the spare parts inventory. Spare parts are maintained to foster uninterrupted service and to support scheduled inspections and overhaul. Documentation includes a list of critical spare parts, onsite stocking levels, local vendor spare parts, delivery times, and reorder quantities. Spare parts are identified in a manner that cross-references them to all equipment for which they can be used.

Critical spare parts that have long lead times to obtain or create a potential for non-compliance will be labeled, catalogued and stored on site in the Maintenance Building. Common parts such as bearings, motors and fuses used on equipment and spare parts that can be purchased locally will be listed, cross referenced with local vendors and not purchased until necessary. This program is continually evolving and changing as vendors and equipment change.

Emergency Response Plan

Prepared for
Spokane County

1004 N Freya Street
Spokane, WA 99202

October 2012, Revised April 2014

CH2MHILL

1004 N Freya Street
Spokane, WA 99202

Contents

Contents.....	2
Abbreviations.....	3
1.0 Introduction.....	4
2.0 Roles and Responsibilities	5
2.1 Emergency Response Team	5
3.0 Notification.....	9
3.1 Emergency Notification.....	9
3.2 Emergency Action	12
4.0 Emergency Preparedness	13
4.1 Pre-Planning.....	13
4.2 Emergency Equipment and Supplies	14
4.3 Emergency Monitoring Equipment and Alarms	14
4.4 Training.....	15
4.5 Property Protection	16
5.0 Emergency Response/Actions	17
5.1 Evacuation Procedures	18
5.2 Emergency Medical Treatment.....	18
5.3 Emergency Actions/Response	22

Tables

Table 2.1	Emergency Response Team
Table 3.1	CH2M HILL Emergency Response Contacts
Table 3.2	County utilities Emergency Response Contacts
Table 3.3:	Emergency Contacts
Table 3.4:	Emergency Contacts within 24 hours
Table 4.1	Emergency Equipment and Supplies for Personal Safety
Table 5.1	CH2M HILL Emergency Assignments

Figure

Figure 1	Facility Map
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Attachments

Attachment A	CH2M HILL Initial Medical Treatment Form
Attachment B	Vulnerability Assessment

Abbreviations

AED	Automated External Defibrillators
Applicable Law	Rules and regulations of local, State and federal agencies and governmental bodies
County	Spokane County
CPR	Cardiopulmonary Resuscitation
Ecology	Ecology
EMS	Emergency Medical Services
ERL	Emergency Response Lead
ERP	Emergency Response Plan
ERT	Emergency Response Team
Facility	Spokane County Regional Water Reclamation Facility
H&S	Health and Safety
IT	Information Technology
NPDES	National Pollutant Discharge Elimination System
NVIPS	NVI Pump Station
Service Contract	<i>Service Contract for the Design, Construction and Operation of the Spokane County Regional Water Reclamation Facility between County of Spokane, Washington and CH2M HILL Constructors, Inc. Dated January 13, 2009.</i>
SL	Project Team Safety Lead
SVIPS	SVI Pump Station
TOF	Treatment Operations Facility
VA	Vulnerability Assessment
WAC	Washington Administrative Code

1.0 Introduction

This Emergency Response Plan (ERP) includes written policies, preventive measures and response actions as necessary to comply with federal, State, and local safety, health, and environmental regulations. This ERP has been prepared for the Spokane County Regional Water Reclamation Facility (SCRWRF or Facility) in accordance with:

- Section 8.7 Training of County Personnel, Section 8.15 Emergencies and Section 10.9 Releases, Leaks, and Spills of the *Service Contract for the Design, Construction and Operation of the Spokane County Regional Water Reclamation Facility*
- Section 9.18 Emergency Response Plan of the *Appendices to the Service Contract for the Design, Construction and Operation of the Spokane County Regional Water Reclamation Facility*
- WAC 173-240-080(4)(l), Operation and Maintenance Manual
- WAC 173-303-145, Spills and Discharges into the Environment

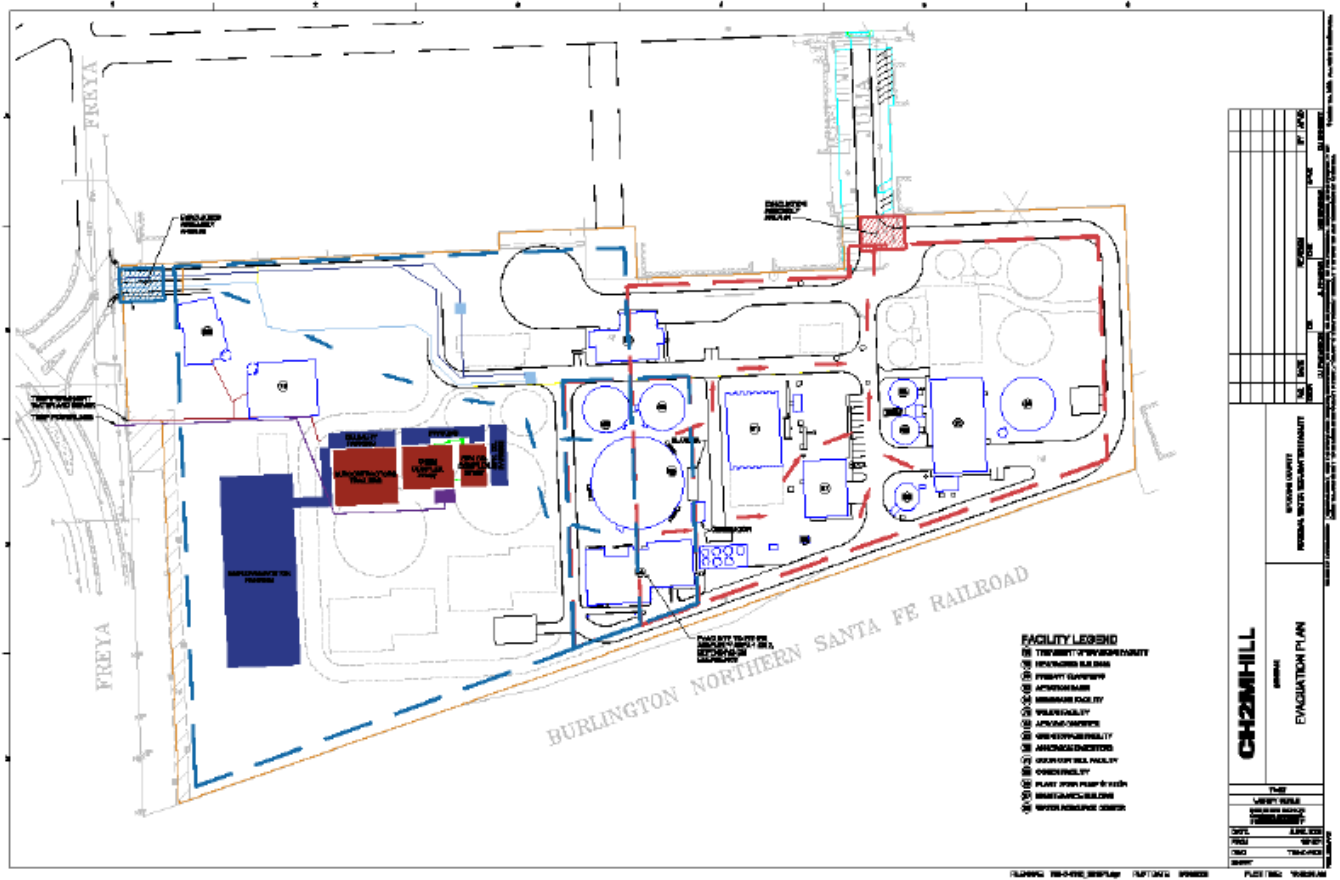
CH2M HILL designed, constructed and now operates and maintains the SCRWRF for Spokane County (County). The Facility is located at 1004 N Freya, Spokane, Washington (See Figure 1, Vicinity Map that includes ingress/egress to the site). The County operates and maintains the wastewater pumping stations; SVI Pump Station and NVI Pump Station, and the wastewater collection system that delivers and conveys wastewater to the Facility. The County is responsible for emergency response planning for the wastewater pumping stations and conveyance system.

This ERP for the SCRWRF is organized as follows:

- Section 1.0 Introduction
- Section 2.0 Roles and Responsibilities
- Section 3.0 Notification
- Section 4.0 Emergency Preparedness
- Section 5.0 Emergency Response/ Actions

This document is intended to be used as a reference and is not to be considered all-inclusive. Emergency response and safety regulations may be expanded, supplemented, and modified from time to time to conform to the most recent legislation or City/County requirements. It is not intended to supersede good sense and personal training. Associated safety equipment and all health and safety procedures must be followed at all times.

Figure 1. Facility Evacuation Plan



2.0 Roles and Responsibilities

2.1 Emergency Response Team

The Emergency Response Team (ERT) will consist of the following operations personnel:

TABLE 2.1: EMERGENCY RESPONSE TEAM
Spokane County Regional Water Reclamation Facility

Role	Position	Staff
Emergency Response Lead	Project Manager/PM	Adam McClymont
Alternate Emergency Response Lead	Lead Operator	Anthony Benavidez
Project Safety Team Lead	Lab Technician II	Neil DeJonge
All other employees who work at SCRWRF	All remaining positions	All remaining staff

Emergency Response Lead

The Project Manager is the Emergency Response Lead (ERL) who will be the main point of contact and decision-maker during a major event. The Project Manager will have responsibility for evaluating incoming information, managing resources and staff, and deciding on appropriate response actions. His responsibilities are further described in sections of this ERP (as noted on the following list) and most are specific requirements of the Service Contract:

- **Section 2 Roles and Responsibilities**
 - Manage staff, assign roles and responsibility, and provide oversight
- **Section 3 Notification**
 - Notify City, County, other local agencies, State and federal agencies as required by this ERP of any activity, problem, or circumstance that threatens the safety, health or welfare of the Facility staff or County residents
 - Provide notification of emergency and/or noncompliant events within the Facility in accordance with permit requirements and the approved ERP
 - Maintain a list of emergency contacts that will be posted at all Facility telephones and in all Facility vehicles, and provided to each employee in a wallet-sized version
- **Section 4 Emergency Preparedness**
 - Procedures:**
 - Ensure that Facility specific procedures will be developed for response equipment failure
 - Provide appropriate City and County officials with the opportunity to rehearse and where accepted, rehearse emergency response procedures to ensure that response functions are properly executed in the event of an emergency
 - Preparedness:**
 - Provide Facility monitoring equipment and alarms as necessary to provide early warning of a potential or pending emergency event

- Monitor all critical process functions and when they exceed alarm set points, the early warning devices shall notify the on-duty and/or on-call operator
- Maintain a complete emergency equipment inventory, with an updated listing that includes all equipment, materials, and chemicals available. This inventory, emergency equipment and supplies shall be purchased, stockpiled, checked for expiration dates, and maintained to enable staff to be prepared for emergencies
- Establish the Treatment Operations Facility (TOF) and Maintenance Building as emergency response centers. Employees will assemble at emergency response centers, depending upon which center is the most readily available during the event of an actual emergency. These centers will be where all direct communication is made to designated resources from the City and County and all appropriate agencies
- Maintain an up to-date bound copy of the ERP at the TOF and Maintenance Building

Training:

- Ensure that operators and maintenance staff will be trained in the use of equipment and in the implementation of the ERP

• Section 5 Emergency Response/Actions

- Shall respond to emergencies and unusual circumstances in accordance with this ERP, applicable regulations and requirements and with such personnel and equipment as necessary to maintain or restore the operations of the Facility in a timely manner with the least possible disruption or inconvenience to the customers of the Facility
- Suspend operation of the Facility in the event of damage or destruction of the Facility or any emergency which, in the reasonable judgment of CH2M HILL, is likely to result in material loss or damage to the Facility or constitute a material threat to human health or safety, but first seek County approval, as appropriate
- Conduct emergency repairs as are necessary to mitigate or reduce such loss, damage or threat to human health or safety in consultation with the County
- Coordinate emergency response efforts with first responders

Alternate ERL and Project Safety Team Lead

The Facility Lead Operator will be the Alternate ERL, who will step in should the ERL be unavailable. The ERL and the Alternate ERL will be reachable 24 hours a day, seven days a week.

The Project Safety Team Lead (PSTL) will be responsible for emergency preparedness activities, reporting, coordinating emergency response and onsite safety. Further details on PSTL responsibilities are found in Section 4.0.

Employee Responsibilities

All personnel are assigned responsibility for safe and healthy operations so that hazards are identified and solutions enacted as soon as possible. For any operation, individuals have full

authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions/practices and follow emergency reporting procedures:

- Be familiar with emergency response planning, coordination, and response actions
- Upon detection of a minor emergency incident or event (small spill, shutting of open valves); the responsible employee will attempt to safely control or end the minor emergency
- Upon detection of a major emergency (large spills, equipment failure resulting in large discharge of untreated wastewater upon the surface of the ground); the emergency incident or event will be brought to the attention of the worker's direct supervisor and the SL to determine the best course of emergency response
- Control and end the emergency condition under the direction of the worker's direct supervisor and the SL

3.0 Notification

Notification requirements, depending on the situation, shall include County Utilities, County Office of Emergency Services, State Office of Emergency Services, Sheriff and City of Spokane Fire and Police Departments. As described in this ERP, other local agencies, State and federal agencies will be notified of any activity, problem, or circumstance that threatens the safety, health or welfare of the Facility staff or County residents.

3.1 Emergency Notification

Personnel will be available to respond to any emergency (no later than two hours during nights, weekends or holidays) and follow notification protocol:

1. SCRWRf operations/maintenance staff contacts immediate supervisor
2. The immediate supervisor contacts the ERL, and if the ERL is not available, the Alternate ERL will be contacted about emergency
3. The SL will be contacted as soon as possible. See Table 3.1 for CH2M HILL Facility emergency response contacts.

TABLE 3.1 CH2M HILL EMERGENCY RESPONSE CONTACTS

Position	Name	SCRWRf Phone	Cell Phone
ERL/PM	Adam McClymont	(509) 536-3702	(509) 979-4926
Alternate ERL/ Ops Supervisor	Anthony Benavidez	(509) 536-3703	(509) 688-3862
Safety Lead	Neil DeJonge	(509) 536-3710	Not Available
Maintenance Supervisor	Devlan Pool	(509) 536-3701	(509) 979-4761

4. ERL notifies the County (Table 3.2 lists County personnel).

The County Water Reclamation Manager will be contacted first and as soon as possible. The County Utilities Wastewater Operators will only be contacted **directly** by ERL under these circumstances:

- Immediate emergency response actions are required at the sewer interceptor pump stations (SVI and NVI)
- Immediate emergency response actions are required at the sewer collection system
- Immediate emergency that may impact County operated utilities (collection and pumping of wastewater) operations or threatens human health or safety of County Utilities Wastewater Operations staff.

[\\97svr008\Public\OPERATOR](#)

During normal working hours County Wastewater Utilities will be contacted at the Wastewater Department. After hours, County dispatch will contact the appropriate County person as listed in Table 3.2.

TABLE 3.2 COUNTY UTILITIES EMERGENCY RESPONSE CONTACTS
Spokane County Regional Water Reclamation Facility

Position	Name	Main Phone	SCRWRF Phone	Cell Phone	Home Phone
Water Reclamation Manager	Dave Moss	(509) 477-7268	(509) 568-0971	(509) 475-5002	(509) 443-2443
Water Resources Manager	Rob Lindsay	(509)477-7576	Not Available	(509)991-7279	(509)838-3880
		Daytime	After Normal Working Hours (Dispatch)	Cell Phone	Home Phone
Wstwater Ops. Manager	Vern Jarvis	(509) 477-1984	(509) 710-9031	(509) 220-0111	(509) 238-2210
Wstwater Ops. Sup.	Chris Walker	(509) 477-7544	(509) 710-9031	(509) 710-7002	(509) 928-3098

5. ERL contacts emergency services (fire, ambulance, and police) as necessary, or instructs the Alternate ERL or SL to make these calls. He also reports emergency to all appropriate agencies as shown on Table 3.3.

If more than minor first aid is needed, the EMT, or other First Aid trained employee, should dial 911 for emergency medical services, or the employee's supervisor will transport the employee to Sacred Heart Medical Center for medical attention. The ERL will make emergency contacts (see Table 3.3) in the event of a serious incident including:

- Fatality
- Critical injuries
- Kidnap/missing person
- Event that involves a fire explosion, or property damage that requires a site evacuation Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community and/or the environment

TABLE 3.3: EMERGENCY CONTACTS
Spokane County Regional Water Reclamation Facility

Medical Emergency – 911	Hospital: Sacred Heart Medical Center 101 W 8 th Avenue, Spokane, WA 99204 Phone: (509) 474-3131
Fire/Spill Emergency – 911 Local Fire Department (Station 8) 1608 N. Rebecca Street Spokane, WA 99217	CH2M HILL Medical Consultant Dr. Jerry Burke Health Resources (800) 350-4511
Security & Police (City and County) – 911 City Police Emergencies – (509) 625-4000 Crimes Reporting Center – (509) 532-9266 Law Enforcement Helpline – (509) 477-5980 Sheriff's Office – (509) 477-2240	CH2M HILL Director Security Operations Thomas Horton/DEN Phone: (720) 286-0022 Cell: (720) 273-3100
Spokane Emergency Management and Emergency Coordination Center – 911	Washington State Office of Emergency Services (800) 258-5990
Utilities Emergency : Water: City of Spokane – (509) 625-6270 Gas: Avista – (509) 495-4469 Electric: Avista – (509) 495-4469 Phone: Qwest – (800) 247-7285	Spokane Regional Clean Air Agency (Emergency results in emissions to the air) Joe Southwell (509) 477-4727
Spokane Regional Health District Phone: (509) 324-1500 (24-hours)	CH2M HILL Human Resources Department Nancy Orr Phone: (801) 244-9516
Poison Control Center (800) 222-1222	Health & Safety Manager Scott Billings Phone: (801) 244-9516

There are certain incidents that must be reported within 24 hours after the time CH2M HILL becomes aware of the circumstances including exceedances of permit limits. When warranted, immediate notification to the public, health agencies, and other affected public entities will be taken by contacting the following people or agencies shown in Table 3.4:

TABLE 3.4: EMERGENCY CONTACTS WITHIN 24 HOURS
Spokane County Regional Water Reclamation Facility

When SCRWF Discharge Permit Limits are Exceeded:	
Ecology's Eastern Regional Office Wastewater Permitting (509) 329-3400	Spokane Regional Health District (509) 324-1500 for general information or
Department of Health, Drinking Water Program (800) 521-0323 (bus. Hours) (877) 481-4901 (After bus. Hours)	Environmental Public Health (509) 324-1560
When there is an Injury:	
Washington OSHA (509) 324-2600 Notify the supervisor immediately who completes the "Authorization to Treat" form for employee to take to medical provider. Then call the Injury Management number at (866) 893-2514 for further assistance.	CH2M HILL Injury Management (866) 893-2514

When There is a Spill:	
Ecology's Eastern Regional Office Hazardous Materials Spill Reporting (509) 329-3400	National Response Center (800) 424-8802

3.2 Emergency Action

If CH2M HILL determines in good faith that an emergency situation exists such that action must be taken to protect the safety of the public or its employees, to protect the safety or integrity of the Facility, or to mitigate the immediate consequences of an emergency event, and it is impracticable to obtain the County's approval or consent or CH2M HILL is unable to obtain the County's approval or consent (and the County has not expressly withheld such approval or consent), then CH2M HILL will take all such action it deems in good faith to be reasonable and appropriate under the circumstances. As promptly thereafter as is reasonable, CH2M HILL will notify the County of the event at an emergency phone number provided by the County (See Table 3.2) and the response thereto. Nothing shall limit the obligation of CH2M HILL to notify Ecology of any emergency event in accordance with Applicable Law.

4.0 Emergency Preparedness

Employees must know what to do if an emergency occurs. This requires pre-planning and communication of these plans to employees. Emergency preparedness will be the responsibility of the Project Safety Team Leader (SL).

4.1 Pre-Planning

The SL will provide for pre-emergency planning before operations begin and for all field activities. SL will coordinate emergency response for onsite parties at the Facility (CH2M HILL employees, County employees, subcontractors, visitors) with local emergency-service providers as appropriate and under the direction of the ERL. The SL will:

- Review the Facility's emergency and contingency plans and procedures, update as necessary, and provide updated version to the County for an annual review.
- Maintain an updated version of ERP at the emergency response centers (TOF and Maintenance Building).
- Verify that Facility specific procedures have been developed for response equipment failure
- Coordinate all emergency activities, particularly potential natural disaster events, with Information Technology (IT) group and include them in the beginning planning stages
- Determine what onsite and offsite communication equipment is needed (e.g., two-way radios, cell phones)
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to the hospital; communicate the information to onsite personnel (includes posting the list of emergency contacts at all Facility telephones and in all CH2M HILL vehicles, and providing the contact list to each employee in a wallet-sized version).
- Communicate emergency procedures for personal injury, exposures, fires, explosions, and releases
- Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers in all Facility buildings
- Keep areas near exits and extinguishers clear
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside
- Check and inventory site emergency equipment, spare parts, spill response, first aid supplies, and potable water

4.2 Emergency Equipment and Supplies

The SL will verify that personal safety emergency equipment and supplies are available for each Facility building or structure, as needed, are in proper working order, and will mark the locations of emergency equipment and supplies on a site map (See Figure 1.1 Site Map). Spill response equipment and supplies are listed and can be found in the *SCRWRF Spill Response, Control, and Countermeasures Plan*. Table 4.1 lists emergency equipment and supplies to be on-hand for personal safety and to be readily available.

TABLE 4.1 EMERGENCY EQUIPMENT AND SUPPLIES FOR PERSONAL SAFETY
Spokane County Regional Water Reclamation Facility

Emergency Equipment and Supplies	Location
20 lbs (9 kg) or two 10 lbs (4.5 kg) fire extinguisher (A, B, and C classes)	In CH2M HILL Treatment Operations Facility (TOF), Headworks, Membrane Facility, Maintenance Building, and Solids Facility.
One 5 lbs (2.25 kg) or 10 lbs (4.5 kg) fire extinguisher (A, B, and C classes)	In every CH2M HILL Facility vehicle.
First aid kit	In CH2M HILL TOF and Maintenance Building. Also, include a first aid kit in every CH2M HILL Facility vehicle.
Personal eye wash	In CH2M HILL TOF, Maintenance Building, Headworks, Membrane Facility, Bulk chemical storage area, and Solids Facility.
Bloodborne-pathogen kit	In CH2M HILL TOF and Maintenance Building.
Additional equipment	In CH2M HILL TOF and the Maintenance Building.

For a list of Facility equipment, repair parts, chemical supplies for normal maintenance and operations, see Appendix A.

4.3 Emergency Monitoring Equipment and Alarms

The SCADA system will monitor equipment and critical process functions and when they exceed alarm set points, early warning devices shall notify the on-duty and/or on-call operator. These early warnings of a potential or pending emergency event include:

- Above ground diesel storage tanks (used for emergency generators) that will have over-fill alarms
- Chemical storage tanks that will have over-fill alarms
- Functionality of Facility equipment and critical processes, including case of failure or when operating parameters are not met
- Odor control monitoring equipment – equipment functionality will be checked by SCADA and also during daily inspection rounds of the Facility

When on-duty and/or on-call operators receive a SCADA alarm, including an emergency operational alarm, fire and/or evacuation alarm, the operator will notify staff at the Facility with two-way radios and/or cell phones.

In regards to fire alarms, the fire alarm system will be shown on ancillary SCADA screens. The liquids screen shows fire alarms for the Headworks Building, Maintenance Building, and treatment operations. The solids screen shows fire alarms for the Membrane and Solids Facilities. The fire alarms will also show up on the alarm banner at the top of the SCADA screen and on the SCADA alarm overview page.

4.4 Training

The SL will be responsible for employee training at the Facility.

4.4.1 Facility Staff

All Facility staff will be trained on emergency procedures and in the implementation of the ERP annually during a monthly safety training meeting. Operators and maintenance staff will be trained in the use of equipment, spill response actions, communication protocol and coordination should the SCADA system issue an emergency alarm (including an alarm for evacuation), and be aware of the location of the designated assembly and evacuation muster areas.

Health and Safety (H&S) training, which can minimize or prevent many emergency situations, will be provided to all staff. Training is to be documented when it has been completed and reports will be kept in office files.

A Safety Manual is available to CH2M HILL and County employees and associates. It contains detailed information that helps create and maintain a safe work environment. CH2M HILL conducts monthly training for all personnel on standard operational procedures including emergency and safety procedures, and notification requirements.

4.4.2 County Training

As per Section 8.7, Training of County Personnel of the Service Contract, the County retains responsibility for treating wastewater received from the collection system and serving the public health, safety and welfare needs of its rate payers. The County accordingly has the right to designate up to three officers or employees for the purpose of receiving emergency preparedness training from CH2M HILL at the Facility during the term of service to any CH2M HILL training program offered onsite. Such training will be scheduled 30 days in advance to enable any of the three officers or employees to be familiar with the equipment, supplies, processes, operations and performance of the Facility. CH2M HILL will provide such training in accordance with prudent industry practice to ensure that the County's designees receive appropriate emergency preparedness training. CH2M HILL will be responsible for the cost of training such County employees and the County will be responsible for all employee expenses (wages, travel, lodging, meals, etc.) incurred while participating in such training programs.

4.4.3 Emergency Responders

The SL will contact and coordinate with the County and City officials, and local emergency responders (fire, ambulance, police and spill response) to rehearse accepted emergency response procedures to ensure that the response functions are properly executed in the event of an emergency. The SL will coordinate emergency response planning with the local emergency management agency and file a copy of the County approved ERP with that agency.

4.5 Property Protection

The following is to provide property protection:

- A security fence has been erected around the entire SCRWRF and a fence has been erected around the process portion of the site to secure the site
- Buildings are secured with locks
- All visitors must check-in at the Treatment Operations Facility and be issued a badge before accessing the processing portion of the site
- All septage and biosolids haulers will be trained on site safety, emergency procedures and how to conduct themselves onsite; they will be issued security keys that allow access to the site, but only during certain hours

Protective measures during an emergency incident or event:

- The ERL will be responsible for ordering the “lock down” of the entire Facility (if necessary)
- The SL will be responsible to ensure that there is a secure perimeter established following a major event
- The SL will ensure that evidence protection measures are implemented for law enforcement (should the major event also be declared a crime scene)

5.0 Emergency Response/Actions

All personnel at the SCRWRF are members of the Emergency Response Team (ERT). Emergency response assignments for the ERT are summarized in Table 5.1.

TABLE 5.1: CH2M HILL EMERGENCY ASSIGNMENTS
Spokane County Regional Water Reclamation Facility

Staff	Responsibility
ERL	Respond to incident or emergency event; or assign staff to respond Direct emergency response actions Call emergency responders, conduct notifications Assist with statements/or make statements for media (if necessary and in coordination with the County) Submit emergency response reports to County and other agencies as appropriate
Alternate ERL	Respond to incident or emergency event if ERL is not available. Notify ERL or SL if not previously notified Take any witnesses to TOF or Maintenance Building for statement Supervise, and if necessary, personally conduct emergency repairs as necessary Coordinate emergency response actions with SL
SL	Respond to incident or emergency event, notify ERL if not already notified Assign an employee to go to main gate to escort emergency vehicles into Facility and site of emergency Assign an employee to do a lockdown of main gate if necessary Assign an employee to manage radio/coordination and document all radio traffic Prepare report of emergency incident or event, describing emergency response actions (notifications, repairs, supplies used, procedures implemented, etc.)
All Other Employees	For a minor emergency incident or event; immediately control if it can be done safely For a major emergency incident or event, which is an incident or event that can't be controlled safely by employee; immediately contact supervisor and/or SL Conduct emergency response actions as instructed by Supervisor, SL, ERL and/or Alternate ERL. If necessary, assemble at assembly areas (TOF or Maintenance Building) for site emergency direction or evacuate Facility at nearest exit and meet at mustering areas (primary mustering area is at Freya Street entrance and secondary at Julia Corridor

This section further describes actions that may be necessary during an emergency response; including procedures for evacuation, medical treatment, and specific emergency incidents or events including those caused by Facility bypass or upset or natural disaster.

5.1 Evacuation Procedures

If the SCADA system issues an evacuation alarm, all Facility personnel will be contacted by two-way radios and/or cell phones. Facility personnel will take the following actions:

- Notify any subcontractors or visitors onsite for the need to evacuate and they will be requested to leave the site at the nearest exit.
- Assemble at the nearest assembly area (TOF and/or Maintenance Building) upon hearing the emergency call
- Provide adequate distance from the site emergency
- Leave the site by the nearest exit if site evacuation is necessary
- All evacuated personnel meet at muster area (Freya entrance) and if route is blocked, Julia Corridor is the secondary mustering point. A role call will be taken of CH2M HILL employees by a designated supervisor. A role call will be taken of County employees by a designated supervisor.
- The SL and the ERL will remain on the site after the site has been evacuated (if safe) to inform local responders of the nature and location of the incident

See Figure 1-1 for Facility exits, evacuation routes, and areas for assembly and muster areas.

5.2 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to CH2M HILL Human Resources. If there is doubt about whether medical treatment is necessary, or if injured person is reluctant to accept medical treatment, contact CH2M HILL's medical consultant.

5.2.1 Serious Injury or Illness:

The following serious injuries and illnesses are considered life threatening and should be treated with extreme caution:

- Head injury
- Neck injury
- Chest Pains
- Unconsciousness
- Hazardous material
- Serious burns

- Excessive Bleeding
- Broken Bones

In the event that a serious injury or illness has occurred, the following steps will be taken:

1. The first person to arrive should quickly assess the scene to ascertain the nature of the emergency and contact their supervisor
2. Call 911 for an ambulance for a serious medical emergency
3. The person placing the call to emergency authorities shall relay the following information:
 - Their name and telephone number (including extension)
 - The nature of the emergency and/or injury
 - The exact location of the Facility (1004 North Freya)
 - The number of injured and is the victim:
 - Conscious
 - Breathing without assistance
 - Bleeding
 - Has chest pain
 - Has broken bones
 - The exact location at the Facility and any information known about the victim or other persons involved (name, sex, approximate age of the victim)
4. For a serious medical emergency call a CODE RED over the Radio Channel one (1), Channel two (2), and Channel four (4) and announce location and any information on accident/incident. Stay on line until released by dispatch.
5. When CODE RED has been announced over the radio, employees involved in emergency activities shall turn to Channel three (3).
6. Person in charge of the scene shall call the ERL and SL per Table 3.1.
7. The ERL will contact the County per Table 3.2
8. The ERL will contact other appropriate emergency authorities per Tables 3.3 and 3.4, or direct the SL or other employees to do so.
9. The radio will be monitored by the ERL and the SL who will communicate between each other and update the Fire/EMS Department as to the situation and any additional information that can be relayed to them.
10. Do not remove the injured unless it is necessary due to imminent danger
11. The SL will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room. If possible, have someone meet responding personnel to lead them to the victim's location. The SL or any employee with first aid training will perform the following duties:
 - Send for or respond with first-aid equipment and AED

- Ensure victim is breathing and has a pulse. If not begin CPR if trained.
 - Control any bleeding
 - Attempt to stabilize injuries and prevent movement
 - Treat for shock
 - Gather as much information about the injury/illness as possible
 - Get medical attention immediately and assist rescue workers or more highly trained individuals as they arrive
12. The person in charge of the scene or the SL should at this point send any other available personnel to secure the site entrances. No one is permitted to enter or exit the site during or after an emergency situation, except for the following:
- Fire Department and EMS
 - Police Department
 - CH2M HILL
 - Spokane County
 - Authorized Washington/OSHA representative
 - Ecology representative
13. Any employee requiring medical treatment at a medical facility shall be accompanied to the medical facility by the SL or employee supervisor.
14. Injuries requiring treatment at a medical facility shall receive initial care at the following facility:
- Sacred Heart Hospital
101 W 8th Ave
Spokane, WA 99202
509-474-3131
15. The accident scene shall be secured and operations within the area shall stop (with the exception of emergency operations). The area shall remain undisturbed until CH2M HILL representatives and Washington/OSHA (if required) and Ecology (if required) have investigated the accident.
16. Any family members of the injured that show up to the jobsite shall be escorted to the hospital.
17. Injured employee contacts CH2M HILL's 24-hour emergency nurse at 866-893-2514. State that the situation is a CH2M HILL matter, and give your name and telephone number, name of the injured person, the extent of the injury or exposure, and name and location of medical facility where the injured person was taken. The nurse will:
- Listen to the injured employee to understand the injury/illness
 - Provides guidance on appropriate treatment options and any visit to medical facility
 - If injured visits a medical facility, the Supervisor is responsible for instructing the injured employee to take a copy of the "CH2M HILL Initial Medical Treatment Form (Found in Attachment A) with them to the physician, clinic or hospital

- Appropriate treatment details are handled by the Occupational Injury Nurse and Workers Compensation
 - Nurse communicates and troubleshoots with and for employee through full recovery
18. SL will write up emergency incident as soon as possible after it occurs and submit a report to the ER Lead, the Corporate Director of Health and Safety, the Regional Health and Safety Manager, and the County. Serious incidents must be reported in accordance with CH2M HILL's Standard of Practice, *Serious Incident Reporting Process*. Serious incidents are those that involve any of the following:
- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, County employee, or member of the public
 - Kidnap/missing person
 - Acts or threats of terrorism
 - Event that involves a fire, explosion, or property damage that requires site evacuation or is estimated to result in greater than \$500,000 in damage
 - Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment

5.2.2 Minor Injury/Illness

The following minor injuries and illnesses are considered non-life threatening:

- Headaches
- Nausea
- Itching
- Small cuts

In the event that a non-life threatening injury or illness occurs, the following steps will be taken:

1. Any person on the site sustaining an injury or illness should immediately report it to their supervisor.
2. The supervisor shall immediately report incident to ERL and SL.
3. Any employees at Facility who are currently certified in First Aid or CPR may also provide treatment.
4. A written report shall follow-up any incident within 24 hours (This report is to include investigation and root causes).

5.2.3 Chemical Exposure by Inhalation

In the event of chemical exposure by inhalation, the following steps will be followed:

- Notifications will be done as follows for all chemical exposure by inhalation:

- Call 911 unless exposure is minor, in which case, take individual to doctor or clinic
- Person in charge of the scene shall call ERL and SL per Table 3.1.
- The ERL will contact the County per Table 3.2
- The ERL will contact other appropriate emergency authorities per Tables 3.3 and 3.4, or direct the SL or other employees to do so.
- Put on SCBA, survive air pacts and personal protective equipment if available
- Remove individual into fresh air
- Provide CPR if needed by trained staff

In the event of chemical exposure through eye contact, the following steps will be followed:

- Wash eye with large amounts of cold water for 15 to 20 minutes

In the event of chemical exposure through skin contact, the following steps will be followed:

- Flush skin with large amounts of cold water for 15 to 20 minutes
- Remove contaminated clothing

5.3 Emergency Actions/Response

An emergency may be an injury to a worker, or a major event caused by an explosion, evacuation, fire, or chemical release. This ERP identifies and describes specific emergency response actions relating to potential emergency situations as follows:

- General Emergency Response (includes explosions)
- Fires
- Spills
 - Chemical Releases
 - Diesel, Oil and Grease
- Natural disasters
- Terrorist activities
- By-Pass/Facility Upsets
 - Power Failure
 - Foaming
 - Hydraulic Overload
 - Organic Shock Loads
 - Anaerobic Digesters
 - Loss of City Water
- Release of contaminants exceeding permitted levels
- County Utilities Wastewater Operations
 - Plugging of sanitary sewers and/or stormwater sewers causing sewage overflows onto the streets/roadways
 - Hazardous substances spills entering into the wastewater and/or stormwater collection systems

In addition, a vulnerability assessment (VA) for the SCRWRF can be referenced in Appendix C, which provides implementation measures to protect design basis threats to the SCRWRF.

5.3.1 General Response to Emergencies (includes explosions)

In general, emergency response actions, including those for explosions, should be as follows:

1. **Shut down appropriate Facility operations:** Shut down may mean shutting down minor operations by turning off specific valves, motors, or other equipment or it could mean shutting down entire operations (e.g., digesters, odor control facility, waste gas burner, etc).
2. **Evacuate the immediate area:** Assess the need for site evacuation, and evacuate the site as warranted.
3. **Notify appropriate response personnel:** Should an emergency situation of any type take place, the following notifications will be done:
 - Report first to the supervisor and then the ERL and SL per Table 3.1
 - Notify the County per Table 3.2
 - Notify appropriate government agencies depending upon the type of emergency (e.g., medical emergencies include medical contacts, and spills, fires, etc. have specific contacts). See Tables 3.3 and 3.4 for contact information.
 - Site Security is to be notified immediately if emergency response vehicles have been dispatched to the Facility.
4. **Account for personnel at the designated assembly areas:** Personnel not immediately involved in emergency or rescue operations should stay together and move to the designated assembly areas (TOF and Maintenance Building).
5. **Designated Meeting Area:** Under no circumstances should any employee leave the designated meeting area for any reason during or after an emergency situation, unless released by his/her supervisor.
6. **Supervision of incident or event:** The ranking supervisor shall remain in control of the scene until the arrival of the ERL, ERL Alternate or SL.
7. **Under no circumstances shall any person involved with the Facility discuss their knowledge of or the circumstances surrounding an emergency situation with anyone except their employer and CH2M HILL.**
8. **All inquiries or matters relative to the news media shall be referred to the ER Lead.**
9. **Reporting:** SL will write up the incident as soon as possible after it occurs and submit a report to the ER Lead, Corporate Director of Health and Safety, County, and Ecology as necessary.

5.3.2 Fire

In the event of a fire, the following steps will be taken:

- All personnel will promptly report the occurrence of any fire, no matter how small, to their immediate supervisor, ERL and the SL per Table 3.1.
- Notifications for fires always include:
 - County per Table 3.2
 - Spokane Emergency Management and Emergency Coordination Center (911, contacts medical, fire, police responders as needed)
 - Spokane Regional Clean Air Agency
 - Ecology
 - Avista (if a gas fire)
- All personnel will familiarize themselves and be trained in the use of different types of fire extinguishers. They shall also familiarize themselves with the types and locations of fire-fighting equipment in their work areas.
- In the event of a minor fire, attempt to extinguish the fire with available fire extinguisher and/or water lines, assuming you can do so without risk of personal injury
- Never attempt to put water on a flammable liquid or electrical fire. Use only dry chemical type ABC Fire Extinguishers for those types of fires
- The supervisor in charge of the work area will make the determination as to whether or not the fire has been completely extinguished and a post fire watch is required
- Should a major fire occur, all personnel should immediately evacuate the area in an orderly fashion and report to muster areas (Freya Street and Julia Corridor entrances)
- Turn off power and natural gas to area of fire
- Supervisors shall take the head counts at muster areas, and ensure that all staff are present. They will notify the SL and ERL of the counts
- The person calling 911 shall relay the following information:
 - Their name
 - The site location
 - Type of emergency (fire)
 - Types of materials burning or type of structure
 - Nearest site entrance
 - Advise if persons are trapped or injured
 - Stay on the line until released to hang up
- The SL will ensure the following duties are assigned and carried out:
 - Assign a CH2M HILL staff member to direct fire personnel in from the Main Gate to the location of the emergency
 - Notify the ERL
 - Ensure that the gates are secured

- Upon arrival of the fire and ESM personnel, the supervisor in charge will fully brief them to:
 - Any missing personnel and their last known location
 - Types of materials burning and what is stored in the structures

5.3.2.1 Electrical Panels

In the event of a fire at electrical panels:

- Use Halotron 1 fire extinguisher
- Call 911 if needed
- Notify Supervisor, ERL and SL per Table 3.1
- Notify Maintenance
- Notify County per Table 3.2

5.3.2.2 Vehicles

In the event of a vehicle fire:

- Pull off of road
- Use fire extinguisher
- Call 911 if necessary
- Notify Supervisor, ERL and SL per Table 3.1
- Notify County per Table 3.2

5.3.3 Spill Response

CH2M HILL will operate the Facility in such a manner that influent, effluent, and residuals will not contaminate, or be bypassed, released, leaked or spilled on or into the environment (other than as permitted by Applicable Law and the Service Contract).

CH2M HILL personnel will be knowledgeable of the potential health, safety and environmental concerns associated with petroleum and other hazardous materials or chemicals that could potentially be released at the Facility. Refer to the *Spokane County Regional Water Reclamation Facility, Spill Prevention Control and Countermeasures (SPCC) Plan* for a list of hazardous materials that are used and/or stored at the Facility.

Spill Control Stations have been designated throughout the Facility and were chosen based on their locations near areas where spills are most likely to occur or where hazardous materials are stored and handled. The Spill Control Stations are at the:

- Treatment Operations Facility (for spill containment related to laboratory)
- Headworks Building
- Membrane Building
- Chemical Storage
- Maintenance Building
- Solids Building

Any supervisor or employee that discovers a spill or leak should identify and locate the source of the spill, assessing the type, quantity, and related hazards. If unsafe conditions exist, then leave the area, inform nearby personnel, notify the site supervisors, and initiate spill reporting as soon as possible. The Lead ERL and SL are to be notified immediately.

CH2M HILL will notify the County promptly upon the occurrence of any unauthorized release, and shall be responsible for fulfilling all notification and reporting requirements established by Applicable Law related to any unauthorized release of influent, effluent or residuals into the environment from or in connection with its operation and management of the Facility.

Notification of CH2M HILL employees, County employees, and other agencies regarding spills will be done as described in Section 3.1 (contact information shown in Tables 3.1, 3.2 3.3 and 3.4) as necessary or in accordance with federal, state and local regulations.

Notifications for spills will always include:

- County Water Reclamation Manager (Dave Moss) or County Water Resources Manager (Rob Lindsay)
- Spokane Emergency Management and Emergency Coordination Center (Call 911, Center contacts Fire Department, medical responders and police as needed)
- Ecology
- National Response Center

CH2M HILL will coordinate with the County and all appropriate Governmental Bodies in the prompt remediation of any unauthorized release. Cleanup and remediation of released materials, including influent, effluent or residuals will be done as quickly as possible and in accordance with Applicable Law.

The following procedures will be followed:

- Evaluate the information provided by the spill notifier. The supervisor and SL will conduct evaluation and supervise emergency responses/actions. Those will include:
 - Attempt to identify the character, exact source, amount, and extent of the released materials. Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified
 - Assess possible hazards to human health or the environment as a result of the release, fire or explosion
 - Call 911 for serious spills that may pose a threat to public health and the environment
 - Contact and arrange for a spill cleanup contractor, if required for pump truck, containment, cleanup, disposal, etc.
- Take response actions to mitigate for hazardous material incidents in accordance with federal, state and local regulations. Actions may include:
 - Stop the spill immediately (if possible)
 - Extinguish sources of ignition (e.g. flames, sparks, hot surfaces, cigarettes, etc.)
 - Clear personnel from the spill location and barricade the area

- Utilize available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, reoccur, or spread
- Use sorbent materials to control the spill at the source
- Divert discharge to a containment area if a secondary containment area is present; verify that valves and drains are closed prior to diverting the spill to this area.
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks or other suitable materials to help contain the spill
- Ensure that all emergency equipment is cleaned and fit for its intended use before operations are resumed
- If spill response measures involve the temporary cessation of any operations, the affected equipment will be monitored for (1) leaks, (2) pressure buildup, (3) gas generation, or (4) ruptures in valves, pipes or other equipment
- Provide for the proper treatment, storage and disposal of any waste or contaminated materials; use qualified and duly trained employees or subcontractors familiar with proper spill cleanup criteria including:
 - Use of proper waste containers and marking, labeling
 - Waste removal methods and measures to ensure incompatible wastes are not commingled
 - Waste disposal methods for bulk materials not reclaimed onsite
 - Use of sorbent materials to pick up remaining liquid after bulk liquid has been removed
 - Use of equipment and container decontamination methods and spill response equipment
- The following steps will be taken to secure the Facility:
 - Shut off flow to the aeration basins to minimize contamination of aeration basin
 - Shut off one of the clarifiers to minimize contamination of the clarifiers
 - Shut off RAS and WAS pumps
 - Allow sweeper arms to collect floating material to scum pit
 - Do not pump down scum pit contents to other plant processes
 - Place absorbent pads in primary clarifier effluent launders to collect contaminants
 - Pump out scum pits with pump trucks
 - Pump off surface of aerated grit basin
- A spill report will be completed that includes a memorandum evidencing notification and reporting in accordance with the Service Contract and WAC 173-303-145, Spills and Discharges into the Environment. The report will also include a description of the event, root causes, and corrective actions. A copy, along with any documents provided to the relevant Governmental Body regarding the release, will be provided to the County. This written record of any incident will be kept in Facility files and submitted to the Ecology if necessary.

5.3.4 Natural Disasters

Natural disasters include earthquakes, tornadoes, storms, and floods. In addition to the general emergency response actions explained in Section 5.3.1, the following paragraphs provide specific information for certain natural disasters.

5.3.4.1 Earthquakes

In case of earthquake, all personnel should move outside and away from buildings where the risk of injury from falling objects is at a minimum.

- Notifications of the emergency will follow Section 3.0 (provides contact information for Facility, County and agencies). Earthquakes notification will include:
 - County Water Reclamation Manager (Dave Moss)
 - Spokane Emergency Management and Emergency Coordination Center (Call 911-Center contacts Fire Department, medical responders, and police)
 - Ecology
- If personnel can't move outside of buildings, personnel in buildings should move to and stand or crouch in the doorway of these buildings.
- Personnel shall not position themselves near the following:
 - Windows or glass walls
 - File or storage cabinets (need to be anchored and secured to walls)
 - Bookshelves
 - Copying machines
 - Water coolers, refrigerators, etc.
- Personnel at the Facility shall attempt to move away from the following:
 - Stacks of materials
 - Overhead power lines
 - Windows or glass walls
- Once the tremors cease, all personnel shall proceed immediately to the designated muster area (primary by Freya entrance and secondary by Julia entrance)
- A designated supervisor will take a head count and ensure that all employees are present. They shall accomplish this task using daily schedules. After taking a head count, the supervisor will report to the SL and ERL of status (i.e.; all present, etc.)
- No employee is permitted to leave the site until released by his/her supervisor
- Available first-aid personnel will treat any injured
- Emergency personnel are the only ones to conduct rescue searches for missing/injured employees
- No personnel are permitted to re-enter any structures for any reason until it has been inspected and deemed safe by a structural engineer

Inspections at Facility should be made as follows:

- Check collection system onsite for ruptures or breaks in the line
- Check all buildings, tanks, etc. for structural damage
- Check all mountings, flexible couplings, and machinery for damage that may result in malfunctions as the equipment is returned to normal service
- Report findings to the ERL/PM, Alternate ERL/Operations Lead, and SL
- If utility power has been interrupted, ensure emergency generators are functioning properly. If an extended power outage is anticipated, make necessary arrangements for diesel deliveries as needed.
- If the emergency generators have been damaged and/or are not functioning correctly, flow to the plant will need to be suspended to avoid loss of containment in the aeration basins. Portable generators will be secured from a local supplier or government emergency management agency and a qualified electrician will be on hand for installation upon delivery.

5.3.4.2 Tornadoes

Should a tornado warning be issued for the area, the SL will assign 2-4 employees to be on the alert for a nearby funnel cloud or tornado. Should a tornado be sighted, the employees will alert the ER Lead and SL by radio of the sighting and describe location of tornado in respect to the Facility.

The ER Lead with the advisement of the SL; will authorize notification of all employees by use of two-way radio or cell phones. All CH2M HILL employees, subcontractors, County employees and visitors will be notified of the eminent tornado and asked to seek shelter at the pump room (basement) of the Headworks Building.

Should the tornado cause structural damage, fires, the need for medical attention or any other emergency, the notification procedures in Section 3 will be followed. Notifications for tornadoes will always include:

- County Water Reclamation Manager (Dave Moss)
- Spokane Emergency Management and Emergency Coordination Center (Call 911-Center contacts Fire Department, medical responders and police as needed)

5.3.4.3 Severe Weather

Severe weather can include high winds, lightening, torrential rain, heavy snow and/or ice storms. The ER Lead will determine if the weather is severe and authorize all outdoor activities to cease until the severe weather has passed. All CH2M HILL employees, subcontractors, County employees and visitors will be notified by two way radio or by cell phone. Other agency notifications will occur (contact information in Section 3) should the

severe weather result in flooding, structural damage, or any other type of emergency. Notifications for severe weather emergencies will always include:

- The County
- Spokane Emergency Management and Emergency Coordination Center (Call 911-Center contacts Fire Department, medical responders and police as needed)

Areas of the Facility that are subject to flooding include:

- Insert areas here

In the event of flooding the following actions will be taken:

- Turn off all electrical power to area
- Notify the ERL and SL based on Table 3.1
- Notify the County based on Table 3.2
- Notify appropriate emergency response agencies based on Tables 3.3 and 3.4

5.3.4.4 Telephone Outage

In the event that the telephone service is no longer active at the Facility:

- Call Qwest at (800) 247-7285
- Notifications of the telephone outage emergency will follow Section 3.0 (provides contact information for Facility, County and agencies).

5.3.4. Terrorist Activities

Refer to the *Vulnerability Assessment* (Attachment B) for planning preparation and response to potential terrorist activities.

In the event of a telephone bomb threat, the employee taking the call should notify immediate supervisor who will follow the notification procedures as described in Section 3. Notifications will always include:

- County Water Reclamation Manager (Dave Moss)
- Wastewater Operations Manager (Vern Jarvis)
- Spokane Emergency Management and Emergency Coordination Center (call 911).

The employee who received the call should attempt to identify the caller by noting:

- Voice characteristics such as slurred or lisped words, stuttering, ethnicity, race
- Age
- Gender
- Attitude (confrontational, agitated, impatient)

Also, listen for background noise to identify the possible location of the caller including traffic, railroad, bar or party, radio or television, and or airplanes.

5.3.5 By-Pass or Facility Upset

This section describes operational emergencies caused by a Facility by-pass or upset. These operational emergencies are also addressed in the *Process Control Management Plan* and include:

- Power Outage
- Foaming
- Hydraulic Overload
- Organic Shock Loads
- Anaerobic Digester Upset
- Loss of City Water

In the event of a Facility operational emergency, the employee taking the call should notify immediate supervisor who will follow the notification procedures as described in Section 3. For any type of by-pass or Facility upset notification will always include:

- County Water Reclamation Manager (Dave Moss)
- Wastewater Operations Manager (Vern Jarvis)
- Spokane Emergency Management and Emergency Coordination Center (911, contacts medical, fire, police responders as needed)
- Ecology

CH2M HILL is required to report all bypasses that occur. If CH2M HILL knows in advance of the need for a bypass, a written notice must be submitted to Ecology 10 days before the bypass is scheduled. If an unanticipated bypass occurs, CH2M HILL must submit notice of noncompliance as detailed below.

CH2M HILL must report occurrences of noncompliance to Ecology by telephone within 24 hours from the time they are aware of the circumstance. The following circumstances are considered non compliant:

- Any non compliance that may endanger health or the environment
- Any unanticipated bypass that exceeds any effluent limitation in the permit
- Any upset that exceeds any effluent limitation in the permit
- Any violation of a maximum daily or instantaneous maximum effluent limitation for applicable pollutants listed in the permit to be reported within 24 hours
- Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limitation in the permit

In addition, CH2M HILL must also provide Ecology a written submission within 24 hours of the time that they are aware of any event. The written submission must contain:

- A description of the noncompliance and its cause

- The period of noncompliance, including exact dates and times
- The estimated time noncompliance is expected to continue if it has not been corrected
- Steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance

Ecology and the County can take enforcement action for bypass unless:

- The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage
- There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance.
- CH2M HILL submitted notices as required
- The bypass was approved by the County and Ecology

5.3.5.1 Power Failures

In the event of a power failure, the headworks generator and the membrane building generator will be activated to continue wastewater treatment operations temporarily until power can be restored. If an extended power outage is anticipated, it will be necessary to immediately schedule the necessary diesel deliveries to keep the generators running for the duration of the outage. Should the emergency generator(s) fail to activate, operators will have approximately 30 minutes to diagnose and repair the problem before a loss of containment event occurs. Should operators fail to activate the emergency generator(s) in time, flow to the plant will need to be suspended and alternative generators brought to the Facility.

In addition to the notifications mentioned above for by-pass and Facility upsets, should the operational failure be the result of a power failure, the electric and gas utility, Avista, will also be contacted. If the emergency generators do not come on in the event of a power failure the on-call Facility Mechanic (509-) and Facility Maintenance Supervisor (509) _____ will be contacted. See *Operations Plan* for more details on responding to power failures.

5.3.5.2 Foaming

In the event of foaming the following actions will be taken:

In the headworks:

- Implement water spray in headworks channels
- Divert foam to Headworks Building dumpster storage

- Add defoamant to headworks, if necessary

In aeration basins:

- Divert foam to site drain adjacent to Aeration Basins
- Add defoamant to aeration basins, if necessary

5.3.5.3 Hydraulic Overload

In the event of hydraulic overload at the Facility, the following steps will be taken:

- Following health and safety procedures, remove any obstruction in the influent flow channel
- Contact County to slow influent flow to plant.
- Take actions to ensure as much solids retention as possible

5.3.5.4 Organic Shock Loads

The following industries could contribute organic shock loads to the Facility:

1. Rendering Plant

In the event that a high organic load is discharged to the Facility, the following steps will be taken:

- Notify the Facility Pretreatment Coordinator
- Verify operation of Chemically Enhanced Primary Treatment System (CEPT), increase chemical feed dose if appropriate
- Check that aeration basins are on line
- Increase ferric chloride dose at the influent channel and increase the polymer dose at the primary influent channel to increase solids capture in the primary clarifiers
- Monitor aeration system and increase air demand if required

5.3.5.5 Anaerobic Digesters

In the event that a gas leak is detected in or around the anaerobic digester, the following steps will be taken:

- Notify the ERL
- Assess what is causing the leak
- Secure flow to the digester
- Develop an incident specific plan to mitigate situation
- Implement plan

5.3.5.6 Loss of City Water

Essential equipment at the SCRWRF that requires water for proper operation (i.e. pump seals, dilution water, carrier water, etc.) uses W3 plant water. Thus, much of the Facility operations are not reliant on city water service. In the event that city water service is lost to the Facility, the following steps will be taken:

- Notify City Water Department at (509)625-6270

- Check grounds and buildings for water line breaks

5.3.6 Release of Contaminants Exceeding Permitted Levels

Any release of contaminants exceeding permitted levels will follow notifications procedures in Section 3 and the Service Contract. The following will always be contacted:

- County Water Reclamation Manager (Dave Moss) at County
- Ecology
- Spokane Emergency Management and Emergency Coordination Center would be notified if release of contaminants was a threat to public health or the environment (call 911).

CH2M HILL will take corrective actions as specified in the Service Contract and Operations Plan to address any release of contaminants that exceed permit levels.

5.3.7 County Wastewater Utilities Operations

Wastewater Utilities manage the County's sewer collection and NVI Pump Station and SVI Pump Station systems.

5.3.7.1 Plugging of Sanitary Sewers

The County would take the lead regarding notification and response related to plugging of sanitary sewers that may cause sewage overflows onto the streets/roadways and other public and private property; and when there is a potential for human contact that could affect public health. CH2M HILL will coordinate with the County should Facility operations be affected by this type of problem.

5.3.7.2 Hazardous Substance Spills to Wastewater Collection System

The County would take the lead regarding notification and emergency response related to a hazardous substance spills entering into the wastewater and/or stormwater collection system that would potentially harm public health or environment. CH2M HILL will coordinate with the County should Facility operations be affected by this type of problem.

Alternate Wastewater Treatment

If SCRWRP operations are discontinued because of an emergency or for any reason, an alternate source for wastewater treatment would be the City of Spokane's Riverside Park Water Reclamation Facility.

Attachment A

Exhibit 6-23

CH2M HILL OMI WORKERS' COMPENSATION INITIAL INTAKE INFORMATION (WC-1)

EMPLOYER INFORMATION:

WORKCARE 1 (866) 893-2514

Caller Name:	Caller Tel. No.
Supervisor Name:	Supervisor Tel. No.
Project :	Work Schedule / Shift:
Project Address: (City, State, Zip Code)	
Location of Accident: (City, State, Zip Code)	

INCIDENT INFORMATION:

Employee Name:		Employee Home Tel. No.	
Address: <i>(City, State, Zip Code)</i>			
SSN:		Job Title:	
Date of Injury:		Time of Injury: _____ <input type="checkbox"/> AM <input type="checkbox"/> PM	Date & Time Reported:
Time EE Began Work On Day Of Injury: _____ <input type="checkbox"/> AM <input type="checkbox"/> PM		Employee Performing Regular Job Duties? <input type="checkbox"/> Yes <input type="checkbox"/> No	List Task:
Will EE Miss Work Past Date Of Injury: <input type="checkbox"/> Yes <input type="checkbox"/> No	Estimated days away:	Was there a Fatality: <input type="checkbox"/> Yes <input type="checkbox"/> No	Name:
Detailed Description of Accident: _____ _____ _____ _____ _____ _____ _____			
Nature and Extent of Injury:		Body Part:	
Safety Equipment & PPE	JSA / SOP Provided: <input type="checkbox"/>	SOP Followed:	PPE Worn:

Provided: <input type="checkbox"/> Yes <input type="checkbox"/> No	Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
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TREATMENT INFORMATION:

Employee already sent for treatment: Yes <input type="checkbox"/> No <input type="checkbox"/>
Medical Provider: (City, State, Zip Code)
Clinic Telephone No:
Has the clinic/doctor suggested this will become a lost time accident? <input type="checkbox"/> Yes <input type="checkbox"/> No (How Long? _____)
Has the clinic/doctor suggested Modified Duty? <input type="checkbox"/> Yes <input type="checkbox"/> No If YES, what will this be? _____
Do you feel this is a suspicious claim? <input type="checkbox"/> Yes <input type="checkbox"/> No Explain: _____ _____

CORRECTIVE ACTION PLAN:

What can be done to prevent this accident/incident from reoccurring?

Was this a result of an unsafe condition or unsafe act? ☐ Condition ☐ Act ☐ Both ☐ N/A

How long has this condition existed: _____

Does condition still exist: ☐ Yes ☐ No

Is a "Work-Around" Plan in Place: ☐ Yes ☐ No

Root Cause Corrective Action:	Task Responsibility:	Timing:

[If no Disciplinary Action is recommended to HR, please provide an explanation.]

NOTIFICATION TIMING:

- ✓ Immediately address any Immediately Dangerous to Life or Health conditions at scene. (Call 911 if necessary). Secure Incident Scene.
- ✓ Inform Immediate Supervisor, PSTL, PM & Health Care **1-866-893-2514**. Proceed as directed.
- ✓ PSTL to Inform Regional H&S ASAP for their coordinated assistance.
- ✓ *This form should be completed and e-mailed within 24 hours to Denver @ Fax - 720-286-8723.*
- ✓ For any incident that requires medical attention, please call or e-mail to inform your RBM ASAP.
- ✓ Follow-up (until case closed) with Incident Investigation, Medical Progress & Corrective Actions.



Attachment B

Memorandum

Date: August 3, 2009
To: Dave Moss
c: *Vern Jarvis, Bruce Rawls*
From: Darrel Nice, Neill Pulliam and Brian Carter
Project No./Name: 135-17247-09001 / Spokane County Wastewater System Vulnerability
Subject: Security and Operational Enhancements for Future Water Reclamation Facility

This memorandum is a deliverable of Tetra Tech's work effort outlined in our scope of work with Spokane County under Tasks 3-1 and 3-2, which are tasks related to the Future Water Reclamation Facility Vulnerability Assessment. The memo is intended to provide Tetra Tech's, "cursory review" of the County's future wastewater treatment plant, the Spokane County Regional Water Reclamation Facility (SCRWRF), and is based on a workshop (Workshop 2) with staff from Spokane County and CH2M Hill (CH2M).

1. BACKGROUND

1.1 Vulnerability of County Wastewater System

Tetra Tech is in the process of assisting the County in performing a vulnerability assessment (VA) of the County's entire wastewater system. The VA team has kicked off the project, participated in two workshops, and visited all of the County wastewater facilities and assets that are to be included in the VA. From this initial effort Tetra Tech is in the process of documenting the wastewater system mission, ranking the facilities, developing a design basis threat, developing a level of consequence, characterizing the facilities, and evaluating security and operational system effectiveness.

As mentioned above, the VA includes future facilities such as SCRWRF, which is the focus of this memo. At this time we are only providing a summary of potential security enhancements for SCRWRF without the benefit of a completed VA effort. Tetra Tech will complete a comparative risk analysis later in the project.

Workshop 2 was conducted in order for Tetra Tech to gain an understanding of CH2M's plans for physical and operational security. CH2M is the company designing, building and operating the SCRWRF. In order to provide review of the proposed security and operational systems at an appropriate time in the design process, Tetra Tech is preparing this memorandum before all of the VA steps have been completed. In addition to the workshop we have been provided the following reference information:

- Spokane County Regional Water Reclamation Facility Physical Security, June 23rd, 2009, PowerPoint by CH2M Hill (as presented to Spokane County and Tetra Tech)



TETRA TECH

- Spokane County Regional Water Reclamation Facility, May 27, 2009, PowerPoint by County/CH2M Hill (as presented to the Design Review Committee at the City of Spokane)
- Primary Design Document – Volume 1, October 15, 2007, by Spokane County and edited by CH2M Hill

Engineering & Architecture Services

1235 North Post Street, Suite 101, Spokane, WA 99201
Tel 509.744.9271 Fax 509.744.9281 www.tetratech.com

- Four plan sheets from the Spokane County Regional Water Reclamation Facility design drawings prepared by CH2M Hill

1.2 Facility Description

A new Spokane County Regional Water Reclamation Facility (SCRWRF) will be constructed to treat wastewater generated in Spokane County's North Valley Service Area and the Spokane Valley Service Area. Eventually, the plant may also receive some wastewater generated in the eastern reaches of the City of Spokane's collection system or even from Liberty Lake.

The plant will be implemented in Phases. Phase 1 must be on line by 2012 and will provide an average-day treatment capacity of 8 mgd. Phase 2 will be implemented when needed and will increase the nominal plant capacity to 12 mgd. To facilitate the Phase 2 construction, some of the Phase 1 facilities will be sized for a 12 mgd flow rate. With the Phase 2 expansion, the plant is anticipated to provide sufficient capacity through the year 2030. The ultimate capacity requirement for the SCRWRF is uncertain; however, space planning for expansion has been based on a nominal flow of 24 mgd.

Listed below are the components anticipated in Phase 1 and Phase 2. Phase 1 will be implemented using a design-build-operate (DBO) procurement process.

- Phase 1 Conveyance (not included in DBO project)
 - NVI Pump Station and forcemains (off-site)
 - SVI Pump Station and forcemains (off-site)
 - Outfall (off-site)
 - Reclaimed water pipelines (off-site)
- Phase 1 Treatment Plant (included in DBO project)
 - Treatment Operations Facility (administration building and laboratory)
 - Maintenance facility
 - Water Resource Center
 - Roadways, landscaping, irrigation, fencing, and all appurtenant utilities
 - Storm drainage collection and treatment facilities
 - Septage receiving station
 - On-site portions of forcemains, outfall, and reclaimed water pipelines
 - Headworks facility including mechanical fine screening, grit removal, screenings processing and storage, and grit processing and storage
 - Primary influent splitting
 - Two primary clarifiers and associated sludge and scum pumping station
 - MBR influent split box
 - Four bioreactor step feed trains including anoxic, and aerobic basins, membranes and ancillary equipment
 - Two chlorine contact chambers

- Chemical feed and storage facilities including storage tanks and feed equipment for sodium hydroxide, sodium hypochlorite, sodium bisulfite, citric acid (if needed), polymer, and ferric chloride.
- Reclaimed Water Pump Station also housing storage and feed equipment for sodium bisulfite.
- Effluent flow meters
- Two anaerobic digesters
- One Liquid Biosolids Storage Tank
- Solids Handling Building including two centrifuges, two gravity belt thickeners, biogas handling system, polymer feed system and a truck load out facility.
- Compost odor control beds
- Phase 2 Treatment Plant
 - Third primary clarifier
 - Another bioreactor train including anoxic and aerobic basins, membranes and ancillary equipment
 - Third anaerobic digester

1.3 Facility Mission

The typical mission of a wastewater treatment plant is to treat incoming wastewater to an environmentally and public health-acceptable level before discharge to a receiving body of water or other system. We are proposing the mission/objective of the SCRWRF as follows: Provide continuous, safe, reliable, and economic treatment of design and peak flows of municipal sewage.

2. THREAT ASSESSMENT

2.1 Threats to a Wastewater Treatment Plant

The equipment and systems for successful detection and delay of a threat should be matched to the capabilities of the identified adversaries, referred to as design basis threats (DBTs). In general the DBT for a typical wastewater treatment plant (WWTP) would include Vandals, Criminals, Saboteurs, and Insiders. CH2M Hill, in their presentation at Workshop 2, indicated the DBT being used to design the security system for SCRWRF would be Vandalism, Theft, and Criminal Threat.

2.2 Design Basis Threat

A preliminary DBT for the entire Spokane County wastewater system was developed by County and Tetra Tech staff as part of Workshop 1B and is included in the summary below.

- Insider:
 - Motivations are mischievous, immature, and retaliation
 - Number of insiders is two individuals collaborating, but carried out by one
 - Tactics used are bowling ball in sewer, rags in PS, contaminating generator fuel, messing with controls, closing valves, etc.

- Tools used are manhole puller, pick, any misc object
- Technical skills are limited.
- Outsider:
 - Vandals, thieves, and other low level criminals.
 - Commercial accidents such as train and truck wrecks.
 - Number of outsiders is three
 - Tactics used are hunters shooting assets such as fuel tanks or vandals messing with controls.
 - Equipment used are rocks, crow bar, miscellaneous hand tools, hunting rifle.
 - Technical skills and knowledge of the system are low
- SCADA/Cyber:
 - Motivations are disruption, challenge, get on the news, notoriety
 - Number of adversaries is one or two
 - Tactics used are hack into system shut off pump, disrupt operations, get access through admin network
 - Tools used are computer, software, communication equip
 - Technical skills and financial resources are moderate
 - Collusion with an insider is possible
- Natural:
 - Natural Threats and their relative likelihood are as follows:
 - Ice storm = .5
 - Fire storm = .5
 - Snow storm = .7
 - Structure fire = .8
 - Wind or Lightening storm with regional brown out = .9
 - Earthquake or Volcano = .1
 - Flood = .5

Tetra Tech proposes that a few additional, or more specific, threats should be considered when reviewing vulnerability of a facility like SCRWRF. Additional threats are as follows:

- Unprovoked device and equipment failures
- Operator error
 - Accidental
 - Malicious
- Sabotage

- Operator
- Grudge / Retaliation
- Vandalism
- Terrorism

3. SECURITY AND OPERATIONAL ENHANCEMENTS

3.1 Facility Physical Protection System

Proposed physical protection systems (PPS) for the SCRWRF appear adequate for the design basis threats identified from workshop discussions with Spokane County personnel. The PPS is composed of multiple layers consisting of one, or more of the following:

- Perimeter / Internal site fencing
- Communications
- Access Control
- Intrusion Alarms
- Video Assessment capabilities

The following paragraphs discuss and provide recommendations for potential enhancements to the current design proposed for the site to facilitate the ability to “DETECT” “DELAY” “RESPOND” to unauthorized entry into the facility.

Site Fencing

The entire site is intended to be fully enclosed with a system of perimeter fencing of various types. Types of fencing proposed include 8 ft Ornamental / Architectural security fence along the N. Freya St. frontage and extending across the primary public entry location. A PVC coated chain link fence is proposed to separate the public access areas from the limited access areas of the operations. The remaining perimeter is secured with an 8 ft perimeter security chain link fence with climb barriers installed 1 ft inside the property line. There are seven primary points of access into the treatment plant facility [A1, A2, A3, A4, A5, A6, A7] as identified on Figure 1. Access locations A1, A4, A5, A6, A7 are sliding gates for vehicular access; whereas A2 is pedestrian doorway access and A3 is pedestrian access. Additionally, there are 3 secondary access locations interior to the primary access locations: A2.1 is doorway from the Operations Facility and A5.1 and A5.2 are pedestrian access gates located on each side of the headworks building.

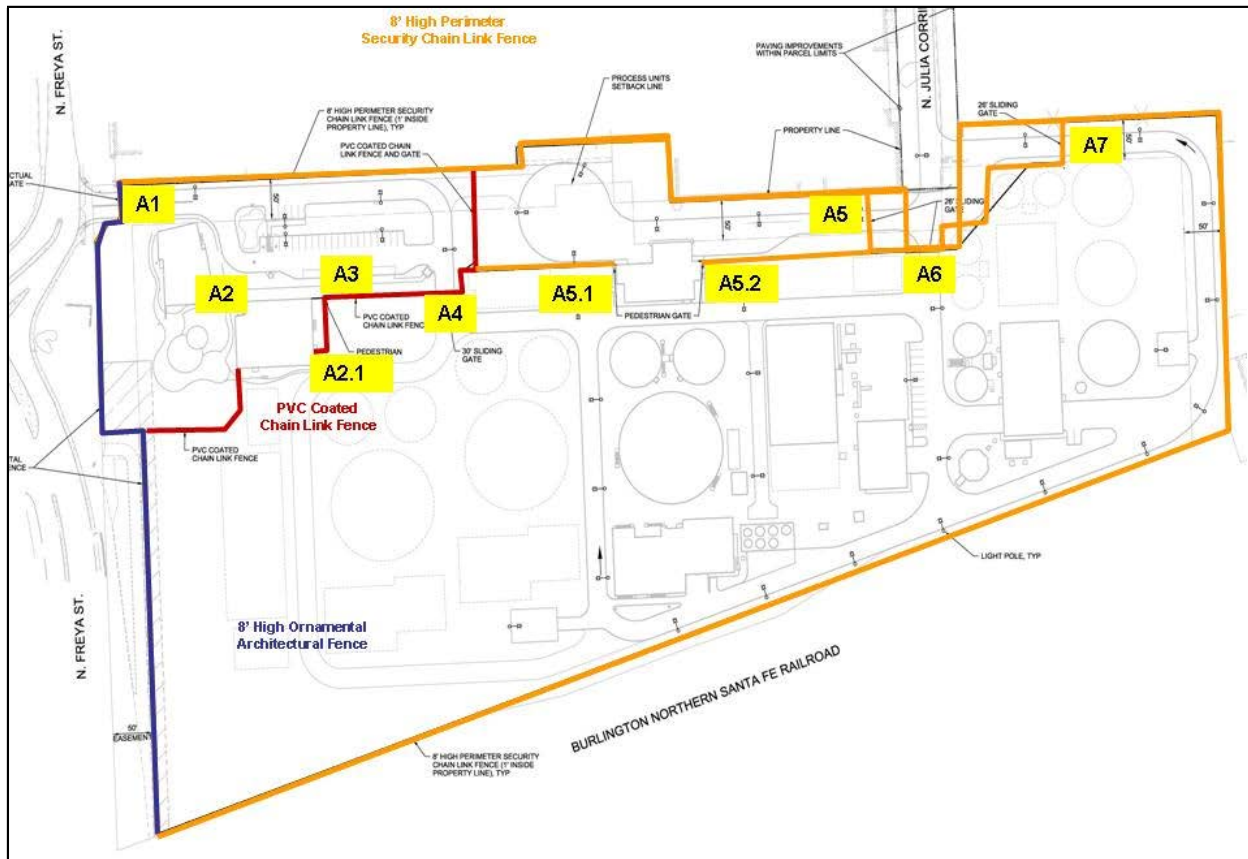


Figure 1. Primary Points of Site Access (North is at top of Figure)

Workshop discussions concluded to relocate gate A7 further to the East to prevent unauthorized entry from the building to the North.

Additionally, we recommend the A3 gate be relocated to the northeast corner of the operations building along an extension of the east-west fence from the Operations building to gate A4. The current design reflects the fence to be located along the outside sidewalk on the east side of the Operations building to doorway A2.1. Doorway A2.1 appears to be the secondary egress point from the Operations Building and should not be a primary access into the facility. Relocation of gate A3 to the northeast corner of the operations building will maintain pedestrian access for employees, while reducing the number of primary access locations. There may be other reasons for gate arrangements in this area that are unknown to Tetra Tech at the time of review. The general goal of this comment is to provide an additional barrier against accessing building entry points.

Landscaping adjacent to perimeter fencing should be planted in a manner to provide and maintain an unobstructed barrier for at least 15 ft from the fence to the landscaping, as indicated in Figure 2. This practice will facilitate good maintenance activities and provide the ability of clear visibility along the perimeter fencing.



Figure 2. Landscaping

Communications

All primary access locations should be configured with the ability for an operator / receptionist, located inside the operations building, to communicate with persons located at one or more of the primary access locations and desiring to enter the facility. Procedures should be established to prevent entry into the facility without the specific granting of access by the operator / receptionist. An intercom system with call button and video viewing works well and allows the operator / receptionist to identify and communicate to persons prior to their access into the facility.

Access Control

All primary and secondary access locations should be configured with electronic access control. Only employees and persons granted a designated access card for respective locations would have the ability to access the facility. Due to the anticipated public use of the Water Resources Center, we anticipate gate A1, the primary facility entrance, would be opened for uncontrolled access during business hours and secured for controlled access during other times. Corresponding access from the public use area and parking lot are maintained by the controlled access locations of A2, A3, and A4.

Table 1 summarizes recommendations for consideration to limit and monitor access to various locations within the facility. Four primary categories of authorized access are identified and include: employees, septage haulers, plant deliveries, and solids removal.

TABLE 1. ACCESS CONTROL RECOMMENDATIONS	
Location	Control access permitted for:
A1	Uncontrolled during business hours; control for all during other times
A2	Employees / others as authorized
A2.1	Employees only
A3	Employees only
A4	Employees only
A5	Employees / designated septage haulers
A5.1	Employees only
A5.2	Employees only
A6	Employees / designated deliveries
A7	Employees / solids removal

Intrusion Alarm

All doorways providing ingress or egress to enclosed buildings should be configured with locks and deadbolts; and should have the ability to alarm upon unauthorized entry. We anticipate the alarm system may be disabled during business hours to facilitate efficient entry / exit by employees. However, during non-business hours, exterior doorways should be locked and alarmed.

Video Assessment

Video assessment does permit the ability to detect, delay, and respond by an operator or other employees. Figure 3 reflects recommended views for the operator to monitor from inside the operations building via the video cameras. Each intercom location should have a dedicated, close-up camera for personal identification. Site videos allow the operator to monitor activities at the primary access locations as well as within the facility grounds.

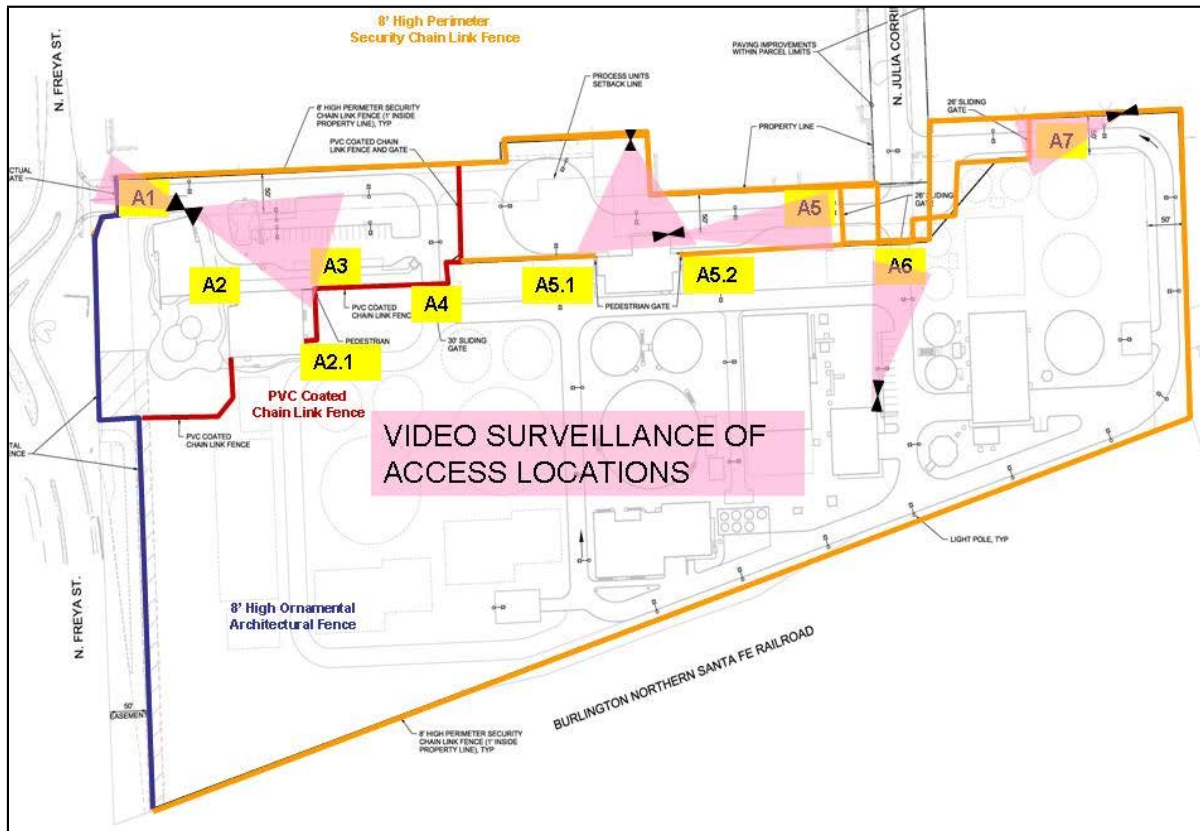


Figure 3. Proposed Video Surveillance

3.2 Computer and Network (IT) Systems

Tetra Tech's review of the computer and network systems are mainly based on our review of the Primary Design Document, Section 19 Instrumentation and Controls, as edited by CH2M Hill. Network and computer system were not described in much detail, and assumptions will not be made about unspecified aspects of the systems. Many of the general recommendations developed in the following sections will be applicable to other County wastewater facilities.

SCADA computers do not appear to be installed in a secure computer room but are located in other areas of the operations building. Location in an equipment rack in a computer room is preferable as the equipment would be more secure in every way and people working on the equipment would not disrupt the operations staff doing their jobs.

The SCADA server computer is specified with RAID but full redundancy and physical separation of redundant SCADA servers is not specified. Full redundancy is more fault tolerant than RAID and physical separation of redundant SCADA servers reduces the likelihood that physical damage to both machines will happen simultaneously.

Infrastructure Damage or Corruption

The following enhancements are recommended to reduce the risk of plant network infrastructure damage or corruption:

- Provide network security scanning software. Software shall provide network scanning, intrusion detection, and alarming which will detect unauthorized users on the network and provide alarms to the responsible IT organization. Network security scanning software shall analyze the operating systems and applications running on the network and identify possible security holes, and alert administrators to the detected vulnerabilities. Network security scanning software shall scan the entire network, IP by IP, and provide information such as service pack levels, missing security patches, wireless access points, USB devices, open shares, open ports, services and applications that are active, key registry entries, and weak passwords, users and groups. Network security scanning software shall provide filter and reporting tools to aid administrators in proactively securing a network. Network security scanning software shall provide patch management functions that can automatically acquire and deploy detected missing patches, service packs, etc. An example is GFi Languard.
- Provide and deploy network change auditing software. Change auditing software shall provide change auditing across multi vendor servers, desktops, directory servers, and network devices. Change auditing software shall independently detect both automated and manual changes, reconcile detected changes with authorized and intended changes, and graphically report on desired and undesired change status. Change auditing software shall assess system damage after an attack or an unintended change, report files and configurations that need to be repaired, and rank violations by relative severity. Change auditing software shall provide notification of all undesired changes, according to severity, and shall show who made the change, what change was made, and when and how the change was made. Change auditing software shall provide change-auditing security for files, directories, registry settings, directory server objects, and configurations files on servers, desktops, and network devices. Change auditing software shall provide quasi real time notification (e-mail, etc.) to alert administrators of intrusion into critical files. An example is Tripwire Enterprise.
- Provide secure physical location for network equipment and computers. Implement strict security policy for IT area access.

Unauthorized Access to Network Systems

The following enhancements are recommended to reduce the risk of unauthorized access to network systems:

- Implement rigorous policy to control physical and network access to operations network, network devices and computers, and county WAN. This policy should be administered by the appropriate IT department to county IT standards.
- Secure all process control communications to offsite devices either by ensuring communications protocol is proprietary and adequately encrypted or thru the deployment of security devices appropriate to each communications channel. For example, alarm notification telephony cards are secure but unsecured data modems are not. Data modem connection to process control computers can be secured thru the use of secure serial port console servers or other appropriate means.
- Provide firewall and other network security measures between the process control network and the operations LAN. Security device and configurations should be per the applicable IT department standards.

- Provide firewall and other appropriate network security measures between the operations LAN and the County WAN. Security device and configurations should be per the applicable IT department standards.
- Secure all incoming communications via the internet by deployment of firewalls, etc., per IT department standards.
- Implement policy to ensure all computers have current security patches and system updates installed per responsible IT department standards.
- Deploy and administer anti virus software, internet security software, and software fire walls for all computers that can connect to the internet per responsible IT department standards.
- Access networks only thru security device. Utilize network access device log on and dial back features, firewall security policy, windows log on, and application log on for multi layer security scheme.
- Dial up lines may be secured by deployment of secure consol servers or LAN modem with firewall. Utilize call back feature with authentication for all dial up connections.
- Firewall and otherwise secure all dial up Ethernet modem connections. Implement security and password policy.
- Deploy read only remote SCADA applications.
- Do not connect data modems directly to computers.
- Do not install PC Anywhere. Do not enable Remote Desktop Protocol on computers with data modem connected. It is most secure to not enable critical computers for remote access and administration via RDP for workstations or Remote Console for servers. Provide SCADA client and view applications that are either single threaded or web server based and do not enable remote control of the computer. Coordinate with county IT department if remote administration is required.
- Firewall al remote access connections to SCADA or the network. Implement dial up remote access with a LAN modem. Utilize dial back and provided security features. Provide firewall between modem and network connection.
- Administer passwords as follows to reduce the risk of unauthorized access to systems
 - Conceal all password lists.
 - Implement password policies which require changing passwords on a schedule.
 - Implement a policy which requires changing all passwords when critical IT or operations staff leave the organization.
 - Implement layered security policies and systems. For remote SCADA access use network access device log on and dial back features, firewall security policy, windows log on, and application log on for multi layer security scheme.

Wide Area Network System Failures

The following enhancements are recommended to reduce the risk of wide area network system failures:

- Provide redundant service, media, and equipment for mission critical functions which rely on WAN service. Alternate WAN service could be provided by T1 line, cable, dial up, wireless,

or fiber optic means. Note that all overhead utilities are vulnerable to automobiles and lightning. Use of overhead media is discouraged.

Connection to County IT Systems

The following enhancements are recommended to reduce risks to the connection to County IT systems:

- County IT systems could be accessed via the plant network and process control equipment. Provide network barriers and security appliances and policies such as firewalls, DMZ's, secure routers, etc. as required to secure county IT network from unauthorized intrusion from the plant and process control network. Implementation and administration shall be per responsible IT organization standards.

3.3 Instrumentation and Control Systems

Tetra Tech's review of the instrumentation and control systems is mainly based on our review of the Primary Design Document, Section 19 Instrumentation and Controls, as edited by CH2M Hill. Instrumentation and control and other operational systems were not described in much detail, and assumptions will not be made about unspecified aspects of the systems.

There was no mention of process or equipment segmentation to increase process fault tolerance.

There was no mention of installing the SCADA server or any PLC's at the plant in redundant configuration. All components at the plant that are mission critical and are not provided with alternate fault mitigation plans should be installed in redundant configuration. The MBR process PLC is the most likely to need redundant installation.

Instrumentation and Controls

The following enhancements are recommended to reduce the risk to instrumentation and controls:

- Increase system tolerance to unprovoked device and equipment failures. Design in adequate redundancy for process, mechanical, electrical, I&C, communications, computer, network, etc. systems as required to ensure no single point failure results in unacceptable consequences, damage, or loss.
- Increase system tolerance to operator error. Include robust alarm notification system. Provide adequate operator training. Provide robust security log on system for all devices and computers running process monitoring and control software programs.
- Critical PLC configuration issues: Provide mission critical PLC's in redundant processor configuration or split redundant process train control into several PLC's so that the failure of one processor does not prevent the system from achieving it's mission objectives. Separate equipment PLC IO points such that the failure of a single IO module does not prevent the system from achieving it's mission objectives.
- Provide all monitoring and control devices required to allow operators to operate all plant equipment and the plant as a whole in completely manual mode not dependent on any programmable control or display device. Provide plant staffing and emergency response policies as needed to inform, contact, and staff the facility in the event manual operation is necessary. Tailor the response policy and associated systems to accommodate the response

time of staff and the grace period after the offending event before the point of unacceptable consequence, conditions, damages, or loss.

- Provide instrumentation to detect flammable, explosive, damaging biological materials, etc. in the influent stream. Connect to alarm notification system.
- Provide instrumentation to detect flammable, explosive, damaging biological materials, etc in the treatment stream. Connect to alarm notification system.
- Provide detection instrumentation to detect the presence of hazardous gasses such as methane or chlorine.
- Provide catch structures or swales at the plant with level detection instrumentation as required to detect spills.
- Password protect all PLC and Operator interface terminals. Implement robust password strength and rotation policy.
- Employ all available wireless security methods such as WEP for wireless communications. Firewall all wireless Ethernet radio connections to process networks.
- Firewall all off site fiber optic cable or co-ax Ethernet connections to the plant such as links to the influent pump stations (NVI and SVI).

SCADA and Process Computing Functions

The following enhancements are recommended to reduce the risk to SCADA and process computing functions:

- Provide robust security log on policies and systems for all devices and computers running process monitoring and control software programs. Use layered security and logon policy where available. For instance, in the case of remote access use network access device log on and dial back features, firewall security policy, windows log on, and application log on for multi layer security scheme.
- Provide change management software for automation systems. Change management software shall provide change auditing and disaster recovery for automation systems through security, version control, audit trails, central storage, and automated backup and recovery. Change management software shall provide protection for software configurations on SCADA systems and PLC's. Change management software shall detect and prevent unauthorized changes and access requests. An Example is G.E. Proficy Change Manager.
- Provide SCADA system in fully redundant hot backup configuration. Install the two redundant SCADA computers in physically separate locations which would not be likely to experience the simultaneous realization of threats.
- Develop, train, implement, and police a rigorous file backup policy and process.
- Maintain an on call relationship with in house or outside programming staff as required to ensure timely response to software failures and take corrective action as required to prevent unacceptable consequence, conditions, damages, or loss.
- Install alarm notification system in redundant hot backup configuration.
- Provide secure physical location for Process control system computers including SCADA, data historian, alarm notification, security server, etc., machines. Implement strict security

policy for access to the machines. Utilize SCADA "client" workstations for use by operators, managers, engineers, etc., in work areas.

- Provide user, operator, and administrator authorization levels for SCADA logon. User is read only, operator is read and process control write only, and administrator has full system control including changing running applications, changing users and passwords and rights, etc. Implement automatic log off and log in of read only user following a preset inactivity period.
- Provide historical records keeping database computers in redundant configuration. Otherwise provide a single records database of each type needed and follow an adequate archiving policy such that data can be buffered if the historian machine or application go down and can be merged into the historical databases when machine and application functions are restored without the loss of data continuity.

Access Control and Security

The following enhancements are recommended to reduce the risk of disruption, damage, loss, and injury as a result of intrusion and sabotage:

- Include robust access control, intrusion alarm, and intrusion alarm notification systems and services. Coordinate with third party responders such as fire and police departments. Identification of responders should be established before the facility construction is complete.
- Provide adequate fencing or other physical barrier at all facilities and structures
- Provide lock and other access control for all vaults, gates, structures, field panels, etc.
- Provide intrusion detection device for all vaults, gates, structures, field panels, etc.
- Provide CCTV surveillance system to aid in identification and prosecution of unauthorized intruders and saboteurs. Fixed cameras should be provided for the most critical surveillance needs. Intrusion device triggered PTZ cameras may be used for less critical surveillance where response time is less critical.
- Provide adequate process alarm detection, communications, telemetry, and notifications systems as required to inform and allow timely response to the realized threat conditions rapidly enough to avert unacceptable consequences. The response plan will involve staff training and assignments, staff notification systems, staff transportation means and methods, staff equipment needs, and availability of replacement parts and equipment.
- Provide robust multi layer security policies and systems for all methods of access to programmable process control equipment, computers, communications systems, and networks.
- Provide robust network auditing, intrusion, and security surveillance and alarming software functionality.
- Do not locate SCADA HMI workstations in public view as this can provide potential saboteurs with system information.
- Provide intrusion detection devices as required to detect intrusion into any critical vault, structure, facility, field located panel, etc. Door switches may be employed where doors are the only access to the space. Motion detectors may be used indoors where there are other routes of ingress. All methods of access to each space should be provided with detection.

- Provide access control such as locking manhole covers and vault hatches at vulnerable or high risk conveyance system access points.

3.4 Fire Alarm and Gas Detection and Alarm

The following enhancements are recommended to reduce the risks of disruption, damage, loss, and injury by fire:

- Provide adequate gas detection and notification systems
- Include adequate fire detection, alarm, and suppression systems

3.5 Electrical Systems

The following enhancements are recommended to reduce risks to the electrical system:

- Provide adequate lightning protection system. Provide adequate surge protection systems for all sensitive equipment. Provide lightning/surge protection for all field devices at control panel terminals.
- Provide adequate backup power systems. Provide onsite generator capable of carrying the mission critical load. Redundant utility services may be considered for some facilities.
- Provide UPS or battery backup systems for equipment which would be disrupted during transfer and retransfer events. List of critical equipment should include but not be specifically limited to access control, fire alarm, intrusion detection, CCTV, process alarms, SCADA, data historians, and remote alarm notification systems
- Note that all overhead utilities are vulnerable to vehicle accident and lightning.

3.6 Phone System Failures

The following enhancements are recommended to reduce risks to the phone system:

- Provide redundant service, media, and equipment for mission critical functions which rely on telephone service. One example is remote alarm notification system which could use a cell phone modem as well as land line communications for alarm dial out. Note that all overhead utilities are vulnerable to vehicle accident and lightning.

3.7 Coordination with Response Personnel

In Workshop 2, CH2M noted that the first responder has not been identified. Tetra Tech suggests that emergency response planning is needed during the design-build phase to clarify this topic and ensure the appropriate equipment and programming is installed. A few typical key alarms and corresponding responders are listed below.

Another related note is that equipment and systems should be selected bearing in mind that the adversary must be adequately delayed until the identified response force arrives. This assessment mainly evaluates physical threats, but operational threats like equipment failure will also need to be considered and mitigated.

Alarm Notification Systems

- Process alarm notification system

- Security alarm system
- Fire alarm system
- Network intrusion and change auditing systems

Corresponding Responder (to alarm list above)

- Operations staff
- Police department
- Fire department
- IT staff

4. CONCLUSION

The next step for the County's Wastewater System Vulnerability Assessment is to assess the consequence and calculate risk for all assets in the system. During the subsequent VA steps, the SCRWRF will be treated as one of the County's Wastewater System assets. Information provided and developed during this Future Water Reclamation Facility task will be used in the overall VA. Once further analysis is done and risk is calculated, recommendations for each asset will be developed.

Chemical Management Plan

Purpose and Content

Most chemical feed and storage facilities will be located in and adjacent to the Membrane Facility, providing a primary location for bulk chemical delivery and storage. This will contain Ferric Chloride for chemical Phosphorous removal, Sodium Hypochlorite for disinfection and membrane cleaning, Citric Acid for membrane cleaning, Sodium Hydroxide for pH control, and Sodium Bisulfite for de-chlorination. Bulk chemical storage tanks will be located outside the facility with accommodations made to protect these from varying weather conditions. Citric Acid and Sodium Bisulfite will be contained in totes and stored inside the Membrane Facility. Polymer will be housed in the Headworks Building and the Solids Facility as its uses will be confined to these areas.

MSDS

MSDS sheets are on file in the TOF building, covering all chemicals on site. All MSDS sheets are reviewed on a regular basis.

Relationship to Other Processes

The Membrane Facility includes the membrane tanks, membrane building and chemical storage. It is located adjacent to an access road to accommodate access for bulk chemical delivery trucks. The W3 pumping station will supply plant water throughout the site for various uses, including wash down, solids equipment water needs, irrigation, and chemical dilution water.

Ferric Chloride

Ferric chloride metering pumps will pump chemical to two mixing chambers, one upstream of the aerated grit basin and one upstream of the membrane influent channel. The addition of Ferric Chloride will facilitate the precipitation of phosphorus. The precipitated phosphorus will either be removed as part of the primary sludge or waste activated sludge.

Sodium Hydroxide

Sodium Hydroxide is fed to the return activated sludge channel to increase the alkalinity and pH of the mixed liquor stream to provide adequate pH for nitrification and to buffer the pH changes from the addition of Ferric Chloride.

Sodium Hypochlorite

Sodium Hypochlorite metering pumps feed chemical to the permeate header upstream of the Chlorine contact tanks for disinfection and to the discharge side of the back pulse pumps for membrane clean in place procedures.

Sodium Bisulfite

Sodium Bisulfite is provided to de-chlorinate effluent from the chlorination basin prior to discharge in the reclaimed water wet well.

Citric Acid

Citric Acid is used for clean in place procedures of the membranes and is fed to the discharge side of the backpulse pumps.

Anionic Polymer

Anionic Polymer improves the solids and phosphorus removal in the Primary Clarifiers by coagulating the chemical precipitate formed by the addition of Ferric Chloride.

Cationic Polymer

Cationic polymer is used to aid in sludge thickening by the gravity belt thickeners and in sludge dewatering by the centrifuges. Cationic polymer is also provided as a slip feed to the dewatered sludge pumps to assist dewatered sludge travel to the truck loading bay.

Process Facilities**Chemical Process Overview**

Schematic diagrams of the chemical feed and storage facilities are shown on drawing numbers 09-N-0104, 0160, 0161, 0162, 0163, 0164, and 0165 of the P&IDs. These facilities will include metering pumps and chemical storage to accommodate chemical requirements to meet projected Phase 1 flows and vendor recommended membrane-cleaning frequencies.

Ferric Chloride

Two 75-gph Ferric Chloride chemical feed pumps are used to convey the solution to the influent stream at Headworks for the CEPT process. Ferric Chloride is sent to the membrane feed channel through the use of two 40-gph chemical feed pumps. Three 8,700-gallon storage tanks are provided for the Ferric Chloride solution, providing a 30-day supply of chemical for Phase 1. Mixers will be utilized at the Ferric Chloride injection points to provide the required mixing.

Sodium Hydroxide

Two 50-gph Sodium Hydroxide chemical feed pumps are used to convey sodium hydroxide to the RAS stream for alkalinity adjustment. Two 8,700-gallon storage tanks are provided for the Sodium Hydroxide solution, providing a 30-day supply of chemical for Phase 1.

Sodium Hypochlorite

The Sodium Hypochlorite system at the Membrane Facility is used for effluent disinfection and membrane cleaning. It includes two 4,400-gal storage tanks and two (four total) metering pumps per process, one duty and one standby. This provides approximately 30 days of storage for Phase 1.

Sodium Bisulfite

The Sodium Bisulfite provides chemical dosing for de-chlorination of the discharged effluent. The system is designed to deliver a concentration of 40% Sodium Bisulfite to the effluent discharge line. Two Polyethylene Sodium Bisulfite totes are stored in the Membrane Facility along with two metering pumps, one duty and one standby; which provide approximately one month of storage for Phase 1. Sodium bisulfate is injected into the reclaimed water wet well when it exits to the effluent discharge line. SCADA monitors the weight of each tote and alarms on High and Low level weights. Any leaking chemical totes will spill to containment sump number two that is monitored by SCADA.

Citric Acid

Citric Acid is used to clean the membranes of inorganic fouling. These chemicals are injected into the back pulse water to clean the hollow-fiber membranes from inside-out. Citric Acid is delivered and stored in 300 gallon Polyethylene totes in the Membrane Facility. Tote level is monitored by weight and alarmed on SCADA when High or Low level conditions exist. Any leaking chemical totes will spill to the secondary containment sump which is monitored by SCADA.

Anionic Polymer

The Anionic Polymer Storage and Feed System located in the Headworks Building consist of one Anionic Polymer storage tote, polymer blending unit, and post-dilution static mixer. The system is designed to activate neat polymer to 0.5% polymer solution at the blend unit with addition of post dilution water to aid in carrying polymer to the injection point. Anionic polymer is used in conjunction with Ferric Chloride to supplement the chemically enhanced primary treatment (CEPT) process. Activated anionic polymer improves the solids removal in the Primary Clarifiers by coagulating the chemical precipitate formed by the addition of Ferric Chloride.

Cationic Polymer

The Cationic Polymer Storage and Feed System located at the Solids Facility consists of three cationic polymer storage totes, polymer blend unit, polymer aging tank with mixer, and seven polymer feed pumps. Cationic polymer is used to aid in sludge thickening prior to anaerobic and aerobic digestion, aid in sludge dewatering prior to off-site disposal, and provide slip feed to the dewatered sludge pumps.

There are three totes to provide polymer storage. One 50-gph polymer blend unit is used to pump and activate neat polymer from the totes and convey the 0.5% polymer solution to the polymer aging tank. The polymer aging tank is equipped with a vertical mixer to aid in the activation and aging of polymer prior to metering. From the polymer aging tank, cationic polymer can be fed to one of three systems: thickening at the gravity belt thickeners (GBTs), sludge dewatering at the centrifuges, and dewatered cake slip at the sludge cake pumps.

Each feed pump is sized to feed one of the thickening or dewatering equipment in the Solids Handling Facility: two for GBTs, three for centrifuges, two for dewatering sludge pumps. After the flow is measured, post-dilution water is added to provide additional mixing energy and carry water. The polymer blend unit will be controlled by level in the polymer aging tank. The plant PLC will control batch operation of the polymer blend unit based on low and high level setpoints.

Bulk Chemical Concentrations and Delivery

Facilities are sized based on delivery of the chemicals in liquid form in the following concentrations:

Chemical	Percent Active
Ferric Chloride	45 %
Sodium Hydroxide	25 %
Sodium Hypochlorite	12.5 %
Sodium Bisulfite	40 %
Citric Acid	50 %
Anionic Polymer	100%
Cationic Polymer	100%

Chemical Use Summary

Table includes a summary of the chemical volume, dosage and storage equipment.

Ferric Chloride Storage Tanks								
Number of Tanks	3							
Volume each, gallons	8,700							
Total Available Volume, gallons	26,100							
Storage Duration	Unit	Min.	Avg.	Max.				
	Days	10.9	29.6	118.4				
Ferric Chloride Dosing Specifics								
Chemical Dosage Point	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
RS @ HW Rapid Mix Basin	mg/L	10.0	40.0	60.0	lb/d	500.4	2835.6	6905.5
ML @ Membrane Feed Channel	mg/L	5.0	20.0	40.0	lb/d	250.2	1417.8	4603.7
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				
	Gal/d	223	892	2413				
Ferric Chloride Delivery Specifics								
Vendor	????							
Delivery Type	Tanker							
Deliveries Frequency	Unit	Avg.	Max.					
	Deliveries/month	7.1	19.2					
Sodium Hydroxide Storage Tanks								
Number of Tanks	2							
Volume each, gallons	8,700							
Total Available Volume, gallons	17,400							
Storage Duration	Unit	Min.	Avg.	Max.				
	Days	10.9	29.6	118.4				
Sodium Hydroxide Dosing Specifics								
Chemical Dosage Point	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
RAS @channel	mg/L	3.0	8.0	10.0	lb/d	552.9	1934.9	2335.2
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				

Gal/d 263 725 875

Sodium Hydroxide Delivery Specifics

Vendor	????
Delivery Type	Tanker
Deliveries Frequency	Unit Avg. Max.
	Deliveries/month 5.2 6.2

Sodium Hypochlorite Storage Tanks

Number of Tanks	2
Volume each, gallons	4,400
Total Available Volume, gallons	8,800
Storage Duration	Unit Min. Avg. Max.
	Days 19.6 35.0 156.6

Sodium Hypochlorite Dosing Specifics

Chemical Dosage Point	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
SE @CC Tank	mg/L	1.0	3.0	5.6	lb/d	25.0	212.7	565.1
Startup SE @ CC Tank	mg/L	1.0	1.0	2.0	lb/d	552.9	1934.9	2335.2
BWS pump discharge (maint.)	mg/L							
BWS pump discharge (recovery)	mg/L							
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				
	Gal/d	56	252	448				

Sodium Hypochlorite Delivery Specifics

Vendor	????
Delivery Type	Tanker
Deliveries Frequency	Unit Avg. Max.
	Deliveries/month 1.7 3.0

Sodium Bisulfite Storage Totes

Number of Totes	2
Volume each, gallons	300
Total Available Volume, Gallons	600
Storage Duration	Unit Min. Avg. Max.
	Days 3.3 10.2 30.6

Sodium Bisulfite Dosing Specifics

Chemical Dosage Point	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
PLE @ Effluent discharge	mg/L	2.0	6.0	10.0	lb/d	50.0	375.3	1150.9
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				
	Gal/d	29	88	271				

Sodium Bisulfite Delivery Specifics

Vendor	????
Delivery Type	Tote Delivery
Deliveries Frequency	Unit Avg. Max.
	Deliveries/month 8.8 27.1

Citric Acid Storage Totes

Number of Totes	2
Volume each, gallons	300
Total Available Volume, Gallons	600

Citric Acid Dosing Specifics

Chemical Dosage Point	Unit	Min.	Avg.	Max.
BWS pump discharge (maint.)	mg/L	N/A	214.0	N/A
BWS pump discharge (recovery.)	mg/L	N/A	392.4	N/A
Bulk Chemical Usage	Unit	Min.	Avg.	Max.

Gal/d 0 28 <28

Citric Acid Delivery Specifics

Vendor	????
Delivery Type	Tote Delivery
Deliveries Frequency	Unit Avg. Max.
	Deliveries/month 0.2 <0.2

Anionic Polymer Storage Totes

Number of Totes	1 (Neat)
Volume each, gallons	300

Anionic Polymer Dosing Specifics

Chemical Dosage Point	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
(neat) feed into blend unit	mg/L	2.0	6.0	10.0	lb/d	50.0	375.3	1150.9
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				
	Gal/d	4	8	63				

Anionic Polymer Delivery Specifics

Vendor	Polydyne
Delivery Type	Tote Delivery
Deliveries Frequency	Unit Avg. Max.
	Deliveries/month 0.8 6.3

Cationic Polymer Storage Totes

Number of Totes	3 (Neat)
Volume each, gallons	300
Total Available Volume, Gallons	900
Aging Tank	1 (Diluted)
Total Available Volume, Gallons	1330

Cationic Polymer Dosing Specifics

Chemical Dosage Point (neat)	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
GBT	mg/L	6.0	6.0	15.0	lb/hr	0.3	1.2	3.1
GBT (recup, thick)	mg/L	6.0	6.0	20.0	lb/hr	0.3	0.6	4.1
Centrifuge	mg/L	20.0	30.0	60.0	lb/hr	2.5	6.3	18.5
Cake Pumps	mg/L	6.0	6.0	15.0	lb/hr	0.4	0.8	0.8
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				
	Gal/d	47	131	371				
Chemical Dosage Point (diluted)	Unit	Min.	Avg.	Max.	Unit	Min.	Avg.	Max.
GBT	mg/L	6.0	6.0	15.0	lb/hr	22.5	90.1	226.4
GBT (recup, thick)	mg/L	6.0	6.0	20.0	lb/hr	21.6	43	330
Centrifuge	mg/L	20.0	30.0	60.0	lb/hr	180	459	1350
Cake Pumps	mg/L	6.0	6.0	15.0	lb/hr	30	60	60
Bulk Chemical Usage	Unit	Min.	Avg.	Max.				
	Gal/h	443	1128	3272				

Cationic Polymer Delivery Specifics

Vendor	Polydyne
Delivery Type	Tote Delivery
Deliveries Frequency	Unit Avg. Max.
	Deliveries/month 13.1 37.1

Chemical Storage Protection

Chemical Storage Tank Farm

The Ferric Chloride, Sodium Hydroxide, and Sodium Hypochlorite tanks are double walled. The Ferric Chloride and Sodium Hydroxide tanks have 12' outside wall diameter and a 10' inner wall diameter. The sodium hypochlorite has a 10' outside wall diameter and an 8' inner wall diameter. The corrosion liner in all tanks are a minimum of 100 mm in thickness, which will contain 10-20 mm of the specified resin reinforced with a single layer of "C" glass followed by 80-90 mm of the specified resin reinforced with two layers of 1 ½ ounce mat. The structure will consist of alternating layers of chopped strand roving, woven roving, and filament winding. The tanks have a 12 mm exterior gel-coat with UV-inhibitors.

Citric Acid Chemical Storage Totes

Citric Acid is delivered and stored in two 300 gallon Polyethylene totes in the Membrane Facility. Tote level is monitored by weight and alarmed on SCADA when High or Low level conditions exist. Leaking chemical totes will drain to containment sump one which is monitored by SCADA. Roll-up doors allow for maneuvering of totes into the Chemical Room with a forklift.

Sodium Bisulfite Chemical Storage Totes

Two 300 gallon Polyethylene Sodium Bisulfite totes are stored in the Membrane Facility. Leaking chemical totes will drain to containment sump two which is monitored by SCADA. Roll-up doors allow for maneuvering of totes into the Chemical Room with a forklift.

Anionic Polymer Chemical Storage Totes

One 300 gallon Polyethylene Anionic Polymer tote is stored in the Headworks Facility and provides approximately 40 days of storage at average flow and dosing. In the case of a leak polymer will be contained in the storage area. Roll-up doors allow for maneuvering of totes into the Chemical Room with a forklift.

Cationic Polymer Chemical Storage Totes

Three 300 gallon Polyethylene Cationic Polymer totes are stored in the Solids Facility. The Cationic Polymer Aging Tank includes overflow and drain connections, vent, and a level transmitter. In the case of a leak polymer will be contained in the blending area. Roll-up doors allow for maneuvering of totes into the Chemical Room with a forklift.

Chemical Spill Plan

This narrative addresses unloading and containment of the chemicals. The outdoor tank farm provides containment by double-walled chemical storage fiberglass reinforced plastic (FRP) tanks. Residual chemical from truck unloading procedures and spilled chemical at the truck apron, located south of the tank farm, collect in one of two below grade containment vaults. Manual drain valves for the vaults contain any chemical spill so it can be drained after appropriate neutralization or dilution measures. The vaults will need to be checked regularly and accumulated wash water or stormwater will be drained when there is no chemical present.

Containment at the chemical pumps and tote storage areas is provided by containment sumps that drain to the containment vaults. Citric acid and sodium bisulfate totes are also provided with containment totes to serve as primary containment. See *Spokane County RWRf Spill Control Response Plan* for more information.

General Initial Spill Response Measures

The following actions will be the initial response to any spill or release at the job site. These steps do not provide the necessary actions for remediation of a major release but they do provide guidance to minimize potential damage from a release. The intent of this plan is to provide appropriate guidance for response to spills of petroleum products and hazardous substances. However, this plan may not address all compliance issues for spills covered by regulations mandated by laws other than the Clean Water Act.

Spill Response Activities When an Individual Discovers a Spill or Release

The individual who discovers a spill(s) or release should do the following activities as long as the individual does not endanger him/her self or others:

1. Follow the spill response flow chart in the *Spill Control Response Plan*.
2. Stop spillage at the source if possible to do safely.
3. Prevent any spilled chemical from spreading by building physical barriers.
4. Contact the immediate supervisor and/or project manager.

Disposal of Materials from Spill or Release Events

Contaminated Soils

Contaminated soils will be collected in drums or roll off boxes if appropriate. The containers will be labeled with the contents in the container (i.e., soil from cleaner xyz spill on 2-20-09, material being classified). The waste will be classified from either process knowledge, knowledge obtained from MSDS of a known chemical spill, or by waste analysis. Once the waste has been properly classified, it will be properly disposed of in accordance with local, state and federal regulations.

Liquids

If a liquid spill or release is contained by using absorbent material, this contaminated absorbent material will be containerized, labeled and managed as stated above for contaminated soils. If the liquid is collected by a vacuum truck or equivalent means, the material will be classified from either process knowledge, knowledge obtained from MSDS of a known chemical spill, or by waste analysis. Once the waste has been classified, it will be properly disposed of in accordance with local, state and federal regulations.

Chemical Unloading Containment Vaults

Containment Vault 1 serves as Temporary Storage for Collection and Disposal of:

- Ferric Chloride Spills that may occur at the Chemical Tank Farm Area,
- Ferric Chloride residual in piping after truck delivery chemical refills at the Chemical Tank Farm
- Ferric Chloride Spills that may occur at the Ferric Chloride Feed Pump Chemical Sump inside the Membrane Building,
- Citric Acid Spills that may occur at the Citric Acid Chemical Sump inside the Membrane Building.

Containment Vault 2 serves as Temporary Storage for Collection and Disposal of:

- Sodium Hypochlorite spills that may occur at the Chemical Tank Farm Area
- Sodium Hydroxide spills that may occur at the Chemical Tank Farm Area
- Sodium Hypochlorite or Sodium Hydroxide residual in piping after truck delivery
- Sodium Hydroxide spills that may occur at the Feed Pump Chemical Sump inside the Membrane Building
- Sodium Bisulfite Spills that may occur at the Sodium Bisulfite Feed Pump
- Chemical Sump inside the Membrane Building

Both vaults serve as Temporary Storage for Collection and Disposal of:

- Rain water at the Chemical Tank Farm Area
- Wash down water at the Chemical Tank Farm Area
- And Water from Emergency Eyewash/Safety Shower runoff

Containment Vault Operation

Containment Vault Valves are operated manually. There is no remote operation by SCADA. If chemicals or wash down water spill into the containment area and fill the containment vault, the high level switch in the vault alarms to SCADA. Personnel are required to inspect the liquid in either vault and determine whether a chemical truck is required to pump liquid out of either vault for offsite disposal. Operators will manually open either of the butterfly valves and gravity drain either vault to the plant drain pump station in the event that storm water, not chemical, has collected in the vault.

Leak detection of the double-walled FRP tanks is performed manually via the leak detection nozzle located on the outer containment wall of the tank. Opening the ball valve at the nozzle and visually inspecting for chemical draining from piping will be used to verify integrity of chemical containment of the FRP tanks.

Containment Vault Process Alarms

If chemicals or chemical wash down water drain into and fill the vaults or sumps, the high level switch from the respective vault or sump alarms to SCADA.

General process alarms and interlocks are listed in the table below.

Process Alarm	Action / Response	Design Setpoint Value	Design Setpoint Units	Adjustable	Alarm Reset
Outdoor Containment Vault 1 Level HIGH	Alarm only	4	FEET	NO	SCADA
Outdoor Containment Vault 2 Level HIGH	Alarm only	4	FEET	NO	SCADA
Indoor Chemical Sump 1 Level HIGH	Alarm only	36	INCH(ES)	NO	SCADA
Indoor Chemical Sump 2 Level HIGH	Alarm only	36	INCH(ES)	NO	SCADA
Indoor Chemical Sump 3 Level HIGH	Alarm only	12	INCH(ES)	NO	SCADA
Indoor Chemical Sump 4 Level HIGH	Alarm only	12	INCH(ES)	NO	SCADA

Utility Requirements

The following utility requirements have been identified:

- Non-potable water for wash down and flushing. The dilution wash water required will be 15 gpm.
- Power for equipment as well as ancillary equipment such as heating, ventilation and lighting.

Communication Plan

Purpose

This plan will describe the communication protocols that will be used to communicate process control information to appropriate staff, including the use of weekly or more frequent meetings, distribution of reports, posting of directives and use of a daily log book. The communication protocols will also address the communication with Spokane County, Washington State Department of Ecology, and other governing agencies.

According to Appendix 9, section 14 of the Service Contract the company shall implement a Communications Plan to inform the County about their ongoing services and performance. The Plan shall include:

- Daily communications
- Weekly meetings
- Monthly and annual reports
- Regulatory reporting and liaison
- Emergency communications and response
- Construction coordination
- Media communication
- Special reports

Performance reports that summarize data to aid understanding, and explain trends and developments that may affect the County's fiscal and administrative planning shall be prepared. Communications with the County shall also include an O&M performance overview, a report of significant events, and a report on staffing or responsibility changes. The Company shall produce and share any plant information requested, including preventive maintenance schedules, regulatory and safety reports, and budgeting information.

The Company shall prepare all reports required in this section and as required by Applicable Law, as well as provide monthly and annual reports to the County as described herein. The Company shall meet at least once per month with County representatives to review the Company's performance. The Company shall meet with the County representatives on an annual basis to present and review the annual data.

The County and its designated representative(s) shall have full access to reports and data at all times. Those reports required by Applicable Law shall be in the format specified by Applicable Law. Those reports required by the County shall be in a format acceptable to the County. Annual reports prepared for budget or operational purposes shall be prepared by March 1 of each year unless noted or agreed upon otherwise.

The Company shall prepare monthly Facility performance reports with analysis of compliance with the Contract Standards for Effluent, Residuals and odor. The analysis shall include complete performance data analysis, summary of statistical parameters,

comparison with permit limits and Performance Guarantee levels, and trend analysis. Facility performance reports shall include both graphical presentation of performance data and narrative descriptions of the analysis and findings. The reports shall also include the Company's corrective action plan and response to operation outside of Performance Guarantee requirements.

Daily communications

All significant operational activity will be entered into the daily logbook. Pertinent data will be collected by the site SCADA system and transferred to the OP10 software package along with information from the lab. CH2M staff as well as Spokane County will have the ability to monitor SCADA. They will also have the ability to check any and all data, records and process control status reports via an electronic, on-line, password protected, encrypted internet connection.

Spokane County Water Reclamation Manager will be immediately reported to during business hours for any major injuries, or other major incidents. The Spokane County Water Reclamation Manager will be immediately reported to during all hours for the release of raw sewage into the Spokane River, overflows offsite, spills of chemicals, fatalities or permit violations.

Weekly Communications

O&M staff will have weekly staff meetings to discuss process control information, procedure changes, and other information pertinent to the proper operation and maintenance of the facility.

Monthly Communications

CH2M will meet once per month with Spokane County Water Reclamation Manager to review Facility performance.

CH2M will prepare monthly facility performance reports with analysis of compliance with the contract standards for effluent, residuals and odor. The analysis will include complete performance data analysis, summary of statistical parameters, comparison with permit levels and performance guarantee levels, and trend analysis. Facility performance reports will include both graphical presentation of performance data and narrative descriptions of the analysis and findings. The report will also include corrective action taken and response to operation outside of performance guarantee requirements. CH2M will provide the following reports to Spokane County within 15 days after the end of each month:

1. Facility Operation, Maintenance and Performance Report:
 - a. Provide within 15 days after the end of each month
 - b. Identify any NPDES permit violations
 - c. Summarize facility performance with respect to permit parameters
 - d. Major expenditures
 - e. Describe any operations problems experienced

- f. Quantity of residuals transported for disposal
- g. Electric power, natural gas, and potable water usage
- h. Chemical usage
- i. Status of preventive and corrective maintenance activities
- j. Copies of correspondence with all regulatory agencies
- k. Accidents or injuries
- l. Summary of training of operations and maintenance staff
- m. Damage to Spokane County property
- n. All citizen complaints
- o. Complaint description
- p. Complaint response
- q. Show Facility performance trends, including performance analysis of compliance with each Performance Guarantee for Effluent, Residuals, and odor

2. Monthly Odor Control Practices Report

- a. Listing of all odor complaints received during the month. Such log shall be an Excel based odor complaint log that details the name and address of complainant; time of complaint; nature, characteristics and intensity of the complaint; and the meteorological conditions at the time of the complaint
- b. Results of measurements of the odor indicators at the Site, including daily fence line monitoring
- c. Description of all investigations conducted and the action or mitigation steps taken or planned in response to each complaint
- d. Date that the complainant was contacted to explain the results
- e. Evidence showing compliance with the odor control operating practices required by the Services Contract and as set forth in Appendices 9 and 10
- f. Quantity of odor control chemicals used during the month
- g. Duration of time that Biosolids and other Residuals remained on the Site after being processed
- h. A summary of maintenance activities that resulted in abnormal odor conditions and mitigation that was taken
- i. Summary of disruptions to the operation of all odor control facilities
- j. Major maintenance activities planned for the coming month if the activities could lead to odor events and mitigation measures that shall be taken
- k. Residuals management activities
- l. Copies of all notifications to the Company given in the reporting period
- m. Such other information pertaining to odor control as the County may reasonably require from time to time

Quarterly Communications

Quarterly Maintenance, Repair, and Replacement Report:

- Provide within 15 days of the end of each calendar quarter

- Show Facility performance trends, including performance analysis of compliance with the Contract Standards for Effluent, Residuals and odor
- Outline planned process improvements
- Summarize the results of previously planned process improvements
- Summarize maintenance problems and progress in correcting those problems
- Review costs of budgeted repair tasks
- Outline capital expense activities and show status of Capital Plan elements
- Compare repair and replacement work in the quarter versus the planned work
- Present a repair and replacement (R&R) work plan and schedule for the next quarter

Annual Communications

CH2M will meet with Spokane County representatives on an annual basis to present and review the annual data. Annual reports prepared for budget or operational purposes will be prepared by March 1 of each year unless noted or agreed upon otherwise.

1. Annual Operations and Maintenance Summary Report

- Submit within 90 days after the end of each calendar year
- A summary of the past year's operation and maintenance activities
- A summary of project costs, project details, solids production, maintenance and repair, staffing, and any other project-related information
- Recommendations to improve O&M and cost effectiveness
- Present planned major activities for the present year
- A summary of company statements including invoicing, payments received and adjustments made
- A record of changes in inventory of all assets

2. Company Wide Financial Report

The Company shall furnish the County, within 180 days after the end of each Contract Year, consolidating balance sheets and income statements for the Company attached to the audited year-end financial statements reported upon by the Company's independent public accountant. The Company shall also furnish the County with copies of the quarterly and annual reports and other filings of the Company filed with the Securities and Exchange Commission.

3. Annual Industrial Pretreatment Report

The Company shall prepare an annual pretreatment report for the County which satisfies the annual reporting requirements contained in the applicable permit. The annual pretreatment report shall include the following:

- An updated list of current and potential SIUs, with changes from previous reports indicated;
- A summary of the compliance, enforcement, and monitoring activities performed during the reporting period, stating the number and percent of SIUs by category in

compliance with baseline monitoring reporting requirements, categorical standards, local limits (as applicable), and inspections;

- A list of significant noncompliance events by SIUs, with such list to be simultaneously published in the local newspaper having the largest daily circulation;
- A narrative description of program effectiveness and current and proposed changes to the IPP, such as funding, staffing, ordinances, regulations, rules and statutory authority; and
- A summary of all pollutant analytical results at the Facility, not previously reported, for Influent, Effluent, and Residuals.

4. Annual Budget

For County budgeting purposes, no later than 120 days preceding each Contract Year, the Company shall provide to the County a written statement setting forth for such Contract Year its reasonable estimate of the aggregate Service Fee for each Annual Reset Group, including each component thereof, the Facility Element Adjustment Factor and the Electricity Element Adjustment Factor. The estimated Variable Component shall be based on the previous 12-month reported average flow and loadings. The estimate of the Variable Component shall not be binding on the Company but shall establish the basis for monthly billing for such Contract Year, subject to annual settlement pursuant to this Article.

5. Annual Settlement

Within 30 days after the end of each Contract Year, the Company shall provide to the County an annual settlement statement (the "Annual Settlement Statement") setting forth the actual aggregate Service Fee payable with respect to such Contract Year and a reconciliation of such amount with the amounts actually paid by the County with respect to such Contract Year.

Regulatory Reporting

CH2M will prepare and submit all regulatory reports by the required deadlines, send copies of all reports to Spokane County, maintain records as required by the appropriate agency, and make these records accessible to Spokane County upon request. The county agrees to sign such reports in a timely manner.

Emergency Communication and Response

CH2M developed an Emergency Response Plan that covers Emergency Communications and Response, please see the Emergency Response Plan.

Construction Coordination

Activities involving new construction or progress of existing construction will be noted as relevant in the monthly Facility Operation, Maintenance and Performance Report and the Annual Operations and Maintenance Summary Report.

Media Communication

All communications requests from print and television media will be referred to Spokane County. With Spokane County's permission communications with media will be handled by CH2M's public relations liaison or the Facility Manager.

Special Reports

The Facility Manager and, if requested by the County, the Senior Supervisors each will personally attend the monthly operations meetings with the Spokane County, and all special meetings which the County may reasonably request from time to time, to review management, operational, performance and planning matters arising with respect to the Facility and the service contract.

Appendix A. Reporting Schedule

Due Date	Frequency	Name	Location
90 days year's end	Annual	Annual Operations and Maintenance Summary	Service Contract Appendix 9
180 days year's end	Annual	Companywide financial report	Service Contract Article VIII
30 days prior to Ecology deadline	Annual	IPP Report	Service Contract Article IX
120 days prior to year's end	Annual	Budget "Estimate of the Aggregate Service Fee for Each Annual Reset Group"	Service Contract Article VIII
30 days contract year's end	Annual	Annual Settlement Statement	Service Contract Article VIII
15 days month's end	Monthly	Facility Operation, Maintenance and Performance Report, including monthly complaints and performance	Service Contract Appendix 9
15 days month's end	Monthly	Monthly Odor Control Practices Report	Service Contract Appendix 9
Immediate	NA	Major injuries/incidents	Service Contract Appendix 9
15 days quarter's end	Quarterly	Quarterly Maintenance, Repair, Replacement Report	Service Contract Appendix 9
TBD	TBD	Regulatory Agency Reports	Service Contract Appendix 9

Grit Plan, Spokane County RWRf

Introduction

As part of the wastewater treatment process at the Spokane County RWRf, grit will be removed from the wastewater stream following screenings removal. Grit will be disposed of by hauling to a landfill.

Definition of Grit

Grit is the heaviest material in wastewater and includes substances such as sand, coffee grounds, eggshells, gravel, and cinders. Grit can become a nuisance in downstream process by settling in areas not intended to receive grit and causing undue wear and tear on pumps and equipment. For this reason the grit is removed immediately following screening removal.

Process Overview

Grit that passes through the 2 mm band screens is settled out in the aerated grit basin. Air at Low Pressure (ALP) is delivered to coarse bubble diffusers at the headworks aerated grit basin from process blowers located adjacent to the aeration basins. The addition of ALP enhances the settling of grit. Grit pumps are used to pump grit from the aerated grit basin to the grit cyclones and then to a grit classifier where grit is removed and dewatered for disposal. The drainage from these dewatering processes is returned to the influent channel and dewatered grit is transferred to a dumpster that will be hauled off-site for disposal at a landfill. The aerated grit basin is covered and ventilated such that foul air is exhausted to the odor control system.

Unit Physical Information

The aerated grit basin is configured as one tank with two sloped bottom hoppers that direct settled grit to the grit pump suction lines. Coarse bubble diffusers deliver ALP to the aerated grit basin from blowers located at the aeration basins. The dimensions of the grit basin are 30 feet long by 15 feet wide by 15 feet deep. This configuration will allow a 5 minute retention time at peak hourly flow. Three dry pit pumps (2 duty and 1 standby) remove the grit from the hoppers and pump the grit slurry to two grit cyclones. The grit cyclones separate the grit out of the wastewater by separating the heavier grit particles from the lighter particles by converting the liquid velocity generated by the pumps into centrifugal force within the cyclonic chamber. The grit classifier serves to further separate the grit from the lighter particles and dewater the grit particles using a screw conveyor. The grit is discharged downward to a dumpster located in the lower level of the Headworks.

Process Monitoring and Responsibilities

Operators should visually inspect the grit classifier each day to ensure that it is cycling on and off correctly and that the grit being discharged is relatively dry and free of organic materials. Operators should also inspect the aerated grit basin periodically to ensure that the coarse air bubbles are being evenly distributed by the diffusers.

Grit Process Monitoring

Parameter	Units	Frequency	Source	Min	Max
Flow	MGD	Continuous	SCADA	0	13.8
Air Flow	CFM/ft	Continuous	SCADA	0	10
Equipment Runtime	Hrs	Monthly	SCADA	0	720
Grit Removed	Cu. yds.	Monthly	Estimate	x	x

The following tasks should be performed once a week:

- Verify adequate wash water flow to the grit classifier
- Remove scum from the aerated grit basin
- Perform weekly preventative maintenance on associated equipment

Design Targets

The grit removal system is designed to remove grit that has passed through the 2mm band screens that has the potential to harm or wear out downstream processes and equipment. The installed equipment is designed to handle the peak hour flow of 13.8 MGD and has built-in redundant features.

Alternate Modes of Operation

In the event that either of the two grit pumps feeding the grit cyclones and grit classifier becomes plugged, there is one fully redundant standby grit pump. There is also a bypass channel at the rapid mixer around the aerated grit basin. Should bypass be necessary, the grit will settle out in the primary clarifiers where it is incorporated into the primary sludge and pumped to the blended sludge storage tank.

High Flow Management Plan

Purpose

This plan will outline the procedures involved at different points of the facility during a high flow event. The plan will include online instrumentation, automated controls monitoring, and the development and implementation of a standard operating procedure (SOP). It will also include communication procedures with the Spokane County Utilities Division. This plan will reduce the risk of loss of containment events and improve effluent compliance.

Design Specifications

The design peak hourly flow through the Spokane County RWRF is 13.8 MGD with the plant configured for full design capacity described in Table 1. Flows exceeding the average daily design will constitute high flow conditions.

Table 1. Design Flow and Equipment Configuration

Event	Flows				Minimum Required Equipment Online				
	Influent	ML*	RAS**	NR***	Screens	Clarifiers	Aeration Basins	Membranes	CCB's°
Peak Hour	13.8	40	26.2	29	2	2	4	6	2
Maximum Day	12.1	40	27.9	29	2	2	4	6	2
Average Day	8	40	32	19.2	1	1	3	5	1

*Mixed Liquor **Return Activated Sludge ***Nitrified Recycle °Chlorine Contact Basins

The headworks facility at Spokane County RWRF has a maximum flow capacity of 22.8 MGD through the 3/8 inch manual bar screen at 20% blinding. This includes a 20.8 MGD influent flow and a 2 MGD recycled flow. As long as the bar screen is constantly attended, loss of containment will not occur at these flow rates.

Response Procedures

The high flow management plan will be enacted when instantaneous influent flows approach either the maximum daily flow or the peak hour flow. Normal operations will include continuous monitoring of influent and plant flows. Increases in flow will be indicated by changes in trend charts or alarms.

1. Operator detects high flow condition.
2. If staff is not available on site call outs will be placed as needed to respond to the situation.
3. Process configuration will be evaluated as per table 1 and adjusted to accommodate increased flows.
4. If flows near design daily or hourly maximums the County will be notified to be on standby for adjusting flows.
5. If flows exceed daily or hourly maximums the County will be notified to decrease flows as needed through a combination of North and South Valley interceptors.
6. The City will be notified of any flows within design that are diverted to the Riverside Park Water Reclamation Facility.

Unit Process Specific Procedures

Preliminary Treatment

High flows could result in a higher screening loading to the band screen. Each band screen is designed to handle 13.8 MGD, and if one screen is not able to maintain an acceptable channel level the second screen can be placed online. If both screens are inadequate the gate to the manual bar screen can be opened and the bar screen will be raked manually to prevent excess level buildup. As a last option there is a fixed concrete weir that would allow the influent to bypass the aerated grit chamber through a bypass channel.

Primary Clarification

Both Clarifiers will be placed online in a high flow situation. Increased ferric chloride and polymer addition may be necessary to compensate for diminished settling rates due to shorter detention times.

Aeration Basin

The aeration basins are not easily placed into service, although it is expected that at average design flows all four basins will normally be online. In the event that all four basins are not in service the time it takes to place an additional unit online will have to be weighed against the duration of any additional flow sent to the River Park Water Reclamation Facility.

Membrane Basins

Additional membrane basins are easily placed into service. In auto mode the units will come online triggered by level feedbacks. If a basin is not in automatic mode the procedures for doing so will be implemented as part of the high flow response.

Chlorine Contact Basins

An additional chlorine contact basin can be placed online in the event of a high flow. The chlorine feed rate will increase as a result of higher flows and if needed the dosage rate may need to be increased to compensate for lower contact times.

Loss of Containment

In the event of a loss of containment event refer to the *Spill Prevention, Control, and Countermeasures Plan*.

Odor Control Plan, Spokane County RWRF

1.0 Contractual Requirements and Odor Plan Purpose

The Spokane County Regional Water Reclamation Facility (RWRF or Facility) will be operated to avoid release of objectionable odors and to prevent receipt of any odor complaints. CH2M HILL (Company) will comply with *the Service Contract for the Design, Construction and Operation of the Spokane County Regional Water Reclamation Facility between County of Spokane, Washington and CH2M HILL Constructors, INC, January 13, 2009* (Service Contract) including its Appendices. See Attachment A that lists the odor control elements described in the Service Contract.

The purpose of this Odor Control Plan is to provide the operations and maintenance (O&M) staff with a clear, concise, and orderly approach to odor control at the RWRF. The Facility must be operated in compliance with the Odor Control Standards and operated and maintained so that there is no odor emanating from the Facility or beyond the site boundary, which causes an Odor Incident or a Sustained Odor Condition (the “Odor Guarantee”) as per Section 10.3(B) and Appendix 10, Section 10.3 of the Service Contract (described in Attachment A).

This plan is meant to be a working document (i.e., it will be revised periodically to match changing conditions at the facility). The plan also acts as a guidance document for the revision of other documents such as standard operating procedures (SOPs) and unit process control procedures (UPCPs).

This odor management plan will systematically identify potential odor sources, determine control strategies to reduce these odors, and describe a program for implementing these strategies. This odor management plan consists of the following sections:

- Section 1.0: Contractual Requirements and Odor Control Plan Purpose
- Section 2.0: Odor Sources
- Section 3.0: Odor Control Program
- Section 4.0: Odor Complaint Response
- Section 5.0: Odor Control Training

2.0 Odor Sources

2.1 Inventory and Mitigation Measures

Nuisance odors can be the result of a single odor source, a single odor event, or the combination of several sources and events. Therefore, it is important to prepare a thorough inventory of all odor sources to assist in identifying the source of any reported odors. This inventory has been initially established based on potential odor sources; those sources where odors are most likely to bring about odor complaints based on perceived odor strength and characteristic. The inventory will be updated when facility operations begin as other potential sources are identified.

The following Facility forms (See Attachment B) will be prepared to identify, report and record potential odors:

- Potential Odor Source Inventory (note: similar to Table 1)
- Checklist for Table 1 Review/Complaint Checklist
- Fenceline Odor Monitoring Tour Form
- Permanent Log of Fenceline Surveys
- Odor Inventory Monitoring Tour Action Plan
- Odor Complaint Registration/Response Form
- Monthly Odor Control Practices Report
- Additional Odor Investigations Form

Other records/reports related to Odor Control Program:

- Hydrogen Sulfide Monitoring Records – daily rounds will check areas/sections for each process and odor monitoring recorded on a daily rounds checklist
- Weather Station Monitoring Records – automatically recorded in the SCADA system and placed into OP10 (reporting software program) where reports can be generated or data compiled
- Odor Control Treatment Unit Status Report/Log – automatically recorded in the SCADA system and placed into OP10 where reports can be generated or data compiled

Table 1 is a preliminary list of potential odor sources that are listed per structure/building at the RWRF. For each structure/building the odor source is described, the potential for its occurrence (low, medium, or high), and an odor mitigation plan (describes measures) to prevent the release of odors. If a structure/building is not on this list, it is assumed that there is no potential source of odors at this structure/building (e.g., Water Resource Center). This list will be revised as needed after the first facility inspection is conducted and thereafter as needed.

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Force Mains (coming from Spokane Valley Interceptors Pump Stations)			
Air/Vacuum Vaults and Sewer Interceptor Pipelines	There are three air/vacuum vaults onsite, two on force mains coming from the South Valley Interceptor Pump Station (SVIPS) and one on force mains coming from the North Valley Interceptor Pump Station (NVIPS). During pipeline filling there is potential for short term odors and for pipelines to “burp” a bit of odor.	Medium to High	<ol style="list-style-type: none"> 1) Monitor the filling of force mains at both SVIPS and NVIPS for odors. 2) If odors occur, evaluate means to prevent release of odors (e.g., light bleach misting during pipeline filling operations). 3) There are activated carbon odor control systems at each pump station to treat odors in the wet wells and adjacent interceptors.

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Treatment Operations Facility (TOF)			
Laboratory Chemicals	Laboratory chemicals can release odors when conducting laboratory testing.	Medium	Follow laboratory procedures when testing is conducted including: <ol style="list-style-type: none"> 1) Use hood when dispensing chemicals. Otherwise, replace caps on chemical storage bottles as quickly as possible. 2) Dispose of testing materials safely and immediately after testing is conducted. 3) Do not store incompatible chemicals together in the same area. 4) Train employees on proper handling of chemicals.
Analysis and Chemical Reactions in Laboratory	Exhaust stack odors from fume hood.	Low	The odors from this should disperse rapidly in the airstream outside and above the building and neutralize.
Headworks Building			
Headworks Building	Potential for odors to migrate outdoors through building openings.	Medium	The building needs to remain balanced to ensure a negative pressure is maintained inside the structure.
Grit Basin	Grit basin is ventilated to odor control system and is a potential source of odor.	Medium	Keep hatches closed and air flows balanced with negative pressure.
Grit and Screenings Bins	Two alternating roll away bins will be stored west of the Headworks Building. They will have built-in hinge covers but there is a potential for odors during warmer months.	Medium	<ol style="list-style-type: none"> 1) When a full bin is removed from the Headworks Building, the bin needs to be covered. Doors need to remain closed if bins are not covered. 2) Hose down bins frequently 3) When hosing bins during the summer months, the lids may be left open for a short period of time to dry quickly. 4) When necessary, apply HTH (powdered chlorine or bleach) or lime to freshen up the inside of bins. 5) The Headworks Building room with the containers for screenings and grit is normally closed and ventilated at 15 air changes per hour, and the ventilation is always on.
Grit, Septage, Primary Sludge, and Primary Scum Pumps	All of these pumps are located in the pump room. The pump room is located in the Headworks' basement and is not expected to release any odors. A potential release would be if pumps were disassembled or leaked. Dilution via ventilation in this space should reduce odors under these conditions.	Low	<ol style="list-style-type: none"> 1) Monitor basement equipment, piping and ventilation system for odor releases. 2) Maintain grit pumps. 3) Quickly cleanup any spills or piles of grit, water, sludge, or scum which fall from pumps during operation or maintenance

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Other Pumps, Valves, Pipes, and Equipment	All process equipment within the Headworks Building is exhausted to the odor collection system. No odors are expected to be released.	Medium	Regularly check and maintain equipment within the Headworks Building to assure that odors are ventilated to odor collection system for treatment.
Septage Disposal	Septage Haulers will dispose of septage within Headworks Building after doors are closed. The building is exhausted to the odor collection system. No odors are expected to be released.	Medium	Regularly check procedures to assure that they are being followed properly including: <ol style="list-style-type: none"> 1) Closing of Headworks doors and hatches before any septage is transferred from tanker truck to septage receiving tank. 2) Clean-up of any septage spillage on floor of Headworks Building and/or truck before doors are reopened and the truck moves out of the building. 3) Instruct Septage Haulers on proper disposal/ cleanup procedures and equipment requirements. 4) It's the drivers' responsibility to make certain that the hose from the septage truck tank to the septage receiving tank is in good condition and doesn't leak or release septage.
Headworks Generator			
Filling Diesel Tank	Fumes released when filling diesel holding tank. Diesel spill occurring during fill-up of holding tank.	Medium	Follow fill-up procedures when generator diesel holding tank is filled including: <ol style="list-style-type: none"> 1) It's the drivers' responsibility to make certain that the hose from the fueling truck tank to the generator holding tank is in good condition and doesn't leak or release diesel. 2) An alarm on diesel holding tank is installed to warn when diesel is approaching full level in tank. 3) A spill clean-up kit is stored at Headworks Building and near generator to be easily accessible and usable should a spill accident occur. 4) The Facility Spill Prevention Countermeasure and Control Plan (SPCC) Plan is prepared, updated as necessary, and properly implemented.
Primary Clarifiers 1 & 2			
Clarifiers	A transfer fan moves air into the headspace of the Clarifier Basins; incorrect pressurization of tank headspace could potentially release fugitive odors.	Medium	<ol style="list-style-type: none"> 1) Maintain balanced air flows in tank headspace. 2) Keep hatches closed.
Cleaning of Surface Scum Trough	Occasionally trough will need to be washed down or unplugged with potential for odor release while hatch is opened.	Medium	<ol style="list-style-type: none"> 1) Keep trough cleaned often to keep debris from accumulating and/or plugging drain pipe to pump pit. 2) Make sure foul air system is properly operating.

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
			3) Keep scum skimmer height adjusted properly to provide adequate carry water with removed scum.
Cleaning, Hosing of Scum Pump Pit	Occasionally scum pump pit will need to be washed down or unplugged with potential for odor release while hatch is opened.	Medium	1) Keep pit pumped down regularly. 2) Minimize time that hatch is opened over pit. 3) Use grease break down additives if needed.
Wash Down of Launderers Through Access Hatches	Occasional wash down of launderers with potential for odor release while hatch is open.	Low to Medium	1) Clean launderers as needed to minimize build up of odor causing material. 2) Close each hatch upon completion of task.
Isolation Valve Vaults	There is a potential for valve packing to leak.	Low	1) Routinely check for leaking valve packing. If leaking excessively, then repair. 2) Routinely clean valves and conduct managed valve exercises to prevent leaks from occurring.
Aeration Basin			
Monitoring of Process and Equipment	Opening of access hatches for viewing of process, surface action or equipment maintenance may have potential for odor release.	Low to Medium	1) Insure odor control system is operating properly. 2) Minimize time spent opening hatches.
Sampling of Process	Spilled process sample may have potential for odor.	Low	1) Use proper sample collection procedures. 2) Thoroughly hose down any residual left on deck.
Taking Basins Offline	If a single basin is offline for a significant amount of time residual sludge may cause foul odors.	Low	1) For extended shut down of a single basin drain and wash out thoroughly.
Blower Area			
	Little to no potential for odors at this site.		
Membrane Facility			
Cleaning and pH Control Chemicals	Potential for odors from spilled or mishandled chemicals in various rooms of this building have potential for slight odors.	Low to Medium	1) Any spilled chemicals should be cleaned and/or flushed into drains immediately to alleviate chance for chemical odors. 2) Keep doors closed.
During Start up of Process, Light Odors from MLSS	During start up procedures a light musty odor may be detected initially. Note: The membrane basins are outside and open to the atmosphere, but are not expected to be a source of odor.	Medium	1) Once process is within operating parameters and odor control facility is running, this should be neutral odor. 2) Rotate trains frequently to prevent septic sludge formation.

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Membrane Facility Generator			
Filling Diesel Tank	Fumes released when filling diesel holding tank. Diesel spill occurring during fill-up of holding tank.	Medium	Follow fill-up procedures when generator diesel holding tank is filled including: 1) It's the drivers' responsibility to make certain that the hose from the fueling truck tank to the generator holding tank is in good condition and doesn't leak or release diesel. 2) An alarm on the diesel holding tank for the generator is installed to warn when diesel is approaching the full level in the tank. 3) Spill clean-up kits are stored at the Membrane Facility and near the generator to be easily accessible and usable should a spill accident occur. 4) Follow SPCC Plan.
Liquids Demonstration Pad			
Spilled Liquids during Demonstration Period	For future use to demonstrate new technology.	Low to Medium	1) Keep any spills or discharges directed to drains and diluted thoroughly. 2) Consider light bleach misting for air quality issues.
Chemical Storage			
Overflow of Tanks During Filling	Possibility of air quality issues if tanks are overfilled during delivery of chemical(s).	Medium	1) All chemical tanks have containment and pad slopes to sumps. Keep sump hatches closed and spills diluted/washed down. 2) There are level alarms and monitoring for all tanks. 3) Employees and delivery personnel need to be oriented to proper responses at each warning level.
Sump Pit Contents	Contents of sump could potentially cause odors.	Medium	Keep sump drained and any contents diluted.
Waste Gas Burner			
Pilot Light Failure	If the pilot light fails and actuator valve opens foul constituents of digester gas may be released to air. (methane should be odorless)	Medium	1) Employees shall be trained on maintenance of flare and observing conditions which may release gas to atmosphere 2) See Cogen Facility for gas cleaning measures. 3) Keep condensation traps drained
Plant Drain Pump Station			
Sanitary Sewer Pump Station	Sanitary sewer pump station vent allows air to enter as liquids enter	Medium	Regularly check and maintain equipment within the Plant Drain Pump Station to

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Vent	and fill the pump station, and as the pumps drain the pump station. All exhaust leaving pump station goes to odor collection system. Sump will fill at a maximum rate of less than 500 gpm.		assure that odors are ventilated to odor collection system for treatment and negative pressure is maintained. Because the air is exhausted to the odor control system, no odors are expected to be released.
Gas Storage Facility			
Dome Seal	If seal between pad and inflatable dome leaks, methane gas may escape to atmosphere.	Medium	Inspect dome on regular basis and report need for repair if leaking. A portable gas detector can be used to detect methane releases.
Digester Gas Equipment Building			
Condensation Trap and Foam Separation Tanks	These systems can potentially have odors if not maintained.	Medium	Keep condensation trap drained. If foam enters separator, stop cause of foaming and then clean separator out. Ensure drain is closed upon completion of task.
Cogen Facility			
Connections at Cogen Facility	Connections at Cogen Facility are a potential leakage point. They are there to release digester gas if necessary. Digester gas is very low in H ₂ S but still has odor.	Low	Connections are not used to release digester gas unless absolutely necessary. If a release becomes necessary monitoring will occur, and if odors are released, measures to minimize or prevent odors will be determined and implemented. A portable gas meter can be used to detect methane releases.
Solids Demonstration Pad			
Spilled Solids During Demonstration Period	For future use to demonstrate new technology.	Low to Medium	<ol style="list-style-type: none"> 1) Keep any spills or discharges directed to drains and diluted thoroughly. 2) Consider light bleach misting for air quality issues.
Aerobic Digester			
Open Hatches	Open hatches can release odors to atmosphere.	Medium	Minimize opening of hatches except to maintain and monitor tank as required.
Blend Tank			
Open Hatches	Open hatches can release odors to atmosphere.	Medium	Minimize opening of hatches except to maintain and monitor tank as required.
Solids Facility			
Solids Building	Potential for odors to migrate outdoors through building openings.	Medium	The building needs to remain balanced to ensure a negative pressure is maintained inside the structure.

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Biosolids Loading	Loading of biosolids needs to be done to minimize spillage and control odors.	Medium	<ol style="list-style-type: none"> 1) All biosolids trucks are loaded indoors (inside Solids Handling Building). 2) Good housekeeping practices are conducted to clean-up spills before doors are opened. 3) Outside of trucks and top of tarps will be inspected for biosolids before removal from truck bay.
Biosolids Hauling	Biosolids haul trucks coming and going from RWRF need to be kept clean from odorous materials, and roll over tarps on trucks need to be in place.	Medium	<p>Regularly check procedures to assure that they are being followed properly including:</p> <ol style="list-style-type: none"> 1) Washdown of biosolids from inside the truck box on haul trucks will be conducted on a concrete wash pad. 2) Washdown will be directed to a sump where residues are sent to the Plant Drain Pump Station and back to Headworks for treatment.
Centrifuges and Gravity Belt Thickeners	Potential for odors to migrate outdoors and through openings at Solids Facility.	Medium	Maintain a negative pressure on these units. Access doors to the Gravity Belt Thickeners will remain closed during normal operations.
Solids Drain Pump Station	Solids drain pump station is a potential source of odor and is connected to odor control system.	Low	Maintain a negative pressure throughout the foul air odor control system.
Anaerobic Digesters 1 & 2			
Pressure Relief Valve Operation	PRV valves have preset weights for pressure release. Stuck valves may release odors/methane to atmosphere.	Medium to High	<ol style="list-style-type: none"> 1) Make sure all condensation drains are maintained to minimize moisture in lines/valves that may freeze and stick valves open. 2) Pressurized methane gas should be routed to flare and Cogen units. 3) Regularly check valves as part of the preventative maintenance program. 4) A Portable gas meter can be used to detect methane gas releases.
Odor Control Facility			
Biofilter Exhaust Must not Emit Odors.	CH2M HILL has completed a mass balance analysis of the influent streams and has determined that, under normal operating conditions, the hydrogen sulfide removal efficiency of the Biofilter should be greater than 99%. However, lower inlet levels coupled with lower removal efficiencies still will result in minimal odor levels at biofilter stacks.	Low	<ol style="list-style-type: none"> 1) Confirm ventilation system is operating and maintained properly. 2) Check differential pressure operation. 3) Review SCADA data. Air intake and discharge is monitored by probes/sensors. See Service Contract for limits. 4) Ensure primary humidification system is operating correctly and that spray nozzles are not plugged. 5) Ensure secondary humidification system is functioning and that SCADA is controlling frequency and duration of irrigation for maintaining media wet.

TABLE 1. POTENTIAL ODOR SOURCES

Odor Source	Description	Potential	Odor Mitigation Plan
Biofilter	Potential for fugitive odors to migrate out of the cover.	Medium	<ol style="list-style-type: none"> 1) Monitor biofilter cover to assure that it is tightly sealed, and maintain stack fans so they operate correctly. 2) Ensure systems are balanced correctly such that stack fans consistently pull a negative pressure on biofilter headspace.
Change-out of Bio-media (Bark)	The bio-media needs to be changed-out every 3-5 years and during the process of removal, odors may be released.	Medium	<ol style="list-style-type: none"> 1) Determine if bio-media (bark) can be removed as isolated units; lessening surface exposure. 2) Remove bark from biofilter units and haul-off from site as quickly as possible. 3) Consider meteorological conditions to avoid inversions or undesirable weather conditions. 4) Inform Spokane Regional Clean Air Agency and neighbors when media is being removed and replenished.
Maintenance Building			
Storage/Use of petroleum products	Petroleum products (oil, grease, lubricants) emit odors when exposed to the air.	Low	Store petroleum products in cabinets or contained in closed containers/drums.
Chemical spill	Chemicals/petroleum products could potentially be spilled or released in Maintenance Building during transfer of materials or use.	Low to Medium	Prepare and follow SPCC Plan, which will describe spill clean-up kit stored at the Maintenance building and processes/procedures for cleanup including employee training.
Maintenance Building Pump Station	The Maintenance Building has a small pump station serving it (located on the west side of the building) and not connected to odor control system.	Low	It is not expected that there will be an odor problem at the maintenance building pump station. It will be monitored and if odors are released, measures for control will be determined and implemented.
Intermittent Sources			
Taking Tanks Off-Line	Tanks are taken off-line for maintenance purposes.	Medium	<p>Steps that will be taken to minimize or prevent odors are:</p> <ol style="list-style-type: none"> 1) Continue foul air exhaust. 2) Minimize hatch open times and close when task completed. 3) Immediately clean residuals and clean area.
Other Maintenance Activities	Replacing valves, replacing or repairing pipes, and other maintenance activities.	Medium	Determine potential for odor releases and determine how to minimize or prevent odors prior to doing maintenance work.

2.2 Determination of High Odor Sources

Research has shown that some odor sources emit more odors per unit area than other sources. Therefore, both relative odor emissions and the size of the odor source must be

considered. Intermittent sources, such as taking tanks off-line, also cause relatively high odor emissions and should be considered in the development of a list of high odor sources.

Another factor to consider in determining high odor sources is the proximity of the sources to public and sensitive receptor areas. (A sensitive receptor is anyone near the odor emission point that senses and is affected by the odors. For the RWRF the sensitive receptors can include: operations and maintenance personnel, neighbors and the public.)

Dilution of odors is caused through the mixing of odors with ambient air. This dilution of odorous air is a function of distance, topography, and meteorological conditions. Farther distances between odor sources and the sensitive receptors will result in fewer nuisance complaints. Topographical features can either enhance dilution or reduce dilution depending on the particular feature. Wind breaks or tree lines will encourage mixing of the odorous air with clean air, whereas valleys or low areas may reduce odor dilution. Meteorological conditions also affect dilution. Maximum dilution occurs when the cool air near the ground is heating and rising. Conversely, during the late evenings, when it is calm and the atmosphere is cooling, the odorous air is trapped near the ground and there is little dilution. Of these three factors: distance, topography, and meteorology, the separation distance will likely have the biggest impact on nuisance complaints. These factors were considered when the RWRF was located and designed. Distance from public receptors was achieved by locating the facility in an industrial zone and maintaining distance from public receptors with railroad tracks bordering the facility to the south, an arterial located to the west and industrial facilities located to the north and east. A minimum setback of 50 feet was also established to keep process structures away from adjacent industrial properties. The topography has been altered to include buffer areas and landscaping with windbreaks to disperse and mix with clean air at the site. Meteorological conditions will be considered when conducting maintenance activities to avoid routine maintenance when there is a high potential for odor releases (e.g., during air inversions).

3.0 Odor Control Program

The Company shall comply with the Odor Guarantee set forth in Section 10.3 and Appendix 10, Section 10.3 of the Service Contract (See Attachment A) by controlling odors through the proper operation and maintenance of the Facility. The Company shall be responsible for operating and maintaining each odor control system so that it performs to its designed capacity and capability. The Company shall capture and treat all objectionable odors and follow best management practices for the prevention of objectionable odors. The Company shall respond to odor complaints, investigate their causes, and take actions to eliminate odors.

The Odor Control Program will consist of daily, monthly and quarterly activities that are listed as follows:

Daily:

1. Inspect the RWRF:

Fenceline: RWRF odor tour will include a site fenceline survey by the Facility Manager and/or Senior Operator at the beginning of each day shift, prior to entering the Facility. Observations will be noted for odors, their intensity and characteristic and the potential on-site or off-site sources of an observed odor along the perimeter of

the Site. Such information shall be recorded on a *Fenceline Odor Monitoring Tour Form* and summarized in a permanent log (See Attachment B for forms).

Facility: An overall Facility tour will be conducted and observations noted on the daily rounds checklist (available in the Operations Plan) when operators move through the Facility. These inspections will be done to assure that:

- Equipment is maintained and operating properly
- Repair and replacement of equipment, parts, and machinery is done in a timely fashion
- Spill clean-up kits are readily available
- Good housekeeping is performed
- Proper procedures and management policies are being followed
- Sampling and measurements are meeting contractual requirements

2. Inspect and record readings from installed monitoring equipment as follows:

- **Hydrogen Sulfide Detectors:** Two portable hydrogen sulfide (H₂S) detectors at strategic locations to monitor and record the air quality and are set up to trigger an alarm when levels exceeding pre-set limits are sensed (checked during daily rounds of the Facility)
- **Hydrogen Sulfide Sensors:** Inlet/outlet hydrogen sulfide sensors at biofilters (automatically monitored through SCADA system)
- **Weather Station:** A weather station at the Facility to continuously monitor and record weather conditions, including wind direction and speed, air temperature, barometric pressure, humidity and precipitation (automatically recorded in the SCADA system)

3. Prepare Operating Checklist or Log Forms.

The SCADA system will record the status of the installed odor control equipment for each odor control system. The information will be recorded for each odor control treatment unit (e.g., bio bed), and includes airflow and pressure drop across the unit.

4. Notify the County of any Odor Complaint.

Notify the County of an odor complaint within a reasonable period, but in no event later than 24 hours after the Company's receipt of the complaint.

5. Respond to Complaints (should they occur).

The site of the alleged odor will be visited as soon as possible but no later than one (1) hour after receipt of complaint. Protocol for response to and documentation of odor complaints is in accordance with follow-up on Section 4.0, Odor Complaint Response of this *Odor Control Plan*.

Monthly:

1. **Prepare Odor Control Practices Report:** Submit with monthly operations report, a *Monthly Odor Control Practices Report* (See Attachment B) to the County in accordance

with Service Contract, Appendix 9 and Subsection 10.3(C) of the Service Contract (See Attachment A of this report). The report shall include the following:

- List all odor complaints received during the month. Such log shall be an excel based odor complaint log that details the name and address of complainant; time of complaint; nature, characteristics and intensity of the complaint; and the meteorological conditions at the time of the complaint
 - Results of measurements of the odor indicators at the Site, including daily fenceline monitoring
 - Description of all investigations conducted and the action or mitigation steps taken or planned in response to each complaint
 - Date that the complainant was contacted to explain the results
 - Evidence showing compliance with the odor control operating practices required by this Service Contract and as set forth in Appendixes 9 and 10
 - Quantity of odor control chemicals used during the month
 - Duration of time that Biosolids and other Residuals remained on the Site after being processed
 - A summary of maintenance activities resulting in abnormal odor conditions and mitigation that was taken
 - Summary of disruptions to the operation of all odor control facilities
 - Major maintenance activities planned for the coming month if the activities could lead to odor events and mitigation measures that shall be taken
 - Residuals management activities
 - Copies of all notifications to the Company given in the reporting period
 - Such other information pertaining to odor control as the County may reasonably require from time to time such as off-site odor sources e.g. the near by rendering plant
2. **Update Mitigation Measures Listed in Table 1.** Update odor control strategies in Table 1 as needed for significant odor sources as good management policies and procedures become evident. Determine which of the odor sources are the most likely to bring about odor complaints. Also, new odor sources as they become identified will be added to Table 1 with one or two odor control measures (mitigations) described.

Prepare a dated checklist documenting review (See Attachment B for *Checklist for Table 1 Review/Complaint Checklist*) and update inspection forms as relevant. Implement existing and new odor control operating, maintenance, and housekeeping procedures at the Facility to eliminate odors.

Quarterly:

1. **Implement and update odor control operating procedures.**

- Prepare new Standard Operating Procedures (SOPs) as needed to optimize the performance of all odor control systems and prevent breakthrough of odors from odor control systems (e.g. checking the condition of biofilter media, etc.). The procedures shall identify what parameters shall be monitored and the procedures to be followed to maintain the target operating range for each odor control system and determine when replacement of odor control materials, such as biofilter media, is necessary to maintain effective odor control.
- Prepare new maintenance schedules and procedures as needed for all odor control systems.
- Prepare new procedures as needed to address odor control when an odor control system is out of service for preventive or corrective maintenance.
- Prepare new procedures as needed to confirm that air is being properly collected from individual process units.

Review and revise existing SOPs and UCPs that have the potential to initiate odor incidents and to include odor mitigation activities.

The SOPs will address the following questions:

- What is the potential of odor emission from this procedure?
- What is the level of odor?
- How can the odor be mitigated?

SOPs will consider odor control technologies that can:

- **Reduce generation of odors**, which includes treatment technologies such as anaerobic digesters or aerations systems, and chemical or biological additives.

Note: The RWRF has been initially designed with these systems and consideration of additives, if needed, to control odors.

- **Reduce odor emissions**, which are those that capture and treat the odorous gases before they leave the site.

Note: The biofilters are a good example of this technology that has been initially designed as an integral part of the RWRF.

- **Increase dilution of odors**, which includes shelterbelts, windbreak walls, and setback distances. Of these, setback distances are the most effective.

Note: The RWRF has shelterbelts (landscaped buffer areas around its perimeter) and setbacks from public roads and sidewalks to dilute odors that might be released. The RWRF location within an industrial zone and bordered by the railroad tracks to the south limits exposure to the general public.

4.0 Odor Complaint Response

One of the most important pieces of an odor management plan is the response protocol to address odor complaints. For the RWRF there cannot be any odor emanating from the

Facility at or beyond the fenceline which causes an Odor Incident or Sustained Odor Condition. Therefore, any odor complaints received by the RWRF, whether it results from excessive to mild odor emissions or from complaints received during non-odor events, are all considered of utmost importance and are to be investigated within 1 hour from when the complaint was reported based on the protocol described in this odor complaint response plan. Any odor emissions that may occur will trigger implementation of an odor control technology or operational procedure, and monitoring of that mitigation measure to monitor the effectiveness of the technology or operational procedure. Also, maintaining good relationships with the sensitive receptors will be a high priority for operations. This section is divided into two parts: (1) Preventive measures to avoid odor complaints and (2) Procedures to follow should an odor complaint occur.

4.1 Preventive Measures to Avoid Odor Complaints

Avoid Odor Emissions

The Facility will be operated to avoid odor complaints by striving to control odor emissions. The role of operations and maintenance in controlling emissions is the proper operation and maintenance of the Facility including the odor control systems. Proper operation and maintenance includes following the instructions listed in the odor control system operations and maintenance manuals. It also requires training of all staff in how to operate the Facility and the odor control systems to control odor emissions.

Some activities such as taking tanks off line are intermittent in nature and have a potential to emit odors. Measures will be taken to mitigate these odors. These measures and their perceived effect on odors will be documented. If tanks must be removed for routine repairs, the potential odor, and steps to mitigate it will be communicated by CH2M HILL to the Spokane County Utilities Division at least 24 hours prior to the repair. If tanks are removed for emergency repairs CH2M HILL will inform the County as soon as practicable.

Monitor Facility and Potential Odor Events

In addition to the daily fenceline monitoring, the Facility and any potential odor events will be monitored to help verify odor complaints and identify odor sources. Monitoring will be conducted by Facility Manager and/or Operations personnel during daily rounds throughout the facility. Reports will be made on the daily rounds checklist and when applicable, a portable gas detection meter will be used and the findings reported. The reporting form will record the date, time, and location of the monitoring, and the strength and type of any odors that were detected, if any. The reporting form will include a list of potential sources of the odor including perceived off-site odor sources. If an odor, or potential odor, has been noted, an action plan will be developed which includes responsible parties and target task completion dates. The action plan will be described in the *Odor Inventory Monitoring Tour Action Plan* form (See Attachment B).

The *Odor Inventory Monitoring Tour Action Plan* will note strength of odors, which will be recorded on a three-point odor intensity scale:

1 = detectable odors

2 = recognizable odors

3 = very distinct and annoying odors.

The *Fenceline Odor Monitoring Tour Form* will also describe odors experienced based on:

- Disagreeable (garlic)
- Pungent, irritating (ammonia)
- Unpleasant, putrid
- Unpleasant, strong
- Skunk like
- Putrid, fishy
- Decayed cabbage
- Rotten eggs
- Fecal, nauseating

4.2 Procedures to Follow Should an Odor Complaint Occur

When a complaint is received from the public, an investigation will take place (at the site where the alleged odors were detected) to determine the source of the odor, and to verify that the odor was generated from the RWRF. This investigation will take place within 1 hour from when the Facility is notified of the complaint.

A record will be maintained of every odor complaint and each complaint will be documented by filling out an *Odor Complaint Registration/Response Form* (See Attachment B) with the required information as stated under Section 9.19.2 of Appendix 9 to the Service Contract (See Attachment A for form requirements). If the complaint was not received directly by the Facility Manager, the Facility Manager will be notified as soon as possible. An investigation will take place with the odor monitoring team identifying the source by using a portable meter to take H₂S measurements, and making other qualitative odor observations of odor intensity and character to establish the presence of H₂S and other odor compounds at the site of detection of the alleged odor. Concurrently with the dispatch to the location of the reported detected odor, an immediate review of the Facility will be made to attempt to identify the source of the odor. The *Checklist for Table 1 Review/ Complaint Checklist* will be used to record findings during the facility survey.

When the source of the alleged odor is found, and if such alleged odor is coming from the Facility, the cause shall be determined and appropriate action will be taken to eliminate the source of the odor. In the event of a major equipment failure, a contingency plan will be implemented to minimize odor emissions until the equipment problem can be rectified.

The *Odor Inventory Monitoring Tour Action Plan* form will be prepared during and at the completion of the investigation. The County will be notified of an odor complaint within a reasonable period of but in no event later than 24 hours after the Company's receipt of the complaint.

There are four potential causes of an odor release, 1) equipment maintenance or equipment failure, 2) inadequate or improper operational procedures, 3) the occurrence of an Uncontrollable Circumstance, or 4) off-site odor sources. If equipment maintenance or equipment failure issues are identified as the reason for the odor release, parts, equipment and tools needed for repair will be ordered as soon as possible if not on-hand. If parts, equipment and tools are on-hand, the repair will progress as soon as possible. If operational procedures were the reason for the odor release, corrections will be made as soon as possible and employees instructed on the proper operational procedures. If the odor release occurred as a result of an Uncontrollable Circumstance that may result in an Odor Incident or Sustained Odor Condition, documentation will be prepared explaining the Uncontrollable Circumstance as required by Section 15.2 of the Service Contract and

described in the next Section 4.2.2. Off-site odor sources will be reported to Spokane County.

Continued Presence of Odorous Compounds

If the results of the odor monitoring and other investigations establish the continued presence of odorous compounds generated from the Facility, then the following additional investigations will be made to determine the nature and source of odors, which will be reported on the *Additional Odor Investigations* form (See Attachment B):

- A comprehensive review of odor sources at the Facility operated by the Company. The review shall include all unit processes and emission points such as points of turbulence in channels, discharges from pipes and over weirs
- An evaluation of the performance of all odor control units
- Air sampling for H₂S, odor strength (D/T), odor intensity, and any other applicable regulatory criteria
- Effluent and residuals sampling of the odor sources including wastewater sulfides, sulfates, dissolved oxygen, wastewater pH, and ORP
- Smoke testing to observe air flow patterns in ventilated areas
- Conduct dispersion modeling, as set forth in Appendix 10 (See Attachment A where Appendix 10 is described).

Based on the results of the investigation into the continued presence of odors generated from the Facility, the Company shall identify and implement the measures necessary to remedy the condition. If the source of the odor is found to be due to the occurrence of an Uncontrollable Circumstance, the County shall be responsible for associated costs to remedy the odor in accordance with Service Contract.

4.2.2 Procedures Outlined in Service Contract Resulting from an Odor Incident or a Sustained Odor Condition

The following describes procedures as stipulated in the Service Contract when an Odor Incident or a Sustained Order Condition has occurred. Thresholds for determining an Odor Incident are:

- Odors at the Site fence (or beyond) exceed a value of 10 dilution-to-threshold (D/T) as determined by dispersion modeling, or
- Atmospheric hydrogen sulfide exceed 0.01 parts per million by volume in air (ppmv) as measured at the Site fenceline by the Company, the County or a third party hired by the County, or
- A perceptible odor emanating from the Facility is detected by any party at the Facility fenceline that is verified by the Company, or
- Three or more independent reports within a 24 hour period to either the Company and/or the County from members of the surrounding community of a perceptible odor emanating from the Facility

When an Odor Incident occurs [as defined in Section 10.3(E) and (F) of the Service Contract and shown in Attachment A], the County may issue an Odor Citation or make a determination of a Sustained Odor Condition. The following outlines the steps to be followed:

Odor Incident:

1. County gives a written notice of the proposed issuance of the Odor Citation to the Company, together with a written statement as to the basis of the determination.
2. Company responds in writing to the County in regards to the proposed Odor Citation within five (5) business days after receipt of the County's written notice. The Company may, in its written statement, present information in refutation of the proposed County determination that an Odor Incident has occurred, including information as to the role of any Uncontrollable Circumstances in any odor condition, other mitigating factors, and any possible assessment of liquidated damages which may result from the County's issuance of an Odor Citation.
3. County makes a final determination of whether to issue an Odor Citation, and if so, issued, the amount of liquidated damages to be assumed, if any.
4. Company shall pay liquidated damages assessed by the County, if any, as set forth in Section 10.3(H) of the Service Contract for each Odor Citation issued by the County.

Sustained Odor Condition:

1. County gives a written notice of a proposed determination of a Sustained Odor Condition to the Company, together with a written statement as to the basis of the determination.
2. Company responds in writing to the County in regards to the Sustained Odor Condition within ten (10) business days after receipt of the County's written notice. The Company may, in its written statement, present information in refutation of the proposed County determination that a Sustained Odor Condition has occurred, including information as to the role of any Uncontrollable Circumstances in any odor condition and as to other mitigating factors including the efforts of the Company to correct the Sustained Odor Condition.
3. County makes a final determination of whether a Sustained Odor Condition has occurred, and if so issued, the amount of liquidated damages to be assumed, if any.
4. Company shall pay liquidated damages assessed by the County, if any, as set forth in Section 10.3(J) of the Service Contract upon a Sustained Odor Condition determination made by the County.

To confirm resolution of an Odor Incident, the Odor Guarantee will be demonstrated by showing compliance with the 10 D/T determined by dispersion modeling and 0.01 ppmv hydrogen sulfide by measuring emissions from sources at the Facility. These measurements can be included in the resolution reports provided to the County.

5.0 Odor Control Training

Odor control training will be provided to O&M employees regarding the implementation of the Odor Control Plan and will cover the following:

- The sources of odors and control strategies both in general and specific to the RWRF
- The operation and maintenance of the RWRF odor control systems
- How to conduct an odor monitoring tour
- How to respond to odor complaints
- How to modify SOPs and UCPs to include odor mitigation
- Identifying off-site odor generators that could result in RWRF odor complaints

In addition, a separate training module on bark bed biofilter operation will be conducted with input from outside experts. All initial classes will be video taped so training will be available for those not able to attend. The tapes will become part of the facility's training library.

Follow-up training will reinforce different aspects of the initial training on an as needed or rotating basis.

Prior to fully developing the details of the odor control training, a training needs assessment will be conducted with O & M personnel to further focus the training program and determine additional needs.

Attachment A: Service Contract Requirements

Spokane County/CH2M HILL Contractual Requirements

CH2M HILL (Company) will comply with the following Service Contract requirements for odor control and management at the Spokane Regional Water Reclamation Facility (RWRF or Facility):

Odor Control Service Contract Sections

Section 8.10 COMPLIANCE WITH APPLICABLE LAW

Section 8.10 (E) No Nuisance Covenant:

The Company shall keep the Facility neat, clean and litter-free at all times, ensure that the operation of the Facility does not create any odor, litter, noise, fugitive dust, vector, excessive light or other adverse environmental effects on the surrounding community constituting, with respect to each of the foregoing, a nuisance condition under applicable law. Should any such nuisance condition occur which is not caused by Uncontrollable Circumstances, the Company shall promptly remedy the condition, pay any fines or penalties relating thereto, make all Capital Modifications and changes in operating and management practices necessary to prevent a recurrence of the nuisance condition, and indemnify, defend and hold harmless the County Indemnitees from any Loss-and-Expense relating thereto in the manner provided in Section 15.3. Nothing in this subsection shall be deemed to limit or otherwise affect the Company rights to compensation and other relief in accordance with Section 15.2 in the event of a Change in Law relating to a nuisance condition under Applicable Law.

Section 10.3 Odor Guarantee:

(A) Applicable Law Limits. Except to the extent relieved as provided in Section 10.7 or otherwise due to the occurrence of an Uncontrollable Circumstance in accordance with Section 15.2 (both 10.7 and 15.2 Sections described below), in operating the Facility, the Company shall comply with all limits and requirements established by Applicable Law with respect to odor control.

(B) Contract Limits. In addition to its obligation to comply with odor limits and requirements imposed by Applicable Law as provided in subsection (A) of this Section and except to the extent relieved as provided in Section 10.7 or otherwise due to the occurrence of an Uncontrollable Circumstance in accordance with Section 15.2, the Company shall comply with the Odor Control Standards and operate and maintain the Facility so that there is no odor emanating from the Facility at or beyond the site boundary, which causes an Odor Incident or a Sustained Odor Condition (the “Odor Guarantee”).

(C) Odor Control Practices Report. The Company shall submit, together with the monthly operations report required by Section 8.14, a monthly odor control practices report to the County in accordance with Appendix 9 (See end of this Attachment A).

(D) Preventing Recurrence of Violations. The general remedies for exceeding odor limits are set forth in Section 10.10 (County Remedies for Non-Compliance with Performance Guarantees) and this Section and may include termination as and to the extent provided in Section 14.2 (Events of Default by the Company). With respect to odor particularly, the parties acknowledge the extreme importance of this issue to the general public. The Company further acknowledges that in the proposal process leading to the execution of this Service Contract, the Company had a full opportunity to propose additional capital improvements for odor control, and by making its proposal and by executing this Service Contract, the Company has assumed the risk that the Facility is capable of controlling odor to a level required by the Contract Standards absent the occurrence of Uncontrollable Circumstances. Accordingly, in the event the Company fails to comply with its odor control obligations set forth or referred to in this Section, and is not excused by Uncontrollable Circumstances, the Company shall be obligated to implement such Capital Modifications and changes in operating, maintenance, repair, replacement and management practices as shall be necessary, in light of the nature, extent and repetitiveness of such non-compliance, to assure that the odor violation will not recur.

(E) Odor Incident. An “Odor Incident” for purposes of this Service Contract is an odor condition of limited duration emanating from the Facility, to the extent not caused by Uncontrollable Circumstances, which is verified by the Company or the County in accordance with Appendix 10 (Supplemental Performance Guarantee Requirements, found at end of this Attachment A) and Section 10.3 (Odor Guarantee).

(F) Sustained Odor Condition. A “Sustained Odor Condition” for purposes of this Service Contract is any Odor Incident, or combination of Odor Incidents, occurring over the course of three or more consecutive days.

(G) Citations for Odor Incidents. Upon receipt of information surrounding any Odor Incident, the County shall have the right to issue a citation (“Odor Citation”) to the Company if the County reasonably believes that the Company has violated the Odor Guarantee. Prior to issuing an Odor Citation, the County shall give written notice of the proposed issuance of the Odor Citation to the Company, together with a written statement as to the basis of the determination. The Company shall have five business days after receipt of the County’s written notice to respond in writing to the County. The Company may, in its written statement, present information in refutation of the proposed County determination that an Odor Incident has occurred, including information as to the role of any Uncontrollable Circumstances in any odor condition, other mitigating factors, and any possible assessment of liquidated damages which may result from the County’s issuance of an Odor Citation. The County may exercise discretion in making its final determination of whether to issue an Odor Citation, and if so, the amount of liquidated damages to be assumed, if any. The limitations of this discretionary power are described in subsection (H) of this Section. In exercising this discretion, the County shall consider the number, frequency, legitimacy and forcefulness of odor complaints logged; the size of the area or magnitude of the number of individuals affected; and the degree of impact on the individuals affected. In exercising this discretion, the County shall also consider the information present by the Company (including the efforts of the Company to correct the odor condition).

(H) Liquidated Damages for Odor Citations: The Company shall pay liquidated damages for each Odor Citation issued by the County in the following amount: (1) for the first Odor Citation, \$0 to \$4,000; (2) for the second Odor Citation, \$0 to \$8,000; and (3) for the third and

each subsequent Odor Citation, \$0 to \$16,000. The County shall have the right in its discretion to set the amount of the liquidated damages within such parameters. Each such dollar amount shall be adjusted annually based on the Facility Element Adjustment Factor.

(I) County Monitoring. The County, upon reasonable advance notice to the Company, shall have the right at any time to hire a third party for the purpose of monitoring the Facility for odor and emissions. Such third party may perform odor panel testing or sampling and monitoring. All costs relative to the third party shall be borne by the County and County shall be responsible for all damage caused to the Company by reason of negligence of such third party while at the Site.

(J) Disregarding Prior Odor Citations: In the event that a period of 365 or more days elapses following the issuance of an Odor Citation without any further Odor Citations being issued by the County, all previous Odor Citations regardless of number shall be disregarded for the purposes of the County's termination rights pursuant to Section 14.2 and for determining Service Fee reductions under subsection (H) of this Section, and the next Odor Citation, if any, which occurs shall be deemed to be the "first Odor Citation" for such termination and Service Fee reduction purposes.

(K) Sustained Odor Condition Determination. In the event that the County believes a Sustained Odor Condition exists, it shall have the right to make a determination that a Sustained Odor Condition has occurred. Prior to making a Sustained Odor Condition determination, the County shall give written notice of the proposed determination to the Company, together with a written statement as to the basis of the determination. The Company shall have ten business days after receipt of the County's written notice to respond in writing to the County. The Company may, in its written statement, present information in refutation of the proposed County determination that a Sustained Odor Condition has occurred, including information as to the role of an Uncontrollable Circumstances in any odor condition and as to other mitigating factors. The County shall consider any such information presented by the Company (including the efforts of the Company to correct the odor condition) in making its final determination as to whether a Sustained Odor Condition has occurred and if so, the amount of liquidated damages to be assessed, if any.

(L) Liquidated Damages for Sustained Odor Condition Determination. The Company shall pay liquidated damages upon a Sustained Odor Condition determination made by the County, in any amount from \$0 to \$20,000 determined by the County. Such dollar amount shall be adjusted annually based on the Facility Element Adjustment Factor.

(M) County Termination Rights Based on Odor Citations or a Sustained Odor Condition Determination. The County shall have the right, but not the obligation, to terminate this Service Contract based upon Odor Citations or upon a sustained Odor Condition determination by the County pursuant to and in accordance with Section 14.2. The rights of the County to collect liquidated damages, or to terminate this Service Contract based on Odor Citations or a Sustained Odor Condition determination, shall not be exclusive, and the County shall have all of the other remedies provided herein in the event of a breach of this Service Contract relating to odor, including the right to require the Company to prevent the recurrence of odor violations as provided in subsection (D) of this Section.

(N) Concurrent Odor Incidents and Sustained Odor Conditions. Notwithstanding the pendency of proceedings relating to the issuance of an odor Citation, the County shall have the right to give notice of a Sustained Odor Condition (whether based on the continuance of the Odor Incident giving rise to the possible issuance of the Odor Citation or based upon other odor conditions). In any such event the Company shall have the rights set forth in subsection (K) of this Section with respect to the determination of a Sustained Odor Condition. If a Sustained Odor Condition directly results from the related Odor Incident giving rise to the issuance of an Odor Citation, the maximum total amount of liquidated damages from both the Odor Citation and the Sustained Odor Condition shall not exceed the maximum allowed for by the Sustained Odor Condition.

(O) Number of Odor Citations and Sustained Odor Condition Determinations. Nothing in this Section limits the number of Odor Incidents or Sustained Odor Condition Determinations that the County may declare if circumstances warrant hereunder.

Section 10.7(A): Upsets and Excessive Influent Affecting Company Compliance with Performance Guarantees.

Subject to the provisions of subsection (B) of this Section, the Company shall be relieved of its obligation to comply with a Performance Guarantee to the extent and for any period during which the operation of the Facility is affected by the occurrence of an Upset, the receipt of Excessive Influent or any other Uncontrollable Substance.

Section 10.7(B): Upsets and Excessive Influent.

The occurrence of an Upset or the receipt of Excessive Influent shall not be considered to be an Uncontrollable Circumstance, and the Company shall not be entitled to relief from a Performance Guarantee due to the occurrence of an Upset or the receipt of Excessive Influent, except to the extent that the Company affirmatively demonstrates through properly signed, contemporaneous operating logs, or other relevant evidence that:

- An Upset actually occurred or Excessive Influent was actually received; and
- The occurrence or receipt thereof could not have been prevented by compliance with the Contract Standards.

Section 10.10 County Remedies for Non-Compliance with Performance Guarantees

(A) Remedies. If the Company fails to comply with any performance guarantee and is not excused from performance due to the occurrence of an Uncontrollable Circumstance as provided in Sections 10.7 or 15.2, the Company shall, without relief under any other Performance Guarantee, or in addition to any other remedy provided herein, allowed by Applicable Law or required by a Governmental Body: (1) promptly notify the County within 24 hours of the Company's having knowledge of any such non-compliance; (2) promptly provide the County within 24 hours copies of any notices sent to or received from the EPA, Ecology, or any other Governmental Body having regulatory jurisdiction with respect to any violations of Applicable Law; (3) pay any applicable liquidated damages or reimbursements specifically provided for herein or have its Service Fee reduced in the amount of such liquidated damages or reimbursements; (4) pay any other resulting damages, fines (discretionary or mandatory in nature), levies, assessments, impositions, penalties or other charges resulting there from; (5) take any action (including making all capital investments, improvements or modifications, repairs and replacements and

operating and management practices changes) necessary in order to comply with such Performance Guarantee, continue or resume performance hereunder and eliminate the cause of, and avoid or prevent the recurrence of non-compliance with such Performance Guarantee; (6) promptly prepare all public notifications required by Applicable Law, and submit such notifications for publication; and (7) assist the County with all public relations matters necessary to adequately address any public concern caused by such non-compliance, including preparation of press releases, attendance at press conferences, and participation in public information sessions and meetings.

(B) **Performance Testing.** The County, at any time, may require a performance test to be conducted by the Company, at the County's cost and expense, to demonstrate that the Facility is operating in compliance with Applicable Law and the Performance Guarantees. The performance tests shall be conducted in the manner provided in Appendix 6 to the extent applicable. If the test is not successfully passed, the Company shall reimburse the County and, at its own cost and expense, make all necessary repairs and replacements, including major repairs and replacements, and the test shall be re-performed at the Company's sole cost. The County Engineering Representative will conduct or verify each test and inspection.

Section 14.2

(A) **Events of Default Not Requiring Previous Notice or Further Cure Opportunity for Termination.** Each of the following shall constitute an Event of Default by the Company upon which the County, by notice to the Company, may terminate this Service Contract without any requirement of having given notice previously or of providing any further cure opportunity:

(5) **Failure to Meet the Odor Guarantee.** The issuance by the County of (1) a fourth or any subsequent Odor Citation (taking into account the provisions of subsection 10.3 (J)), and provided that in order for such termination to occur such fourth or subsequent Odor Citation must be at least the second such Odor Citation in any calendar year), or (2) a Sustained Odor Condition, in either case based on determinations made in accordance with the applicable provisions of Section 10.3.

Section 15.2(A): Uncontrollable Circumstances, Relief from Obligations.

Except as expressly provided under the terms of this Service Contract, neither party to this Service Contract shall be liable to the other for any loss, damage, delay, default or failure to perform any obligation to the extent it results from an Uncontrollable Circumstance . . .

Appendix 9

Section 9.19 Odor Control Standards:

The Company shall comply with the Odor Guarantee set forth in Section 10.3 of the Service Contract. The Company shall be responsible for controlling odors through the proper operation and maintenance of the Facility. The Company shall be responsible for operating and maintaining each odor control system so that it performs to its designed capacity and capability. The Company shall capture and treat all objectionable odors and follow best

management practices for the prevention of objectionable odors. The Company shall respond to odor complaints, investigate their causes, and take actions to eliminate odors.

9.19.1 Odor Control Plan

The Company shall develop an Odor Control Plan that includes an odor response plan and odor control practices reporting procedures. The Odor Control Plan shall be developed and submitted to the County no later than 90 days prior to Acceptance. The final plan shall be prepared within 30 days following receipt of County comments.

The Odor Control Plan shall address, at a minimum, the following:

- Implementation of a daily Site fenceline survey by the Facility Manager or senior operator at the beginning of each day shift, prior to entering the Facility, to conduct an observation for odor intensity and characteristic and the potential on-site or off-site source of an observed odor along the perimeter of the Site. Such information shall be recorded in a permanent log.
- Installation of two portable hydrogen sulfide (H₂S) detectors at strategic locations to monitor and record the air quality and that are set up to trigger an alarm when levels exceeding pre-set limits are sensed.
- Installation of a weather station at the Facility to continuously monitor and record weather conditions, including wind direction and speed, air temperature, barometric pressure, humidity and precipitation
- Implementation of odor control operating, maintenance and housekeeping procedures at the Facility to eliminate odors.
- Development and implementation of operating checklist or log forms to record the status of odor control system equipment for each odor control system. The information to be recorded for each odor control treatment unit, and includes airflow and pressure drop across the unit.
- Standard Operating Procedures to optimize the performance of all odor control systems, including chemical addition measures, checking for breakthrough of odors from odor control systems, checking the condition of biofilter media, etc. The procedures shall identify what parameters shall be monitored and the procedures to be followed to maintain the target operating range for each odor control system and determine when replacement of odor control materials, such as activated carbon or biofilter media, is necessary to maintain effective odor control.
- Maintenance schedule and procedures for all odor control systems.
- Procedures to address odor control when an odor control system is out of service for preventive or corrective maintenance.
- Procedures to confirm that air is being properly collected from individual process units through pressure monitoring and smoke testing.

9.19.2 Odor Response Plan

The Company shall establish an Odor Response Plan to investigate all odor complaints related to the Facility. The County shall be notified of an odor complaint within a reasonable period of but in no event later than 24 hours after the Company's receipt of the complaint. The site of the alleged odor shall be visited as soon as possible but no later than one hour after receipt of the complaint. The Company shall obtain H₂S and other appropriate measurements using a portable meter and make other qualitative odor observations of odor intensity and character to establish the presence of H₂S and other odors compounds at the site of the alleged odor. The Company shall concurrently, with the dispatching of a Company representative to the location of the detected odor, conduct an immediate review of the Facility to attempt to identify the source of the odor.

When the source of the alleged odor is found, and if such alleged odor is coming from the Facility, the Company shall determine the cause and take the appropriate action to eliminate the source of the odor. In the event of a major equipment failure, the Company shall implement a contingency plan to minimize odor emissions until the equipment problem can be rectified. If the source of the odor is found to be due to the occurrence of an Uncontrollable Circumstance, the County shall be responsible for associated costs to remedy the odor in accordance with the Service Contract.

The Company shall maintain a record of every odor complaint and shall document the complaints using an odor complaint registration/response form (and questionnaire). The odor complaint registration/response form shall include the following information:

- Name and location of the complaint
- Date and time the complaint was received
- Name of the Company staff receiving the complaint
- Complainant contact information (name, street, mailing and e-mail address, telephone and fax number)
- Other complaints registered by the complainant or specific to the property in question
- Manner in which complaint filed: indirect (through County or another party), anonymously or identified in person by telephone, fax, e-mail or writing
- Facility operating condition at the time the odor was detected, including odor control systems (e.g. normal operations, certain processes "in trouble", unusual influent conditions, equipment off-line for maintenance, variance in normal operations, etc.)
- Weather conditions at time odor was noticed, including wind speed and direction, temperature, barometric pressure and relative humidity as recorded at the Facility
- Date and time of response and name of employee responding to the complaint
- Operator and complainant observations at the site where the odor was noticed.
- Description of remedial/mitigation action taken by the Company in response to the complaint and its effectiveness

- Description of the follow up with the complainant: in person verbally, follow up telephone call, e-mail or by letter
- Attitude of the person registering the complaint (i.e. satisfied/dissatisfied with the response, cooperative and understanding, impatient, confrontational, or other)
- Day and time the County's representative received verbal notice of the complaint and day and time the County received the complaint form and follow-up and response information

If the results of the odor monitoring and other investigations establish the continued presence of odorous compounds generated from the Facility, then the Company shall undertake the following additional investigations to determine the nature and source of odors:

- A comprehensive review of odor sources at the Facility operated by the Company. The review shall include all unit processes and emission points such as points of turbulence in channels, discharges from pipes and over weirs
- An evaluation of the performance of all odor control units
- Air sampling for H₂S, odor strength (D/T) odor intensity and any other applicable regulatory criteria
- Effluent and Residuals sampling of the odor sources including wastewater sulfides, sulfates, dissolved oxygen, wastewater pH, and ORP
- Smoke testing to observe air flow patterns in ventilated areas
- Conduct dispersion modeling, as set forth in Appendix 10.

Based on the results of the investigation into the continued presence of odors generated from the Facility, the Company shall identify and implement the measures necessary to remedy the condition. If the source of the odor is found to be due to the occurrence of an Uncontrollable Circumstance, the County shall be responsible for associated costs to remedy the odor in accordance with Service Contract.

9.19.3 Odor Control Practices Report

The Company shall prepare and submit to the County, on a monthly basis, an Odor Control Practices Report in accordance with subsection 10.3(C) of the Service Contract. The report shall include the following:

- Listing of all odor complaints received during the month. Such log shall be an excel based odor complaint log that details the name and address of complainant; time of complaint; nature, characteristics and intensity of the complaint; and the meteorological conditions at the time of the complaint
- Results of measurements of the odor indicators at the Site, including daily fence line monitoring
- Description of all investigations conducted and the action or mitigation steps taken or planned in response to each complaint

- Date that the complainant was contacted to explain the results
- Evidence showing compliance with the odor control operating practices required by this Service Contract and as set forth in this Appendix and Appendix 10
- Quantity of odor control chemicals used during the month
- Duration of time that Biosolids and other Residuals remained on the Site after being processed
- A summary of maintenance activities resulted in abnormal odor conditions and mitigation that was taken
- Summary of disruptions to the operation of all odor control facilities
- Major maintenance activities planned for the coming month if the activities could lead to odor events and mitigation measures that shall be taken
- Residuals management activities
- Copies of all notifications to the Company given in the reporting period

Such other information pertaining to odor control as the County may reasonably require from time to time.

Appendix 10

Section 10.1 Purpose

This Appendix sets forth certain specific standards, requirements and liquidated damages associated with the Performance Guarantees identified in Article X in the Service Contract.

10.3 Determination of an Odor Incident for Purposes of the Odor Guarantee.

The Company shall operate and maintain the Facility in accordance with the Odor Guarantee set forth in Section 10.3 of the Service Contract and the Odor Control Standards set forth in Appendix 9. The thresholds for determining an Odor Incident are:

- Odors at the Site fence (or beyond), which exceed a value of 10 dilution-to-threshold (D/T) as determined by dispersion modeling, or
- Atmospheric hydrogen sulfide exceeding 0.01 parts per million by volume in air (ppmv) as measured at the Site fenceline by the Company, the County or a third party hired by the County, or
- A perceptible odor emanating from the Facility that is detected by any party at the Facility fenceline that is verified by the Company, or
- Three or more independent reports within a 24 hour period to either the Company and/or the County from members of the surrounding community of a perceptible odor emanating from the Facility

The Company shall demonstrate compliance with the 10 D/T determined by dispersion modeling and 0.01 ppmv hydrogen sulfide by measuring emissions from sources at the

Facility. The Company shall demonstrate Odor Guarantee compliance to achieve Acceptance and whenever such demonstration is necessary to confirm resolution of an Odor Incident.

Attachment B: Odor Control Plan Forms*

1. Fenceline Odor Monitoring Tour Form
2. **Fenceline Odor Monitoring Tour Permanent Log**
3. **Odor Complaint Registration/Response Form**
4. Odor Inventory Monitoring Tour Action Plan
5. **Checklist for Table 1 Review/Complaint Checklist**
6. **Monthly Odor Control Practices Report**
7. **Additional Odor Investigations Form**

*Forms shown in bold are required in Service Contract.

Fenceline Odor Monitoring Tour Form

Fenceline Survey

The Fenceline Odor Monitoring Survey is intended to be used as a **proactive** odor detection process and to also satisfy a Service Contract requirement. The Facility Manager and/or Senior Operations personnel will tour the fenceline daily. During that survey, this form (*Fenceline Odor Monitoring Tour Form*) will be prepared, and when odors are detected, the *Odor Inventory Monitoring Tour Action Plan* (Attachment B, Worksheet 1) will be prepared that describes the action plan to correct the problem.

Fenceline Surveyed by:

____.

[] No odors detected Date _____ Time _____ Signed _____

[] Odors detected Date _____ Time _____ Signed _____

If odor is detected: report strength, describe odor, identify location, and take measurements.

Intensity Strength of Odors (circle one):

1 = Detectable Odors

2 = Recognizable Odors

3 = Very distinct and annoying Odors

Location of Odor Identified

Offsite Source [] or Onsite Source []

Odor Description (circle appropriate descriptors)

A. Disagreeable, garlic

B. Pungent, irritating (ammonia)

C. Unpleasant, putrid

D. Unpleasant, strong

E. Skunk like

F. Putrid, fishy

G. Decayed cabbage

H. Rotten eggs

I. Fecal, nauseating

Odor Measurements:

D/T: _____

H₂S: _____

Meteorological Conditions:

Wind direction: (Source of Wind) N-S-E-W

Wind Speed _____

Wind towards or away from Facility; Yes [] or No []?

Temperature: _____

Precipitation _____

Barometric Pressure: _____

Other Comments: _____

Relative Humidity: _____

Site Drawing on Back:

Facility Site Map for Odors Detected and Potential Odor Source

Odor Complaint Registration/Response Form

Registration of Complaint:

DATE RECEIVED: _____ TIME reported: _____

Complaint Name: _____ TIME odor detected: _____

Complaint Location: _____

Manner in which complaint filed:

Indirect: ☐; by County, ☐ another party, ☐ or anonymous ☐

Direct: ☐; identified in person by telephone ☐, fax ☐, e-mail ☐, or writing ☐

Name of staff member receiving the complaint: _____

Complainant Contact Information:

Weather Conditions:

Name: _____ Wind direction: (Source of Wind) N-S-E-W

Telephone number: _____ Wind speed: _____

Fax number: _____ Temperature: _____

Email address: _____ Barometric pressure: _____

Address: _____ Relative humidity: _____

City: _____ Other (stormy, etc.) _____

Nature of the complaint (odor description):

Other complaints registered by the complainant or specific to the property in question:

Facility operating condition at the time the odor was detected, including odor control systems (e.g. normal operations, certain processes “in trouble”, unusual influent conditions, equipment off-line for maintenance, variance in normal operations, etc.):

Response and Follow-up of Complaint:

DATE of response: _____ TIME of response: _____

Name of employee responding to the complaint: _____

Operator and complainant observations at the site where the odor was noticed:

Description of remedial/mitigation action taken by Company in response to the complaint:

Effectiveness of response: _____

Description of the follow up with the complainant:

In person verbally [], follow-up telephone call [], email [], or other []

Attitude of the person registering the complaint:

Satisfied [], Dissatisfied with the response [], cooperative and understanding []

Impatient [], confrontational [] or other [] _____

County received verbal notice of the complaint on:

DATE: _____ TIME: _____

County received the complaint form and follow-up and response information on:

DATE (complaint form): _____ TIME: _____

DATE (response information): _____ TIME: _____

DATE (Odor Inventory Monitoring Tour Action Plan prepared: _____

CH2M HILL Spokane County Regional Water Reclamation Facility

Odor Inventory Monitoring Tour Action Plan

Odor Response Team Members

Name	Department

Date and Time

Location	Odor Detected (Y/N) Strength (1-3) Description (A-I) *	Action Plan/Description of Odor Issue	Action Plan Start Date	Completion Date	Responsible Party(s)
1. Force Mains (coming from Spokane Valley Interceptor Pump Stations)					
Air/Vacuum Vaults and Sewer Interceptor Pipelines					
2. Treatment Operations Facility (TOF)					
Laboratory Chemicals					
Analysis/Chemical Reactions in Laboratory					
3. Headworks Building					
Headworks Building					
Grit Basin					
Grit Pumps					
Other Pumps, Valves, Pipes and Equipment					

CH2M HILL Spokane County Regional Water Reclamation Facility Odor Inventory Monitoring Tour Action Plan

Septage Disposal					
Septage Debris Removal					
4. Headworks Generator					
Filling Diesel Tank					
5. Primary Clarifier					
Clarifiers					
Cleaning of Surface Scum Trough					
Cleaning Hosing of Scum Pump Pit					
Wash Down of Launderers Through Access Hatches					
Isolation Valve Vaults					
6. Aeration Basin					
Monitoring of Process and Equipment					
Sampling Process					
7. Blower Area					
Little to no potential odors at this site.					

CH2M HILL Spokane County Regional Water Reclamation Facility

Odor Inventory Monitoring Tour Action Plan

8. Membrane Facility					
Cleaning and pH Control Chemicals					
During Startup of Process, Light Odors from MLSS					
9. Membrane Facility Generator					
Filling Diesel Tank					
10. Liquids Dem. Pad					
Spilled Liquids during Demonstration Period					
11. Chemical Storage					
Overflow of Tanks During Filling					
Sump Pit Contents					
12. Waste Gas Burner					
Pilot Light Failure					
13. Plant Drain Pump Station					
Sanitary Sewer Pump Station Vent					
14. Gas Storage Facility					
Dome Seal					

CH2M HILL Spokane County Regional Water Reclamation Facility

Odor Inventory Monitoring Tour Action Plan

15. Digester Gas Storage Room					
Condensation Trap and Foam Separation Tanks					
16. Cogen Facility					
Connections at Cogen Facility					
17. Solids Demonstration Pad					
Spilled Solids During Demonstration Period					
18. Aerobic Digester					
Open Hatches					
19. Blend Tank					
Open Hatches					
20. Solids Facility					
Solids Building					
Biosolids Loading					
Biosolids Hauling					
Centrifuges and Gravity Belt Thickeners					
Solids Drain Pump Station					

CH2M HILL Spokane County Regional Water Reclamation Facility

Odor Inventory Monitoring Tour Action Plan

21. Anaerobic Digesters					
PRV Valve Operation					
22. Odor Control Facility					
Biofilter Exhaust Must not Emit Odors					
Biofilter					
Change-out of Bio-media					
23. Maintenance Building					
Storage and Use of Petroleum Products					
Chemical Spill					
Maintenance Building Pump Station					
24. Intermittent Sources					
Taking Tanks Off-Line					
Other Maintenance Activities					

Loss of Utility Power Response Plan

Overview

In the event of a utility power failure, the Headworks and Membrane facilities have standby generators for powering select critical process equipment. Also, critical process equipment and PLC panels in the Solids Building are fed from the Headworks generator via the Maintenance Building power panel. Standby emergency power systems include two diesel powered backup generators. The Headworks facility generator has a 300kW capacity and the membrane facility has a 1500kW capacity. Should a utility power failure occur, these generators will automatically start and switch the critical systems to emergency backup power.

Uninterruptable Power Supplies (UPS's) are supplied at each facility for SCADA critical loads. SCADA monitors the utility power conditions for the Headworks Facility, Membrane Facility, Solids Handling Facility, and standby generators. These are indicated on the HMI. Upon loss of utility power while on standby power SCADA provides alarms on the HMI. In addition SCADA sends an alarm signal to both the SVI Pump Station PLC and the NVI Pump Station PLC.

Power Supplies

SCADA will monitor four values at each motor control center and switchboard. These values are: kilowatts (kW), volts, amps, and power factor. These values are displayed on the HMI as well as SCADA for monitoring electrical performance at each facility. Alarms are generated for generator failure, utility power failure, high readings on any of the monitored values, or low readings on the monitored values. Should an electrical alarm occur that is not generator failure, power will automatically switch over to emergency generator backup power.

The majority of the electrical system is manually controlled through medium voltage switches and circuit breakers at each motor control center, switchboard, and panel board. The only automatic controls in the facility electrical system are those that start the backup generators and those that transfer equipment power supplies to generator power.

Uninterruptable Power Supply (UPS) Systems

There are five UPS systems distributed throughout the facility. They are located in the electrical rooms of the following buildings: Treatment Operations Facility, headworks, membrane facility, maintenance facility, and the solids facility. Each UPS feeds a panel board that distributes power to critical components listed below. Each UPS provides standby power for the plant control system components during the time that the

electrical systems in the Headworks and Membrane Facility are transitioning from utility power to generator power. They have the capacity to power the critical components for approximately 30 minutes. The critical control systems that will not see any kind of power outage are:

- PLC panels, instruments
- PC workstations
- Network interface panels

Headworks Facility Utility Standby Power Sequence

On loss of utility power, a stop command is provided to the following equipment:

- Septage Pumps 1&2
- Aerated Grit Mixer
- Aerated Grit Basin Scum Pump
- Grit Pumps 1-3
- Grit Classifier
- Influent Band Screens 2&3
- Screenings Grinders 2&3
- Screenings Washer-Compactor 2&3
- Headworks Polymer Blend Unit
- Headworks Odor Transfer Fan
- Primary Sludge Pumps 1-3
- Primary Clarifiers 1&2
- Primary Scum Pump
- Odor Control Fans 1&2
- Biofilter Inline Stack Fans 1-3
- Bioreactor Fans 1&2

On standby power notification, after a 15 second delay to allow for HVAC equipment initialization, the following equipment will be restarted:

- Influent Band Screens 2&3
- Screenings Grinders 2&3
- Screenings Washer-Compactor 2&3

Once this equipment has been restarted and after another 15 second delay, the following equipment will restart:

- Biofilter Inline Stack Fans 1-3
- Odor Control Fans 1&2
- Headworks Odor Transfer Fan

Once this equipment has been restarted and after a final 15 second delay, the following equipment will restart:

- Primary Clarifier 1&2

Equipment on the stop command list but not on a restart list will remain off during a loss of utility power event. The following equipment will not restart:

- Septage Pumps 1&2
- Aerated Grit Mixer
- Aerated Grit Basin Scum Pump
- Grit Pumps 1-3
- Grit Classifier
- Headworks Polymer Blend Unit
- Primary Sludge Pumps 1-3
- Primary Scum Pump
- Bioreactor Fans 1&2

Membrane Facility Utility Standby Power Sequence

On loss of utility power, a stop command is provided to the following equipment:

- Aeration Basins 1-4 Mixers 1-5
- Nitrified Recycle Pumps 1-4
- WAS Pumps 1&2
- Process Air Blowers 1-3
- Air Scour Blowers 1-3
- Membrane Feed Pumps 1-4
- Membrane Drain Pump
- Membrane Influent Mixer
- Ferric Chloride Feed Pumps 1-4
- Sodium Hydroxide Feed Pumps 1&2
- Sodium Hypochlorite Feed Pumps 1-3
- Sodium Bisulfite Feed Pumps 1&2
- Plant Water Pumps 1-3
- Plant Drain Pumps 1-3

On standby power notification, after a 30 second delay to allow for Membrane System equipment initialization, the following flow critical equipment will be restarted:

- Membrane Feed Pumps 1-4
- Membrane Rapid Mixer

Once this equipment has been restarted and after another 15 second delay, the following equipment will restart:

- Ferric Chloride Feed Pumps 1-4
- Sodium Hydroxide Feed Pumps 1&2
- Sodium Hypochlorite Feed Pumps 1-3
- Sodium Bisulfite Feed Pumps 1&2

Once this equipment has been restarted, the following equipment will restart with a 10 second delay between the restart of each unit:

- Process Air Blowers 1-3
- Air Scour Blowers 1-3

Once this equipment has been restarted and after a 15 second delay, the following equipment will restart:

- Nitrified Recycle Pumps 1-4
- Aeration Basins 1-4 Mixer 1, Mixer 2 Mixer 4

Finally, once this equipment has been restarted and after a 15 second delay, the lead pump for the following equipment will restart:

- Plant Water Pumps 1-3
- Plant Drain Pumps 1-3

All other equipment shut down due to loss of utility power, shall remain off. On return to utility power from standby power, all equipment will restart. The equipment that will not restart during the loss of utility power event are:

- Aeration Basins 1-4 Mixers 3&5
- WAS Pumps 1&2
- Standby Plant Water Pumps
- Standby Plant Drain Pumps

Solids Facility Utility Standby Power Sequence

On loss of utility power, a stop command is provided to the following equipment:

- Blended Sludge Storage Tank Mixing Pump
- Gravity Belt Feed Pumps 1&2
- Gravity Belt Thickeners 1&2
- GBT Wash Water Pumps 1&2
- Thickened Sludge Pumps 1&2
- Anaerobic Digesters 1&2 Draft Tube Mixers
- Gas Storage Air Supply Fans 1&2
- Microturbines 1-4
- Boiler
- Boiler Supply Pump
- Microturbine Supply Pump
- Hot Water Loop Circulating Pumps 1&2
- Hot Water Pumps 1-3
- Aerobic Digester Sample Pump
- Centrifuge Feed Pumps 1-3
- Centrifuges 1&2
- Dewatered Sludge Pumps 1&2
- Aerobic Digester Blowers 1&2
- Solids Facility Polymer Blend Unit
- Polymer Aging Tank Mixer
- Cationic Polymer Feed Pumps 1-5

- Sludge Cake Polymer Pumps 1&2

On standby power notification, after a 15 second delay to allow for HVAC equipment initialization, the following equipment will be restarted:

- Gas Storage Air Supply Fans 1&2

Once this equipment has been restarted and after another 15 second delay, the following equipment will restart:

- Anaerobic Digesters 1&2 Draft Tube Mixers

All other equipment shut down due to loss of utility power, shall remain off. On return to utility power from standby power, all equipment will restart.

Extended Loss of Utility Power Event

Emergency backup generators have the capacity to run for 24 hours on one tank of fuel. Should CH2M HILL anticipate the loss of utility power event be longer than 24 hours, provisions will be made with the diesel supply company to refuel the generators daily and as needed to maintain a sufficient amount of fuel for an uninterrupted power supply.

Total Loss of Power Response

Spokane County RWRF relies on electrical power for many critical processes. Should an emergency backup generator malfunction during a loss of utility power event, flow to the facility would need to be stopped immediately. Spokane County Utilities will be notified and requested to cut power to the SVI pump station and the NVI pump station. Flow will be diverted to the Riverside Park Water Reclamation Facility (RPWRF). Operators will notify personnel at the RPWRF of the situation and continue to inform them of the generator repair status and/or utility power status. Operators will then work continuously to troubleshoot and repair the malfunctioned emergency backup generator.

Pre-Fire Notification Plan

Prepared for
Spokane County

1004 N Freya Street
Spokane, WA 99202

October 2016



1004 N Freya Street
Spokane, WA 99202

Contents

Abbreviations	3
1.0 Introduction	4
2.0 Installed equipment	4
3.0 Fire Water.....	4
4.0 Inspections and system verification.....	5
5.0 Workplace fire hazards	5
6.0 Responsibilities.....	5
7.0 Training.....	6
8.0 Impairment Management for Fire Protection System Components	7

Abbreviations

ABC	Type of fire extinguisher rated for multiple fuel sources
Company	CH2M HILL
County	Spokane County
Facility	Spokane County Regional Water Reclamation Facility
MGD	Million Gallons per Day
NFPA	National Fire Protection Association
PSTL	Project Safety Team Lead
SCRWRF	Spokane County Regional Water Reclamation Facility
SCADA	Supervisory Control and Data Acquisition
Service Contract	<i>Service Contract for the Design, Construction and Operation of the Spokane County Regional Water Reclamation Facility between County of Spokane, Washington and CH2M HILL Engineers, Inc. Dated January 13, 2009</i>

1.0 Introduction

This plan will outline the various systems installed at the Spokane County Regional Water Reclamation Facility (RWRF) in regards to fire notification. It will also include an overview of the potential hazards on site, personnel responsibilities, and training.

2.0 Installed equipment

A zoned, Facility-wide, fire detection and alarm system with audible as well as visual alarm signals is installed. The system is designed to City of Spokane, NFPA, and Factory Mutual requirements.

The system includes:

- Smoke detectors
- Duct smoke detectors
- Manual pull stations
- Sprinkler flow and valve tamper switches
- Visual and Audible alarms
- ABC type fire extinguishers
- Halotron type fire extinguishers for sensitive electrical equipment
- Simplex model 4010 Fire Alarm Control Panel

The headworks pump room air flow fail alarms are separately zoned on the alarms panel.

The fire system will alarm internally through SCADA and send an external signal to an alarm monitoring company approved by the City of Spokane Fire Department.

3.0 Fire Water

A fire water system sized to meet the needs of the current 8 MGD Facility, with provisions for the future 24 MGD expansion and designed based on the materials and design of the Facility structures and meeting the requirements of the City of Spokane Fire Department has been provided. This system is separate from the other water supply systems and is fed directly from water mains around the site.

Facility access for fire-fighting equipment and the number and location of fire hydrants comply with the requirements of the City of Spokane Fire Department.

4.0 Inspections and system verification

Monthly walkthrough fire system inspections will be performed by CH2M Facility operators. This will include a monthly maintenance inspection of all portable fire extinguishers will be conducted.

A thorough annual inspection will be performed by an outside contractor. This will include pulling the fire alarms, tripping the smoke detectors, inspecting sprinkler flow and valve tamper switches, inspection and re-tagging of all fire extinguishers, and inspecting all visual and audible alarms. Any device or system found non-functional will be repaired or replaced.

5.0 Workplace fire hazards

A workplace fire hazard can be defined as any situation, process, material or condition that has the potential to cause a fire or explosion or provide a ready fuel supply to augment the spread or intensity of a fire or explosion and that poses a threat to life or property.

Workplace fire hazards will be kept to a minimum utilizing best management practices, for example waste oils are stored in a metal container and disposed of frequently, oily rags are stored in a fireproof container and emptied before container reaches half full, and waste paper and/or corrugated boxes are picked up for disposal before a large accumulation can occur.

Fuel will be stored in three locations at the Facility, they are: the 1500kW generator with an approximate diesel storage capacity of 2950 gallons, the 300kW generator with an approximate diesel storage capacity of 300 gallons, and the maintenance Facility where small quantities of fuel will be stored in approved metal containers inside a flammable liquid cabinet. This fuel can be a significant fire hazard and is strictly controlled. Spilled fuel will be responded to immediately, see the *SCRWRF Spill Prevention, Control, and Countermeasures Plan*.

6.0 Responsibilities

The CH2M Project Safety Team Leader (PSTL) is responsible for facilitating the following activities:

- Read and review the *SCRWRF Emergency Response Plan* paying particular attention to the section referring to fire and explosion response.
- Distribute procedures for reporting a fire, the location of fire exits, and evacuation routes to each employee.
- Conduct drills to acquaint employees with fire procedures and to judge the plan's effectiveness.

- Satisfy all local fire codes and regulations.
- Train employees in the use of fire extinguishers and the application of basic medical first-aid techniques.
- Keep key management personnel home telephone numbers in a safe place in the control rooms of each Facility for immediate use in the event of a fire. Distribute a copy of the list to key persons to be retained in their homes for use in communicating a fire during non-working hours.
- Decide to remain in or evacuate the workplace in the event of a fire.

If an evacuation of the Facility is deemed necessary, the PSTL or his designated alternate is responsible for:

- Ensuring that all employees are notified of the evacuation order.
- A head count is taken to confirm total evacuation of all employees.

7.0 Training

At the time of a fire, employees should know what type of evacuation is necessary and what their role is in carrying out the plan. In cases where the fire is large, total and immediate evacuation of all employees is necessary. In smaller fires, a partial evacuation of nonessential employees with a delayed evacuation of others may be necessary for continued plant operation. We must be sure that employees know what is expected of them during a fire to assure their safety.

Training, conducted on initial assignment, includes:

- What to do if employee discovers a fire
- Demonstration of alarm, if more than one type exists
- How to recognize fire exits
- Evacuation routes
- Assisting employees with disabilities
- Measures to contain fire (e.g., closing doors, windows, etc. in immediate vicinity)
- Head count procedures (see *SCRWRF Emergency Response* for details)
- Return to building only after the "all-clear" signal

Additional information can be found in the corporate safety manual.

The Project Safety Team Leader ensures in writing that the employee has received and understands the fire prevention plan training.

The PSTL provides training for each employee who is required to use fire prevention equipment. Employees shall not use fire prevention equipment without appropriate training. Training includes:

- Types of fires

- Types of fire prevention equipment
- Location of fire prevention equipment
- How to use fire prevention equipment
- Limitations of fire prevention equipment
- Proper care and maintenance of assigned fire prevention equipment
- Annual training with fire extinguishers

Employees must demonstrate an understanding of the training and the ability to use the equipment properly before they are allowed to perform work requiring the use of the equipment.

8.0 Impairment Management for Fire Protection System Components

If a fire protection system component is impaired for more than 10 hours the following steps will be followed:

- The fire system component will be tagged “out of service” using CH2M’s lock out tag out program.
- CH2M’s maintenance supervisor will notify the County’s insurance provider. Current insurance provider is FM global and contact is to FM Global's San Francisco office via phone (888.247.9062), fax (800.736.5564) or online at <https://redetag.fmglobal.com>.
- When the fire system component is placed back in service the tag will be removed and the County’s insurance provider will be notified using the contact information above.

Notifications apply specifically but are not restricted to the yard fire hydrants, the backflow system that serves the hydrant main, and the fire monitoring control panels. If short duration tests of components are completed under CH2M observation and the components are restored to service immediately no notification is required.

Process Control Management Plan, Spokane County RWRf

1. Purpose

CH2M HILL will implement a treatment process control management plan that will describe process control activities and compliance monitoring and establish goals for efficient facility operation. The plan will identify persons and their responsibilities for the process control management, analysis, QA/QC, reporting, communication and other tasks.

2. Topics Addressed in Process Control Management Plan

The plan will address the following topics:

1. Process control strategies
2. Process control procedures and the following standard operating procedures (SOP)
3. Security plan
4. Spill control and response plan
5. Response to loss of power
6. Pre-fire notification plan
7. Company-wide and site specific safety plan
8. High flow management plan
9. Laboratory quality assurance plan and laboratory manual
10. Chemicals management plan
11. Process control software
12. Operator and management responsibilities
13. Communications
14. Records and reports
15. Plan updates and reviews
16. Supplements for capital modifications

3. Description of Process Control Management Plan

The plan shall identify persons and their responsibilities for process control management, analysis, QA/QC, reporting, communication and other tasks. The plan shall describe training, including process training, vital to achieve a high level of treatment performance. The plan shall describe the type and frequency of process monitoring reports. The plan shall describe laboratory management and procedures such as sample gathering, handling, analysis, and data reporting onsite. The plan shall describe the communication protocols that shall be used to communicate process control information to appropriate staff, including the use of weekly or more frequent meetings, distribution of reports, posting of directives and use of a daily log book. The

communication protocols shall also address communication with the County on the operation of the pump stations that provide the Facility influent.

4. Process Control Strategies

Process control is based on two basic principles:

4.1. Achieve compliance with the NPDES permit

The NPDES permit is the basis for minimum pollutant removal standards. Process control will be based around seasonal and annual permit limits and all related procedures will incorporate these limits.

4.2. Maximize Pollutant Removal and Minimize Resource Consumption

To the degree that it is feasible additional pollutant removal may be achieved by optimizing plant physical, chemical, and biological processes without adding significant costs. Removals beyond the limits set in the NPDES Permit are considered as added benefit to the receiving stream. Process control procedures will incorporate optimization measures where applicable.

5. Process control procedures and standard operating procedures (SOP)

The overlying process control procedure will be dictated by the Unit Process Control Procedures. For each process unit in the Facility these documents contain a process overview, unit physical information, operational parameters and theory, process monitoring and responsibilities, control parameters, calculations and record keeping, targets and process performance, relationship to other unit processes, common problems and troubleshooting, and alternate modes of operation.

Specific standard operating procedures will be developed to implement the actions described in the unit process control procedures. They will include placing units online/offline, adjusting control parameter, sampling, monitoring, and alternative modes of operation.

6. Security plan

A site specific security plan is in place for protecting the site from unlawful intrusion. As related to Facility operations it is important that in the event of a security breach, theft of or damage to equipment is prevented or minimized. See the *Spokane County RWRP Security Plan* for further details.

7. Spill control and response plan

CH2M HILL will operate the Facility in such a manner that Influent, Effluent, or Residuals will not contaminate, or be bypassed, released, leaked, or spilled on or into, the environment, other than as permitted by Applicable Law and the other Contract Standards. This plan serves as guidance, in case of spills from uncontrollable

circumstances, to aid in the prevention and assists with the cleanup of spilled materials of concern at the Facility including but not limited to: Ferric Chloride, Sodium Hydroxide, Sodium Hypochlorite, Sodium Bisulfite, Citric Acid, Polymer, Raw Wastewater, Waste sludge, and petroleum products. Petroleum products can include gasoline, diesel, motor oils and lube oil. See the *Spokane County RWRF Spill Prevention, Control, and Countermeasures Plan* for further details.

8. Response to loss of power

A majority of the processes throughout the Facility relies on the use of electrical power to function correctly. In the event of power loss to the Facility backup generators will provide the power needed to prevent any event of non-compliance until power can be restored. Notification of the power company, Avista Utilities, will be immediate and notification to the County will be made in the case of an extended power loss. Procedures for preventing noncompliance in the event of an extended power loss will be detailed in the *Spokane County RWRF Emergency Response Plan* and also in the *Spokane County RWRF Power Loss Response Plan*.

9. Pre-fire notification plan

Fire prevention, control, and notification procedures are detailed in the *Spokane County RWRF Emergency Response Plan* and also in the *Spokane County Pre-Fire Notification Plan*. A fire in the facility can threaten the integrity of process control measures and equipment. After any fire has been safely extinguished the process related equipment will be evaluated for damage and if needed alternative modes of operation will be deployed to prevent noncompliance.

10. Company-wide and site specific safety plan

CH2M HILL associates are entitled to a safe and healthful work environment. It is CH2M HILL's intent to provide this environment, and in the process, comply with the laws, rules, and regulations of federal, state, and local governments regarding safe practices, and to prevent any injuries or property damage. The programs and procedures set forth by the CH2M HILL HILL Safety program are contained in the company wide *Safety Manual*. The *Safety Manual* will be both in bound book form and electronic form available on all Facility computers and will be available for reference to all Facility personnel.

11. High flow management plan

A High Flow Management Plan outlines the procedures involved at different points of the Facility during a high flow event. The plan includes online instrumentation, automated controls monitoring, and the development and implementation of a standard operating procedure. It also includes communication protocols with the Spokane County Utilities Department. The plan will reduce the risk of loss of containment events and improve effluent compliance. This is detailed in the *Spokane County RWRF High Flow Management Plan*.

12. Laboratory quality assurance plan and laboratory manual

Quality control (QC) and quality assurance (QA) programs are extremely important for all levels of laboratory operations. All results must be valid, representative, comparable, and of known precision and accuracy to be of value. A well-established and well-documented QA program is necessary to meet the requirements of the United States Environmental Protection Agency (US EPA) and the state wastewater regulations. A QA program also provides reliable, legally defensible results to make decisions which protect and enhance the environment. Details will be set forth in the *Spokane County RWRF Laboratory QA/QC Plan*.

The laboratory manual will be specific to the Spokane County RWRF Laboratory and in both bound book form and electronic form. Copies will be available in the laboratory as well as on computers located in laboratory. It will be available to Operators as a reference for all laboratory processes and procedures performed at the Spokane County RWRF.

13. Chemicals management plan

Most chemical feed and storage facilities will be located in and adjacent to the Membrane Facility, providing one location for bulk chemical delivery and storage. This will contain Ferric Chloride for chemical Phosphorous removal, Sodium Hypochlorite for disinfection and membrane cleaning, Citric Acid for membrane cleaning, Sodium Hydroxide for pH control, and Sodium Bisulfite for de-chlorination. Storage tanks will be located outside the facility with accommodations made to protect these from varying weather conditions. Polymer will be housed in the Headworks Building and the Solids Facility as its use will be confined to these areas. More detailed descriptions can be found in the *Spokane County RWRF Chemical Management Plan*.

14. Process Control Software

CH2M HILL will furnish, install, configure, and implement Allmax's Op10 software package for logging, reporting, and analyzing process data. The system will be used to promote process stability by managing the data and monitoring daily operations of the facility for routine facility process control.

Data will be collected by the Allen Bradley SCADA control software and imported into OP10 on a regular basis as needed. Additional data will be stored in Historian for a defined period of time to reference previous plant conditions.

15. Operator and management responsibilities

Job descriptions and responsibilities for each staff member are listed in the *Spokane County RWRF Administration and Staffing Plan*. These offer a brief overview of the responsibilities for each staff position. The staff is not limited to the type of responsibilities that are assigned and are expected to be cross-trained in all aspects of facility operation.

16. Communications

The communications plan will describe protocols that will be used to communicate process control information to appropriate staff, including the use of weekly or more frequent meetings, distribution of reports, posting of directives, and use of a daily logbook. The protocols will address communication with Spokane County, Washington State Department of Ecology, State and Federal Agencies, and other organizations. This is further detailed in the *Spokane County RWRP Communications Plan*.

17. Records and reports

Records are an integral part of the quality assurance program. They provide documented evidence that the program is functioning. Also, they provide the necessary information for performance evaluation and quality assurance audits.

Rules for record retention regarding compliance are specified in the NPDES discharge permit. Guidelines will be established and followed according to the specific rules of the permit and service contract requirements and more detailed schedules are located in the *Spokane County RWRP Communications Plan*.

CH2M HILL will prepare and submit all regulatory reports by the required deadlines, send copies of all reports to Spokane County, maintain records as required by the appropriate agency, and make these records accessible to Spokane County upon request. The county agrees to sign such reports in a timely manner.

18. Plan Updates and Reviews

CH2M HILL will keep the Process Control Management Plan current and will supply Spokane County with appropriate updates, supplements, or revisions annually or at an earlier time when material changes to the plan are made, to be reviewed and commented on.

19. Supplements for Capital Modifications

CH2M HILL will prepare supplements and revisions to the plan which are required due to the design, construction and installations of all capital modifications. Such supplements and revisions to the plan will be provided, reviewed, and approved by Spokane County in the same manner as the initial Process Control Management Plan.

Laboratory QA/QC Plan

Quality Assurance Policy Statement

Quality control (QC) and quality assurance (QA) programs are extremely important for all levels of laboratory operations. All results must be valid, representative, comparable, and of known precision and accuracy to be of value. A well-established and well-documented QA program is necessary to meet the requirements of the United States Environmental Protection Agency (US EPA) and Washington State Department of Ecology (DOE). A QA program also provides reliable, legally defensible results to make decisions which protect and enhance the environment.

QC is a set of measures within a sample analysis batch to ensure the process is in control. Each laboratory must apply QC parameters to ensure the quality and reproducibility of the laboratory results. These parameters consist of precision and accuracy testing coupled with a visual display of results as a final assurance that the analysis is in control.

The purpose of the QA program is to verify the quality of the data produced in the laboratory. The QA program safeguards against errors in data. All analytical compliance testing must be set up and performed according to US EPA and/or DOE-approved methodology. This includes use of proper instrumentation and calibration techniques, equipment maintenance, reagent mixing, and clear documentation of each. Once the testing procedure is properly established, the procedures for analysis are followed step-by-step until the results are obtained. After data acquisition is complete, determination of statistical control is confirmed.

QA is the sum of activities that document and maintain the standard and quality of monitoring data. QA assures only proven analytical methods are used, instruments are properly calibrated and maintained, uniform sampling and laboratory procedures are established and followed, and performance is documented and audited. QA involves every aspect of the laboratory operation and requires the commitment of the entire laboratory staff. QC procedures are a component of the QA Plan.

Through the tracking of precision and accuracy testing and control charts, Spokane County RWRf demonstrates that sampling and testing systems are performing at the acceptable quality levels. Control charts and graphs are generated based on control limits to visually indicate whether the data are acceptable or unacceptable. The control limits determine whether laboratory data is of the accepted level of quality and if testing can continue or should be stop. In order to evaluate the data, laboratory standards' values must be compared to their true values or to historical data. Accuracy and precision testing accomplish this.

Quality control samples are run with the daily samples (batches) to help evaluate the analytical quality through data comparison. If the comparison indicates that the data are questionable or unacceptable, the testing must stop and corrective action must be initiated. Special precautions must be taken, not only to correct the problem, but also to determine why the problem occurred.

Included within this CH2M- Spokane County Laboratory Plan is a sampling method and protocol for possible sampling events on- or off-site.

A satisfactory QC program consists of the following three factors:

- Perform analyses according to established acceptable methods;
- Routinely analyze unknown and control samples;
- Confirm the ability of a laboratory to produce acceptable results by requiring periodic analysis of blind audit samples.

The QA program concentrates on the individual analyst and his/her daily controls; therefore, each analyst is responsible for QC. The analyst is responsible for the quality of the physical, chemical, or biological measurement, as well as data handling, reporting, and control charting of that data. Laboratory personnel are responsible for identification and investigation of any problems that arise. QC criteria for given procedures are established utilizing control charting limits. Proper training shall allow new personnel to perform procedures according to established standards. Control limits are calculated using historical data.

Objectives

The objectives of the QA/QC Plan are as follows:

- Produce reliable data for making decisions concerning the public safety and the environment, as well as generating defensible data in regulatory matters.
- Produce documentation that fully complies with state and federal regulations.
- Identify areas of concern related to analytical methods and results. Correct problems prior to reporting data.
- Determine the degree of accuracy and precision of each analytical parameter.

Project Manager

The Project Manager will review all quality assurance data with the Laboratory Director on a monthly basis and review and sign monthly QA/QC reports. At smaller

projects where there is no Laboratory Director, the Project Manager will assume his/her responsibilities.

Laboratory Director

The Laboratory Director (or the Project Manager) has the following quality assurance responsibilities:

- Administer the CH2M intra-laboratory quality control plans as routine in-house activity to ensure the integrity and validity of analytical data.
- Assure that new personnel are trained in quality control procedures.
- Review data prior to reporting.
- Determine the precision and accuracy of analytical results based on the quality control information provided by the individual analyst.
- Review the permanent record of instrument and analyst performance as a basis for evaluating data.
- Meet with the analyst and evaluate/discuss parameter specific analytical results and associated quality control criteria.
- Take appropriate corrective action when an analysis is out of control or a discrepancy is noted.
- Maintain and provide, upon request, quality control charts and graphs.

Laboratory Technician/Analyst

The Laboratory Technician/Analyst has the following responsibilities:

- Conduct analysis according to the specified methodology.
- Conduct the required amount of quality control tests.
- Verify results to ensure the analytical process is in control.
- Investigate, identify, and correct causes of errors; take immediate corrective action when the process is outside normal operating parameters.

Quality Assurance Objectives

There are several objectives of the QA/QC program.

The first objective is to produce data that meets CH2M's objective of reporting true and accurate analytical values. This begins by making sure that all methods comply with US EPA and DOE regulations.

The second objective is to ensure all data is accurate and reproducible. Data is generally shown to exhibit these characteristics if they fall within a statistical range that follows a normal bell curve. The curve must be centered upon the true value. The curve also must exhibit a standard deviation that is within the upper and lower limits of each specific test. New data must be shown to be within the curve with a confidence level that assures that they belong in the curve and is not representative of a different data set.

Additionally, the QA/QC program assures that the quantitative methods used are appropriate and applied in a manner, which allows a detection level that is both high and low enough to demonstrate compliance with all regulatory requirements. This means that all analysts must be able to show that a given sample either does or does not meet regulatory compliance. The determination of site specific minimum detection levels (MDLs), comparison to industry standards, and comparison of test capabilities to regulatory limits demonstrate conformance to this policy.

Only approved methods shall be used for compliance reporting in CH2M laboratories. Control data based on historical statistical analysis of each reportable parameter shall be constructed and compared against previous performance to assure that data are reproducible. Standard deviations of these curves must be compared to capability indexes when available to assure that the laboratory meets minimum standards. MDLs must be determined and compared against industry standards.

Sampling and preservation procedures outlined in the Federal Register 40 CFR Part 136 July 1, 2001 (or latest edition) Table II are used to ensure that all results are representative of the sample media. Analytical procedures listed in the reference methods are used so that all data is calculated and reported in units consistent with approved practice and other external organizations.

Precision and accuracy control limits are based on historical data from method validation studies using replicates, spikes, QC samples. All precision and accuracy data generated from parameters that are routinely analyzed are based on historical data within the laboratory.

Security Plan

The Spokane County RWRf has a Security Plan (SP) that includes written policies, security planning, and response to potential problems that may threaten the security of the Facility. Spokane County is responsible for security planning for the wastewater pumping stations; Spokane Valley Interceptor Pump Station (SVIPS) and North Valley Interceptor Pump Station (NVIPS), and the wastewater conveyance and collection system.

The SP interfaces with the Emergency Response Plan (ERP), both plans working together to respond to emergencies and to take recovery actions to prevent adverse consequences. The SP describes the roles and responsibilities for providing security at the Facility. Security responsibilities are assigned to the Security Response Lead (John Keady); Alternate Security Response Lead (Adam McClymont); Project Safety Team Lead (Neil De Jonge), who is the Point of Contact (POC) for the Security Plan; Supervisors, and remaining Facility personnel. A Security Committee (SC) is designated and it will be responsible for security and emergency preparedness matters, ranging from comments on the management of the SP to liaison with public agencies and feedback from employees. It will be an ongoing part of the SC agenda to determine the level of compliance with company policies, rules, regulations, standards, codes, procedures, and to identify changes or new challenges as a result of incidents or other operating experience.

The SP describes pre-planning and security preparedness, which includes a Facility design that has a security alarm system for each building, cameras, perimeter fencing with controlled gates and exterior access doors with magnetic card readers. In addition, the SP describes personnel security response training, participation and coordination with local law enforcement and emergency responders including the County Emergency Response Coordination Center, regular meetings to evaluate security/emergency procedures and effectiveness, and security inspections of the Facility. An emergency contact directory is provided in the SP and it will be kept up to-date.

The training program is a high priority exercise and it will include both CH2M HILL and County employees to make certain that all Facility employees are familiar with security response. In addition a mock system shutdown or a mock local security incident will be scheduled to monitor company and employee preparedness and to determine areas for improvement. Local emergency responders (local, state and federal law enforcement, fire services, emergency medical services, and emergency planning agencies) will be invited to participate in one of these exercises. A review of all security incidents will be conducted on an annual basis to identify improvements to training and exercising. Any improvements identified will be incorporated into future employee training and exercising. If during internal or external evaluations, or based upon SC findings and activities, CH2M HILL will revise the SP and supporting documentation and training to reflect new practices, policies and procedures. The SC is responsible for screening changes and modifications to facilitate ongoing revisions to keep the SP current.

Emergency response and security response are inter-related and function together for Facility safety and protection of the Facility and its employees. Emergency response procedures are found in the ERP and include:

- Emergency evacuation/shelter procedures and routes
- Emergency shutdown procedures
- Employee accountability procedures following an emergency evacuation
- Emergency response, rescue and medical duties
- Assistance to emergency responders

Employee and operational procedures for specific security emergencies are also described in the ERP including the following hazards:

- Fires
- Hazardous Materials Release or Spill
- Natural Disasters including:
 - Earthquakes
 - Tornadoes
 - Severe Weather (wind, ice, lightning storms, floods)
- Telephone Outage
- Terrorist Activities
- By-pass or Facility Upset
 - Power Outage
 - Foaming
 - Hydraulic Overload
 - Organic Shock Loads
 - Anaerobic Digester
 - Loss of City Water
- Release of Contaminants Exceeding Permitted Levels

The hazards listed above could result in potential undesirable consequences to the Facility. The SP addresses what pre-planning and recovery actions should be done to lessen or prevent the following consequences:

- Disruption of wastewater treatment
- Contamination including chemical, radiological and biological

- Damage to infrastructure
- Environmental impacts
- Loss of revenue or other serious economic disruption in the community, or loss of essential supplies either because contracts are voided or supplies cannot get to the Facility
- Denied or limited access to utility facilities and infrastructure, e.g., if facilities are unsafe or unreachable
- Loss of employees/contractors; e.g., if employees or contractors cannot come to work because roads are impassable or they are too sick, or they are taking care of their family
- Loss of SCADA systems
- Loss of public confidence

In summary, the ERP describes emergency response actions and the SP describes pre-planning and recovery actions for “All Hazards”, and also for specifically described hazards to lessen or prevent undesirable consequential outcomes caused by emergency incidents or security related events.

Septage Receiving Plan

Overview

Spokane County Regional Water Reclamation Facility (RWRF) will receive septage from local septage haulers at a rate of not more than 24,000 gallons a day from persons or businesses specifically designated by the County. The septage will be transferred from the septage receiving tank to the influent channel prior to screening via two septage pumps located in the Headworks. Haulers will apply for permission to discharge at Spokane County RWRF through Spokane County, and CH2M HILL Facility operators will oversee septage receiving operations and enforce Spokane County regulations. Septage receiving hours will be Monday through Friday, 7:00 AM to 4:00 PM. Every load will be sampled and monitored for acceptable conditions.

Regulations for Septage Dumping

Materials removed from onsite wastewater facilities (i.e. septic tanks, cesspools, sewage holding tanks, and other approved by Spokane County) may discharge into the Spokane County RWRF at a charge rate established by Spokane County.

“Acceptable Septage” means Septage that 1) does not contain grease trap material, 2) has a pH not lower than 5 and not higher than 8.5, 3) does not contain Toxic Substances or a Hazardous Material, and 4) is transported into the Facility by Authorized septic tank haulers pre-registered by the Company and the County. This discharge is subject to the following regulations:

1. Companies or individuals must register all equipment used to transport septage material to the facility. The equipment must be inspected and approved for hauling the materials and capacity of each tank unit noted on the hauler’s permit.
 - a. Charges will be determined by tank capacity.
 - b. Any transport unit that deteriorates after inspection will be denied dumping privileges until it has been repaired and inspected again.
 - c. Truck inspection may be required annually. Any new or replacement unit must be inspected.
 - d. Your permit may be revoked, including dumping permits for all of your company’s units for using improper equipment resulting in spillage, breakage, or other hazards.
2. Septage haulers must input all required information into the computer prior to dumping load. Once the information is inputted and accepted by the system, haulers may commence unloading. Any false information inputted into the

system will be considered falsification of documents and will result in that company's permit being revoked. Required information will include the following:

- a. Company Name
 - b. Unit Number
 - c. Source of material including type of waste (septic tank, cesspool, portable toilets, etc.), name of owner, and address.
3. Any person or company unloading without following the proper procedure shall have their permit revoked. Reinstatement will require approval from Spokane County.
 4. Unloading devices and other mechanical devices shall be furnished at the expense of the hauler.
 - a. If the connection is broken, haulers will report this to the Operations Facility Immediately
 - b. Unloading or dumping of septage by any method other than direct connection to the facilities provided is strictly prohibited. The drain in the septage receiving bay and the septage pump tank are not considered "direct Connection". Dumping permits may be revoked, including dumping permits for all of the company's units, for unloading or dumping of septage by any method other than direct connection.
 5. All non-domestic loads shall be analyzed and approved before hauling to the facility. Domestic loads are from activities typical of a household, such as bathrooms and kitchens. Non-domestic loads are from commercial and industrial processes that would have non standard strength wastewater, such as automotive activities, grease traps, and other industrial activities.
 6. Random sampling is performed periodically. Laboratory personnel may at any time require a septage truck driver to extract a sample beyond the sample already taken on every truck for further analysis.
 7. Records of the actual source of all materials shall be maintained by the permitted users of this service. Records shall include as a minimum, the address and type of material. These records shall be provided to Spokane County upon request.
 8. A copy of the current Pumper Permit issued by the Spokane Regional Health District, or other Health Department, shall be carried on each tanker truck.
 9. Materials shall not be unloaded at the Spokane County RWRF that are specifically prohibited, such as designated Dangerous Waste by Washington Administrative Code (WAC 173-303), or other substances specified in Spokane Municipal Code (SMC 13.03.0404 and SMC 13.03.0406). This material shall be taken to a suitable facility as required.

10. The septage receiving facility shall be kept clean. Each driver shall be responsible for leaving the area clean of any material resulting from dumping.
 - a. Hoses must be put in their proper place. If the connection hose is broken, report this to the Operations Facility.
 - b. No dumping tools or hoses may be stored on this site.
 - c. No cleaning sand or other debris from the tanker trucks. This material shall be taken to a suitable site as required.

Septage Unloading Procedure

Septage trucks will enter the Facility by entering in an assigned passcode at the Julia Corridor gate. Once inside the fence line they will pull around the Headworks building and into the Septage receiving bay from the West side. The haulers will input all required information into the computer located inside the septage receiving bay prior to discharge of material. Once the computer has accepted the information, the receiving bay door will close, the Facility receiving valve will automatically open, and a connection can be established between the truck and the Facility using a four inch cam lock hose furnished by the hauler. The inline pH probe will monitor the septage transferred. Should the pH probe detect septage outside of the acceptable range, the Facility valve will automatically close and SCADA will alarm to Operators who will respond immediately. Operators will then determine whether to allow the remainder of the load to be discharged or rejected (see septage rejection procedure). If the septage falls within the acceptable range of pH the hauler will extract a sample into a Facility provided sampling container and discharge the remainder of his load.

Once the Septage hauling truck is empty, haulers will be responsible for disconnecting their hose from the facility and washing down the septage receiving bay. This will be done to preserve sanitary conditions and minimize odors. Hoses and plant water will be provided by the Facility. Once this is complete, haulers will verify that they have fulfilled their responsibility by re-entering their hauler identification code into the computer. Upon re-entry of the code, the exit door will open and the truck can leave the Facility.

SCADA will log all information inputted into the computer by the septage hauler and organize it in a manner acceptable to the County. This will be referred to as the Septage Delivery Log. The Septage Delivery Log will be organized by date, time, septage hauler identification, septage source, and volume discharged. This information will be transmitted monthly to the Spokane County Utilities Billing Department in order for them to bill the individual septage hauling companies for materials discharged into the Facility.

Septage Sampling and Analysis Procedure

CH2M HILL will furnish clean sample bottles with labels that will be used to sample every septage truck at the time of unloading. The sample bottles will be labeled with the delivery date, time, septage hauler identification, septage source (owner, address), and amount of septage discharged. The sample shall be collected at the beginning of the unloading of septage.

CH2M HILL will exercise Prudent Industry Standards with regard to determining whether the septage is acceptable, including: 1) Visual observation of the septage for unusual color or excessive amounts of grit, sand, oil or grease, 2) septage odor for excessive amounts of solvents, hydrocarbons, or other unusual odors, and 3) test the pH of each sample collected.

CH2M HILL will preserve all septage samples under refrigeration at 4°C for one week. If after one week there is no indication of a Facility impact potentially related to septage, CH2M HILL will dispose of the sample into the influent. If Facility impacts are related to septage, CH2M HILL will analyze the septage samples for potentially toxic or other deleterious substances. CH2M HILL will immediately notify the County of any Septage hauler failing toxicity testing.

Septage Rejection Procedure

There are several instances that could result in a septage load being rejected. They could be the result of visual observation of the septage, unusual odors, pH outside of the acceptable range, failure to follow established procedures, unpaid bills, sample analyses, or other mitigating circumstances. If a load is rejected the County will be notified with the haulers identification and the reason for rejection. Riverside Park Water Reclamation Facility will also be notified of the rejection in order to prevent the delivery of an unfit load to their facility. When a load is rejected, the hauler will be expected to dispose of the load in a manner appropriate to the materials being hauled. Haulers may be required to re-apply for their permit if the reason for rejection is severe enough to reject their existing permit.

Septic Hauler Permitting Procedure

The following actions must be completed in order to discharge Septage at the Spokane County Regional Water Reclamation Facility.

1. Complete information requested on the Septage Hauler Permit Application Form, available from the Operations Facility at Spokane County RWRF.
Address: Spokane County Regional Water Reclamation Facility
1004 N. Freya St.
Spokane, WA 99202

Phone: (509) 536-3700
FAX: (509) 536-3720

2. Acquire an account with Spokane County Utilities Billing.

Address: Spokane County Utilities Billing
1026 West Broadway Ave.
Public Works Building 4th Floor
Spokane, WA 99260
Phone: (509)477-3604
FAX: (509)477-4715

3. Apply for a City Business License if conducting business within the City of Spokane.

Address: City of Spokane
Taxes and Licenses Department
808 West Spokane Falls Blvd.
Spokane, WA 99201
Phone: (509)625-6070

4. Apply for County Pumper Permit if pumping septic sludge within Spokane County.

Address: Spokane Regional Health District
Environmental Health Division
1101 West College Ave.
Spokane, WA 99201
Phone: (509)324-1560

5. Arrange tanker truck inspection at the Spokane County RWRF (see address above) and bring the truck inspection form. This is necessary to confirm that the vehicle is in safe condition, is compatible with the Spokane County RWRF septage discharge system, and to measure the volume of the tank. Haulers will be billed for the full volume, no credit for partial loads.

6. Read, understand, and follow all rules and regulations regarding septage discharge at the Spokane County RWRF.

Spill Prevention, Control, and Countermeasures Plan

Prepared for
Spokane County

1004 N Freya Street
Spokane, WA 99202

June 2011, Revised December 18, 2012, April 5, 2017



1004 North Freya Street
Spokane, WA 99202

Oil Spill Prevention, Control, and Countermeasure Plan Certification

Management Responsibility

CH2M is responsible for the management of the Spokane County Regional Water Reclamation Facility (SCRWRF). As required by 40 CFR 112.7, the management of the SCRWRF is committed to preventing discharges of oil to navigable waters and the environment, and to maintaining the highest standards for spill prevention, control, and countermeasures (SPCC) through the implementation and regular review and amendment of this SPCC Plan (Plan). This Plan has full approval of CH2M's management. CH2M has committed the necessary resources to implement the measures described in this Plan.

The Facility Manager is the designated person accountable for oil spill prevention at this Facility and has the authority to commit the necessary resources to implement this Plan.

I certify that I have reviewed and approve this Oil Spill Prevention, Control, and Countermeasure (SPCC) Plan. This is a self-certification because the SCRWRF has less than 10,000 gallons of oil onsite and has not had two (2) spills greater than 42 gallons within the last year (40CFR112.6).

Signed: _____

Facility Manager
CH2M

Dated: _____

Self-Certification

As required by 40 CFR 112.3(d), I hereby certify that:

- 1) I am familiar with the requirements of 40 CFR 112;
- 2) I have visited and examined the Spokane County Regional Water Reclamation Facility addressed in this SPCC Plan;
- 3) This Plan was prepared in accordance with accepted and sound industry practices and standards
- 4) Procedures for required inspections and testing have been established in accordance with industry inspection and testing standards or recommended practices;
- 5) I will fully implement the Plan
- 6) This Facility meets the following qualification criteria (under §112.3(g)(1):
 - a. The aggregate aboveground oil storage capacity of the Facility is 10,000 U.S. gallons or less; and
 - b. The Facility has had no single discharge as described in §112.1(b) exceeding 1,000 U.S. gallons and no two discharges as described in §112.1(b) each exceeding 42 U.S. gallons with any twelve month period in the three years prior to the SPCC Plan self certification date, or since becoming subject to 40 CFR Part 112 if the Facility has been in operation for less than three years (not including oil discharges as described in §112.1(b) that are the result of natural disasters, acts of war, or terrorism); and
 - c. There is no individual oil storage container at the Facility with an aboveground capacity greater than 5,000 U.S. gallons.
- 7) This Plan does not deviate from any requirement of 40 CFR Part 112 as allowed by §112.7(a)(2) (environmental equivalence) and §112.7(d) (impracticability of secondary containment) or include measures pursuant to §112.9(c)(6) for produced water containers and any associate discharge.
- 8) This Plan and individual(s) responsible for implementing this Plan have the full approval of management and I have committed the necessary resources to fully implement this Plan.

I also understand my other obligations relating to the storage of oil at this Facility, including, among others:

- 1) To report any oil discharge to navigable waters or adjoin shorelines to the appropriate authorities. Notification information is included in this Plan.

- 2) To review and amend this Plan whenever there is a material change at the Facility that affects the potential for an oil discharge, and at least once every five years. Review and amendments are recorded in an attached log
- 3) Optional use of a contingency plan. A contingency plan:
 - a. May be used in lieu of secondary containment for qualified oil-filled operational equipment, in accordance with the requirements under §112.7(k), and
 - b. Must include an established and documented inspection or monitoring program; must follow the provisions of 40CFR Part 109; and must include a written commitment of manpower, equipment and materials to expeditiously remove any quantity of oil discharged that might be harmful. If applicable, a copy of the contingency plan and any additional documentation will be attached to this Plan.

I certify that I have satisfied the requirement to prepare and implement a Plan under §Part 112.3 and all of the requirements under §112.6(a). I certify that the information contained in this Plan is true.

Signed: _____

Adam McClymont - Facility Manager

Dated: _____

Review due: December 2022

Table of Contents

Oil Spill Prevention, Control, and Countermeasure Plan Certification.....	ii
1.0 Regulations and Applicability (CFR 40, Part 112.1)	5
2.0 Overview	5
3.0 Definitions and Acronyms (Section 112.2).....	6
4.0 Location of SPCC Plan [Section112.3(e)]	8
5.0 Spill Notification & Reporting Procedures – 112.4.....	8
5.1 Spills Not Considered Reportable	8
5.2 Reportable Spills.....	8
5.3 CH2M Reporting.....	9
6.0 Amendments to SPCC Plan (Section 112.5)	12
6.1 Changes in Facility Configuration	12
7.0 Qualified Facilities Plan Requirements – 112.6	13
8.0 General Requirements [112.7(a)].....	13
9.0 Facility Description [112.7(a)(2)]	14
9.1 General Facility Description	14
9.2 Surface Water/Stormwater Drainage.....	15
10.0 Location and Contents of Oil/Critical Materials – 112.7(a)(3)	15
11.0 Critical Materials Storage/Containment.....	17
11.1 Oil and Oil Product Storage/Containment – 112.7(a)(3)(i)	17
11.2 Non-Oil and Non-Oil Product Storage/Containment	19
12.0 Discharge Prevention Measures – 112.7(a)(3)(ii) & (iii)	20
13.0 Spill Response Procedures – 112.7 (a) (3)(iv)	24
13.1 Non-Reportable Response	24
13.2 Reportable Response.....	24
14.0 Site Specific Situations.....	25
14.1 Leaking Concrete Tanks.....	25
14.2 Spilled Chemical at Delivery to Chemical Storage Area	25
14.3 Broken Chemical Feed Line.....	26
14.4 Loss of Containment, Headworks.....	26
14.5 Spilled Sludge or Septage, Truck Accident.....	27
14.6 Tote Spill.....	27
15.0 Methods of Disposal – 112.7(a)(3)(v)	28
16.0 Emergency Contacts – 112.7(a)(3)(vi)	28
17.0 Emergency Response Plan – 112.7(a)(4 and 5)	29
18.0 Oil Spill Potential – 112.7(b)	29
19.0 Containment and Diversion Structures and Oil Spill Contingency Plan and Staff – 112.7(c) and 112.7(d)	31
19.1 Containment and Diversionary Structures – 112.7(c)	31
19.2 Oil Spill Contingency Plan and Staff – 112.7(d)	33
20.0 Inspections, Tests and Records – 112.7(e).....	33
20.1 Inspections and Records.....	33
20.2 Integrity Testing of Oil Containers.....	34
21.0 Training and Discharge Prevention Procedures – 112.7(f) (1-3)	35
22.0 Security – 112.7(g)	35
23.0 Tank Car and Tank Truck Loading and Unloading – 112.7(h).....	36
24.0 State and Local Spill Prevention Rules - 112(j)	36
25.0 Qualified Oil-filled Operational Equipment 112(k)	37
26.0 SPCC Plan Requirements for Onshore Facilities – 112.8.....	37
26.1 General SPCC Plan requirements – 112.8(a).....	37
26.2 Facility Drainage – 112.8(b)	37
26.3 Bulk Storage Tanks – 112.8(c).....	37
26.4 Transfer Operations and In-Plant Processes – 112.8(d)	39

Annual Inspection Checklist for Oil Handling.....	Error! Bookmark not defined.
SPCC Training Record	6

Tables

6.1	Plan Review Log
8.1	General Facility Information
10.1	Chemicals and Hazardous Materials Storage Areas
11.1	Oil Container Locations, Capacity, Substance, Secondary Containment and Volume
11.2	Non-Oil Container Locations, Capacity, Critical Material, Secondary Containment and Volume
16.1	Federal and State Emergency and Spill Reporting Contacts
18.1	Potential Discharge Volumes and Direction of Flow
19.1	Secondary Containment Calculations
19.2	Descriptions of Spill Cleanup Kits

Figures

1.0	Site Map
2.0	Drainage Facilities and Flow
3.0	Locations of Oil and Critical Materials at Facility

Appendices

Appendix A – Figures
Appendix B – Substantial Harm Determination
Appendix C -- Forms

1.0 Regulations and Applicability

(CFR 40, Part 112.1)

This Spill Prevention, Control and Countermeasure (SPCC) Plan describes the storage and management of critical materials in accordance with City of Spokane Code, Section 17E.010, *Environmental Standards, Critical Aquifer Recharge Areas – Aquifer Protection*, and in accordance with Washington State Code (WAC), Chapter 173.303.145 *Dangerous Waste Regulations, Spills and Discharges into the Environment*. Because critical materials include petroleum materials, and the Spokane County Regional Water Reclamation Facility (SCRWRF or Facility) exceeds 1,320 gallons of oil, the Facility is also subject to Code of Federal Regulations (CFR) Title 40, Part 112, *U.S. Environmental Protection Agency (EPA) Oil Pollution Prevention Regulations*. This Plan describes the practices, procedures, structures, and equipment used at the Facility to prevent spills and to mitigate potential impacts on the environment.

2.0 Overview

CH2M will operate the Facility (See Appendix A for site maps) in such a manner to prevent the spill of influent, effluent or residuals, other than as permitted by Applicable Law and the other Contract Standards. This plan serves as guidance in case of spills from uncontrollable circumstances to aid in the prevention and assists with the cleanup of spilled materials of concern at the Facility including but not limited to: ferric chloride, sodium hydroxide, sodium hypochlorite, sodium bisulfite, citric acid, polymer, raw sewage, waste sludge and petroleum products. Petroleum products can include gasoline, diesel, motor oils and lube oil.

The Facility Manager is responsible for the response coordination of all spills, and he or designated alternate will delegate the assignment of Facility personnel and equipment to such tasks as may be necessary to effect prompt containment and cleanup of spilled material. Furthermore, the Facility Manager has determined that this Facility does not pose a risk of substantial harm under 40 CFR, Part 112, as recorded in the “Substantial Harm Determination” included in Appendix B.

3.0 Definitions and Acronyms (Section 112.2)

Aboveground Storage Tank (AST) – Any one (1) tank or connected combination of tanks that is used to contain an accumulation of liquid critical materials and the aggregate volume of which (including the volume of piping connected thereto) is more than sixty (60) gallons and the entire exterior surface area of the tank is above ground and is able to be fully visually inspected. Tanks located in vaults or buildings that are to be visually inspected are considered to be aboveground tanks [SMC 17A.020.010(B)].

Aquifer – A subterranean body of flowing water, also known as the Spokane-Rathdrum Aquifer that runs from Pend Oreille Lake to the Little Spokane River

Aquifer Sensitive Area (ASA) – That area or overlay zone from which runoff directly recharges the aquifer, including the surface over the aquifer itself and the hillside areas immediately adjacent to the aquifer (The area is shown in the map adopted as part of SMC17E.050.260).

Bulk Storage Container (Critical Materials) – A container of one hundred thousand (100,000) gals or more

Bulk Storage Container (Petroleum Materials) – A container of 55 gallons or greater used to store petroleum materials (same as a storage container for petroleum materials)

CMMS – Computerized Maintenance Management System

Critical Materials – A compound or substance, or class thereof, designated by the division director of public works and utilities which, by intentional or accidental release into the aquifer or ASA, could result in the impairment of one or more of the beneficial uses of aquifer water and/or impair aquifer water quality indicator levels. Beneficial uses include, but are not limited to: domestic and industrial water supply, agricultural irrigation, stock water, and fish propagation (Used herein, the designation is distinguished from state or other designation). A list of critical materials is contained in the City's Critical Materials Handbook, including any City modifications thereto [SMC 17A.020.010(AU)].

Ecology – Washington State Department of Ecology

EPA – Environmental Protection Agency

ERP – Emergency Response Plan

Facility – Spokane County Regional Water Reclamation Facility (SCRWRF)

LEL – Lower Explosive Limit

Oil – Any kind, or any form, including, but not limited to: fats, oils, or greases of animal, fish, or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits, or kernels; and other oils and greases; including petroleum, fuel oil, sludge, synthetic oils, mineral oils, oil refuse, or oil mixed with wastes other than dredged oil.

Oil-filled Operational Equipment - Equipment that includes an oil storage container (or multiple containers) in which the oil is present solely to support the function of the apparatus or the device (does not include oil-filled manufacturing equipment (flow-through process). Examples of oil-filled operational equipment include, but are not limited to hydraulic systems, lubricating systems (e.g., those for pumps, compressors and other rotating equipment, including pumpjack lubricating systems), gear boxes, machining coolant systems, heat transfer systems, transformers, circuit breakers, electrical switches, and other systems containing oil solely to enable the operation of the device.

Operations Plan - Spokane County Regional Water Reclamation Facility Operations Plan

P. E. - Professional Engineer

Facility Manager- The Facility Manager is the same as the owner/operator per CFR 40, 112.2 which states that an owner/operator is a person owning or operating an onshore Facility or an offshore Facility, and, in the case of an abandoned offshore Facility, the person who owned or operated or maintained the Facility immediately prior to such abandonment.

QA/QC - Quality Assurance/Quality Control

SCADA - Supervisory Control and Data Acquisition; computer systems that monitor and control industrial, infrastructure, or Facility-based processes

Secondary Containment - A means of spill or leak containment involving a second barrier or tank constructed outside of the primary container and capable of holding the contents of the primary container.

SMC - Spokane Municipal Code

Spill - Any incident that releases a contaminant in to the environment.

Spills - This response plan recognizes two kinds of spills: Minor and Major:

Minor - Minor spills are less than 1,000 gallons, non-hazardous, not oil, and completely contained within the plant.

Major - greater than 1,000 gallons, spilled to state waters, oil, or hazardous substances.

State Waters - State Waters include: Washington's marine waters, estuaries, rivers, lakes, streams, creeks, ponds, springs, wetlands, underground (ground) water sources, sewers, storm drains, beaches, ditches, and even snow banks.

Storage Container (Critical Materials) - A container of sixty (60) gallons or greater used to store critical materials.

Storage Container (Petroleum Materials) - A container of 55 gallons or greater used to store petroleum materials

TOF - Treatment Operations Facility

4.0 Location of SPCC Plan [Section 112.3(e)]

Complete copies of the SPCC Plan are maintained at the Facility's Treatment Operations Facility. This Plan is available for review by regulatory agencies during normal working hours. The Facility operates 24/7 but is generally only staffed during normal business hours, Monday-Friday. The Plan is also available at any time to Facility personnel and to Spokane County.

5.0 Spill Notification & Reporting Procedures – 112.4

CH2M shall notify the County promptly upon the occurrence of any unauthorized release, and shall be responsible for fulfilling all notification and reporting requirements established by Applicable Law related to any unauthorized release of influent, effluent, or residuals into the environment in connection with its operation and maintenance of the Facility. CH2M shall prepare an electronic letter to submit to the regulatory authority and shall provide a copy to the County.

The State of Washington Department of Ecology (Ecology) regulates the spill response and cleanup of hazardous materials. However, the US EPA has the right to exercise jurisdiction over all inland water spills and the US Coast Guard has the right to exercise jurisdiction over all navigable waters. The following is a brief summary of requirements for reporting spilled liquids.

5.1 Spills Not Considered Reportable

Spills that are less than 1,000 gallons, non-hazardous, not oil, and completely contained within the plant are not considered to be required to be reported to Ecology. A spill that is completely contained within the plant will fall on impermeable surface and be returned either by physical action or drainage back to the facility for treatment or disposal.

5.2 Reportable Spills

Reportable spills are greater than 1,000 gallons, spilled to state waters, oil, or hazardous substances. These types of spills have to be reported to Ecology within 24 hours via phone call. All such spills will be followed up within 5 days of discovery with a written letter to Ecology. Spills within the plant that contaminate soil or other permeable coverings that have the potential to contaminate the environment are reportable.

Secondly, dependent on the severity of the incident it may require activation of the *Spokane County Regional Water Reclamation Facility Emergency Response Plan (Emergency Response Plan)*.

For chemical spills that exceed the quantities below report immediately (within 15 minutes of discovery to the National Response Center at (800) 424-8802.

For any chemical spill report immediately to:

1. Washington Emergency Management Division: (800) 258-5990
2. WA Department of Ecology Eastern Regional Office: (509) 329-3400.

Name	Lbs	Gallons
Sulfuric Acid	1000	>65.44
Methanol	5000	>754.15
Sodium Hypochlorite	100	>9.91
Ferric Chloride	1000	>83.8
Sodium Hydroxide	1000	>93.6
Sodium Bisulfite	5000	>447.2
Citric Acid	NA	NA
Polymer	NA	NA

*NA = not applicable

The following contact numbers may be used in the case of non-chemical spills:

- 1.
2. City of Spokane Fire Department: 911
3. Greater Spokane Emergency Management Emergency Coordination Center: 509-477-2204
4. National Response Center: (800) 424-8802
5. Ecology Eastern Regional Office: (509) 320-3505
6. Spokane Regional Clean Air Agency: (509) 477-4727
(when spill results in emissions to air)

5.3 CH2M Reporting

Reporting Requirement

Any spills which discharge to Waters of the State (Spokane River, Spokane Aquifer) (or releases of hazardous gas to the atmosphere) shall be reported via telephone within 24 hours of becoming aware of the spill to the following:

1. Washington Department of Ecology Eastern Regional Office: (509) 329-3400
2. Department of Health, Drinking Water Program: (800) 521-0323 (business hours), (877) 481-4901 (after business hours)
3. Spokane Regional Health District: (509) 324-1500 for general information or Environmental Public Health at (509) 324-1560

Within 5 calendar days of becoming aware of the spill a written report shall be sent to Ecology which includes the following information:

1. Name of the Facility and location
2. Name of Reporter
3. Date of the spill
4. Location of the spill
5. Description of what was spilled
6. Cause of spill
7. Estimated volume of discharge and name of receiving waters if applicable
8. Corrective action(s) taken to mitigate or reduce the adverse effects of the spill
9. Actions taken to prevent similar spill in the future
10. Contact information (name of Facility and person reporting the incident, address, phone)

As a minimum reports shall be made to:

1. Washington State Department of Ecology
- 2.
3. Spokane County Environmental Services
4. Additional agencies may need to be notified based on extent of spill.

Note: Any written report intended to go to a regulatory agency must be reviewed and approved by the Facility Manager and the Company's Environmental Compliance Designee prior to submittal.

Exceptions

The following exceptions apply unless local, state, or federal requirements are more stringent.

Gases

1. Inert Gases; unless released in sufficient quantities to a confined space, including interior rooms, in sufficient volume to pose suffocation potential.
2. Flammable gases in quantities that do not exceed the Lower Explosive Limit (LEL) in the environment to which it is released.
3. Oxygen to the atmosphere.
4. Nitrogen – see inert gases.

Wastewater

1. Spills less than 1,000 gallons that are to areas that are completely lined with impermeable surfaces (such as concrete, asphalt, or plastic liner) which are returned in its entirety to the treatment system provided that the spill is not accessible to the public or the spilled area is attended to by personnel onsite to protect the public until the spill is removed.
2. Treated effluent that is used for irrigation in designated areas.

Water

1. Spills of potable water or W3 that do not cause a public nuisance or erosion sufficient to impact public health or potential for additional infrastructure damage.

Sludge

1. Spills less than 1 cubic yard if spilled to a public rights of way if both a) the sludge is stabilized either to meet class A or class B under 40 CFR 503 and b) the sludge is removed within 24 hours of the actual spill.

Note: All sludge spills to an unapproved area shall be removed immediately upon discovery.

Additional Reporting Requirements

If a spill reaches surface water the project shall post notice as close to where the spill occurred as possible and along waterway if applicable, the notice shall include at a minimum the information in 1-10 of reporting requirements.

Spills except those excluded in "Exceptions" shall be reported (via email or telephone – depending on legal aspects of release) to the CH2M Environmental Compliance Designee within 5 days of finding).

Additional reporting requirements, based on Permit requirements may apply based on a case by case basis.

Failure to Adhere to Policy

Failure to adhere to this policy will be treated as a falsification of records and is subject to potential Decision-Making Leave or termination.

Monitoring

1. Wastewater

Spills of wastewater external to the plant must be sampled and tested for BOD, TSS, pH and bacteriological testing (refer to permit and test for same parameters required in permit i.e. fecal coliform, total coliform, e. coli). Additional monitoring may be required by the permit, refer to the permit for these monitoring requirements.

2. Sludge

No additional testing requirements.

3. Chemical

Notify Fire Department (if HAZMAT response required), Company Environmental Compliance Designee and Facility Manager. After consultation proceed to cleanup if so instructed.

4. Water

Spills of potable water which enter surface water shall be immediately tested for chlorine content and pH.

6.0 Amendments to SPCC Plan (Section 112.5)

Amendments to the SPCC Plan shall be implemented as follows:

6.1 Changes in Facility Configuration

In accordance with 40 CFR 112.5(a), the SPCC Plan will be periodically reviewed and evaluated for changes in Facility design, construction, operation, or maintenance that materially affects the Facility's potential for an oil discharge, including but not limited to:

- Commissioning of containers
- Installation of new piping systems
- Construction or demolition that might alter secondary containment structures

Amendments to the Plan that addresses changes of this nature are referred to as technical amendments and are usually certified by a professional engineer (P.E.). However, because of the low volume of oil used and stored onsite, the SCRWRF can self certify (§112.6(a)). In addition, non-technical amendments can be made (and must be documented in this section) by the Facility owner and or operator. Non-technical amendments include the following types of changes:

- Name or contact information (e.g., telephone numbers) of individuals responsible for implementing this plan
- Name or contact information for spill response or cleanup contractors

Both technical and non-technical amendments will be reported on Table 6.1. Needed revisions to this Plan will be implemented the following calendar year after the change/amendment occurs. This Plan must be implemented as soon as possible following a technical amendment, but no later than 6 months after the date of the amendment. The Facility Manager is responsible for initiating and coordinating revisions to the SPCC Plan.

TABLE 6.1
Plan Review Log
Spokane County Regional Water Reclamation Facility

By	Date	Activity	PE Certification Required?	Comments
Changes to SPCC Plan as Facility Changes Occur				
John Keady	June 2011	Initiated Plan	No	<10,000 gals onsite, no spills historically
John Keady	December 2012	Revised Plan	No	Updated after one year of operations
Five-Year Updates				
Facility Manager	April 2017	Five-Year Update and Revision	No	Reviewed and updated
	December 2022	Five Year Update Required	No	
	December 2027	Five Year Update Required	No	

7.0 Qualified Facilities Plan Requirements – 112.6

The SCRWRF meets the criteria for self-certification, and those certification documents are at the front of the SPCC Plan.

8.0 General Requirements [112.7(a)]

This Plan has been prepared in accordance with good engineering practices and has the approval of CH2M. The management of CH2M is committed to providing the staff, equipment, facilities, and materials required to safely manage oils and all critical materials at the Facility. General Facility information is provided in Table 8.1.

This plan is organized in accordance with the sequence presented in 40 CFR 112.7 and meets the applicable requirements specified in the regulations.

TABLE 8.1
General Facility Information
Spokane County Regional Water Reclamation Facility, Washington

Facility Name	Spokane County Regional Water Reclamation Facility	Address	Phone
Facility Owner:	Spokane County Water Reclamation Manager	Public Works Building 1026 W Broadway Ave Spokane, WA 99260-0001	509-568-0971
Facility Operator:	CH2M	1004 N Freya Street Spokane, WA 99202	509-536-3702
Facility Type	Wastewater Treatment Plant		
Date of Initial Operations	2011 (Start-up) 2012 (Fully Operational)		
Contact Information			
Name	Title	Telephone Number	Cell Number
Adam McClymont	Facility Manager	(509) 536-3702	(509) 979-4926
Anthony Benavidez	Operations Supervisor	(509) 536-3703	(509) 688-3862
Bill Nakoa	Safety Lead	(509) 536-3707	
Devlan Pool	Maintenance Supervisor	(509) 536-3701	(509) 979-4761

9.0 Facility Description [112.7(a)(2)]

9.1 General Facility Description

The SCRWRF is located at 1004 North Freya Street, west of Freya Street, south of Trent Avenue, and north of the railroad tracks. It is a regional water reclamation Facility that will receive and treat wastewater from Spokane County owned conveyance facilities and pumping stations. The site is industrial and adjacent to commercial/industrial facilities. The treatment facilities (listed from raw sewage entering the plant to discharge of treated water) include the Headworks Building, Primary Clarifiers, Aeration Basin, Membrane Facility, Solids Facility, Aerobic Digester, Gas Storage Facility, Anaerobic Digesters, Odor Control Facility, Cogeneration Facility, and Plant Drain Pump Station. Supporting facilities include the Maintenance Building and Treatment Operations Facility (TOF) where offices are located.

9.2 Surface Water/Stormwater Drainage

The Facility is relatively flat, but it has been graded to facilitate drainage throughout the Facility. The Facility process area is mostly paved and all is graded, including the undeveloped area, for stormwater runoff to flow into the treatment Facility for processing. Flows in excess of the maximum pump capacity of the pump station (3.56 cfs) or the maximum conveyance to the pump station will be conveyed by pipe to a grassed infiltration pond that includes two Spokane County Type B drywells.

The overflow system consists of 24" pipe, beginning at the manhole in the southwest corner of the system. The pipes are designed to provide storage volume; stored runoff that has not infiltrated will drain back into the system and be pumped back to the headworks as the storm peak decreases to the point where the pumps are able to handle the incoming flow.

Storms larger than the 2-yr flow have peaks larger than the pumping or conveyance capacity, and will, therefore, back up through the 24" overflow piping and discharge to the grassed infiltration pond. The pond is designed to handle a 100-yr peak flow.

The northwest corner of the site where the administrative buildings are located have their own separate stormwater swales to collect and treat stormwater as it infiltrates to groundwater. See schematic in Appendix A that shows drainage flow at the Facility and location of treatment swales/pond.

10.0 Location and Contents of Oil/Critical Materials – 112.7(a)(3)

See Table 10.1 for a summary of critical materials (oil materials are bolded) that are listed with the Spokane City Fire Department, quantities and their location. These critical materials include those that are part of the treatment process and also materials that are carried through the treatment process (raw sewage, mixed-liquor, biosolids, gas, etc.) because they meet the Spokane County code's definition for critical materials. See Appendix A for a Facility diagram showing locations of oil-based and other critical materials. An exception is that there are critical materials stored in the Treatment Operations Facility (TOF) and because quantities (for each type of material) are less than 5 gallons, these laboratory materials are not included in Table 10.1 or the Facility diagram. The laboratory critical materials are addressed in the *Chemical Management Plan* for the laboratory, which is also included in the Facility's *Operations Plan*.

TABLE 10.1
Chemicals and Hazardous Materials Storage Areas
Spokane County Regional Water Reclamation Facility, Washington

Chemical/Material	Quantity (gals except where otherwise noted)	Specific Location
Headworks Building		
Polymer	660	Headworks Building – SE corner

TABLE 10.1
Chemicals and Hazardous Materials Storage Areas
Spokane County Regional Water Reclamation Facility, Washington

Chemical/Material	Quantity (gals except where otherwise noted)	Specific Location
Raw Sewage	72,500	Headworks Building
Grease (petroleum)	15	Headworks Basement
Diesel (petroleum)	600	Headworks Generator – East of Headworks Bldg.
Primary Clarifiers		
Sewage	322,000	Primary Clarifier 1
Sewage	322,000	Primary Clarifier 2
Aeration Basin		
Mixed Liquor (wastewater and biological solids)	1,300,000	Aeration Basin
Membrane Building		
Sodium Bisulfite	660	Membrane Building – SE portion of building
Citric Acid-50%	660	Membrane Building – SE portion of building
Mixed Liquor	254,000	Membrane Basins
Diesel (petroleum)	2,630	Membrane Generator – NE of Membrane Bldg.
Sodium hypochlorite-15%	8,800	Chemical Storage – East of Membrane Building
Sodium hydroxide – 25%	17,400	Chemical Storage – East of Membrane Building
Ferric chloride-40%	26,100	Chemical Storage – East of Membrane Building
Solids Facility		
Active Emulsion Polymer-35%	900	Solids Facility – SW corner
Active Emulsion Polymer-0.5%	1,250	Solids Facility – SW corner
Thickened Raw Sludge	300	Hopper inside Solids Facility
Dewatered Digested Sludge	300	Hopper inside Solids Facility
Blended Raw Sewage	12,000	Blend Tank – East of Solids Building
Sodium Bisulfite	990	Main room –SE corner
Citric Acid-50	990	Main room –SE corner
Maintenance Building		
Motor Oil (petroleum product)	385	Maintenance Building – SW corner (oil storage room)
Compressor Oil (petroleum product)	90	Maintenance Building – SW corner (oil storage room)

TABLE 10.1
Chemicals and Hazardous Materials Storage Areas
Spokane County Regional Water Reclamation Facility, Washington

Chemical/Material	Quantity (gals except where otherwise noted)	Specific Location
Heavy Duty Grease (petroleum product)	70 lbs.	Maintenance Building – SW corner (oil storage room)
Active Emulsion Polymer-35%	1800	Maintenance Building – Main room
Gas/Biosolids Facilities		
Digester Gas	cubic feet varies	Digester Gas Equipment Room – sediment trap
Digester Gas	cubic feet varies	Digester Gas Equipment Room – foam separator
Aerobically Digested Sludge	700,000	Aerobic Digester
Digester Gas	cubic feet varies	Gas Storage Facility
Hydrogen sulfide	Varies	Odor Control Facility (none stored, only processed)
Methane gas	Varies	Odor Control Facility (none stored, only processed)
Gas	cubic feet varies	CoGen Facility
Gas	Varies	Waste Gas Burner
Biosolids	varies – 565,000 tank	Anaerobic Digester 1 – inside digester tank
Grease (petroleum)	5 gallons	Anaerobic Digester-next to mixer gear box
Methane Gas	varies – 2300 cu ft	Anaerobic Digester 1 – inside digester tank between the liquid level and the lid
Biosolids	varies – 565,000 tank	Anaerobic Digester 2 – inside digester tank
Methane Gas	varies – 2300 cu ft	Anaerobic Digester 2 – inside digester tank between the liquid level and the lid
Yard Piping		
Sewage or chemical materials	Varies	Yard piping throughout the Facility complex

11.0 Critical Materials Storage/Containment

11.1 Oil and Oil Product Storage/Containment – 112.7(a)(3)(i)

Oil materials stored and used onsite include diesel fuel stored in double wall tanks located at the emergency generators (Headworks and Membrane Facility); and motor oil and

compressor oil stored at the Maintenance Building. The diesel fuel tanks sit on containment tanks. Motor oil and other fluids stored at the Maintenance Building will be stored in spill containment lockers. Table 11.1 identifies locations of oil-holding containers, their capacity, type of oil, and containment (type and capacity) at the SCRWRF. Appendix A has a Facility diagram showing the locations of oil and critical materials at the SCRWRF.

TABLE 11.1

Oil Container Locations, Capacity, Substance, Secondary Containment and Volume
Spokane County Regional Water Reclamation Facility

Container Location	Container Volume (gal)	Oil Substance (gal)	Secondary Containment	Containment Volume (gal)
Storage Tank (AST)	2,630	Diesel	Double-walled Containment Tank	3,000
Storage Tank (AST)	600	Diesel	Double-walled Containment Tank	650
Buckets (5 gals)	40 (200 gals total)	Motor oil and Compressor oil, Heavy duty grease	Spill Containment Lockers	Oil room drain goes to bldg oil trap
NE corner of TOF	149	Transformer oil	Not required	N/A
SE corner of Headworks Bldg.	178	Transformer Oil	Not required	N/A
SE corner of Membrane Facility	566	Transformer Oil	Not required	N/A
NW corner of Solids Facility	340	Transformer Oil	Not required	N/A
Total gallons	4,778			

¹Transformers are considered to be operating equipment and secondary containment is not required. However, they are included in site inspections, looking for potential leaks or spills.

Transformers

There are four (4) transformers onsite that have oil; all others are “dry”. These transformers are described below.

The transformer located outside of the northeast corner of the TOF is the smallest and has 149 gallons of oil. It sits on a concrete pad but is surrounded by soil. If a spill were to come out of this transformer, operators would respond with a spill response and cleanup kit available from the Headworks Building. The soil around the transformer would more than likely have to be removed and disposed of at an approved site.

The transformer located outside of the southeast corner of the Headworks Building contains 178 gallons of oil. It sits on a concrete pad and is surrounded by asphalt. An uncontained oil spill from this transformer would likely drain to the main plant pump station and into the treatment system. A spill would be responded to by operators with a spill response kit located at the Headworks Building.

The transformer located outside of the southeast corner of the Membrane Facility holds 566 gallons of oil. It is situated on a concrete pad and surrounded by asphalt. A spill from this transformer would drain into the spill containment vault that also serves the Chemical

Storage area. It could then be pumped out and hauled offsite and disposed of at an approved site.

The transformer located outside of the northwest corner of the Solids Facility contains 340 gallons of oil. It sits on a concrete pad but is surrounded by soil. If a spill were to occur, operators would respond with a spill response and cleanup kit located at the Membrane Facility. The soil around the transformer would potentially have to be removed and disposed of at an approved site.

11.2 Non-Oil and Non-Oil Product Storage/Containment

Table 11.2 identifies locations of non-oil containers, their capacity, type of critical material, and containment (type and capacity) at the SCRWF.

TABLE 11.2

Non-Oil Container Locations, Capacity, Critical Material, Secondary Containment and Volume
Spokane County Regional Water Reclamation Facility

Container ¹ Location	Container Volume (gal)	Critical Material	Secondary Containment	Containment Volume (gal)
Totes (2) @ 330 gals each, inside Headworks	660	Anionic Polymer	curb	568
Grit Basin ¹	50,500	Raw Sewage	NA	N/A
Primary Clarifiers (2) ¹	322,000 (each)	Sewage	NA	N/A
Totes (2) @ 330 gals each, Inside Membrane Facility	660	Sodium Bisulfite	curb	889
Totes (2) @ 330 gals each @ Membrane Facility	660	Citric Acid	curb	889
Aeration Basins ¹ (4)	330,000	Mixed liquor	Not required	N/A
Tanks (2) @4,400 gals each, East of Membrane Facility	8,800	Sodium hypochlorite 15%	Double contained tank/Vault	4,400/6,333
Tanks (2) @8,700 gals each (filled to 7,830 each), East of Membrane Facility	17,400	Sodium hydroxide 15%	Double contained tank/Vault	4,400/6,333
Tank (3) @8,700 gals each (filled to 7,830 each), East of Membrane Facility	26,100	Ferric chloride 40%	Double contained tank/Vault	4,400/6,333
Totes (9 total) 3 at Solids Facility & 6 at Maintenance Bldg @330 gals each, filled to 300 gals	2,700	Cationic Active Emulsion Polymer 35%	Floor drains in areas return spills of polymer to process for treatment	N/A
Polymer Aging Tank ¹ , Solids building	1,450	Active Emulsion Polymer – 0.5%	Not required	N/A
Hopper ¹ , Solids building	300	Thickened Raw Sludge	Not required	N/A
Hopper ¹ , Solids building	300	Dewatered Digested Sludge	Not required	N/A

TABLE 11.2

Non-Oil Container Locations, Capacity, Critical Material, Secondary Containment and Volume
Spokane County Regional Water Reclamation Facility

Container ¹ Location	Container Volume (gal)	Critical Material	Secondary Containment	Containment Volume (gal)
Blend Tank – east of Solids Building	12,000	Blended Raw Sewage	Curb directs flow to plant pump station	N/A
Aerobic Digester ¹	700,000	Aerobically Digested Sludge	Not required.	N/A
Tanks (2) ¹ , Anaerobic Digester	555,000 each	Biosolids	Not required	N/A
Membrane Basins ¹ (6), Membrane Facility	42,300	Mixed Liquor	Not required	N/A
Pipes, valves, sumps, pumps, etc.	Varies	Sewage or chemicals	10 curbed containment areas (where piping is exposed aboveground)	Varies

¹Secondary containment is not required for processing structures.

12.0 Discharge Prevention Measures – 112.7(a)(3)(ii) & (iii)

Discharge prevention measures have been established for the SCRWRF including procedures for routine handling of products (loading, unloading and Facility transfers, etc.). Refer to the *Operations and Maintenance Manual and Standard Operating Procedures*.

Containment structures have been provided throughout the Facility, where applicable, and their design and construction have been approved by the City of Spokane Fire Department. All tanks and containers used to store liquids are selected to be compatible with the materials being stored.

As described in the *Emergency Response Plan*, spill control stations have been designated throughout the Facility and were chosen based on their locations near areas where spills are most likely to occur or where hazardous materials are stored and handled. The spill control stations with spill response kits are located at:

- Treatment Operations Facility (for spill containment related to laboratory)
- Membrane Facility
- Maintenance Building

The Facility is designed so that any residues from a spill indoors or outdoors within the process area would be directed to drains, sumps and other conveyances where it would flow to the plant drain pump station where it can be returned as desired back into the water reclamation Facility for treatment without discharging from the site. An exception is that any diesel spill from the emergency generator fuel tanks could not find its way back to the treatment plant. These spills would be either contained by the diesel secondary containment or in the unlikely event that spills occur outside of containment; a spill response kit would

contain spills until properly disposed offsite by a contractor, preventing any potential harm to the treatment plant's biological processes.

12.1 Oil Discharge Prevention Measures – 112.7(a)(3)(ii) & (iii)

All liquid materials at the Facility are stored indoors or within liquid-tight structures (containers), with the exception of the oil-filled transformers located outside. To reduce the possibility of vandalism, the transformers and the entire process area is protected by security fencing. The *Operations and Maintenance Manual* and the *Spokane County Regional Water Reclamation Site Security Plan (Security Plan)* describes inspections and site security for the SCRWRF. Also, see Section 22 of this SPCC Plan.

There is a 1500 kW generator with a 2,870 gallon fuel tank that sits in a 3,000 gallon secondary containment tank, and a 300 kW generator with a 600 gallon fuel tank that sits in a 650 gallon secondary containment tank. Diesel delivered to either of these fuel tanks will be manually filled by the delivery truck driver/vendor who will be required to be present at all times during filling of the diesel tanks. There is an external alarm that flashes and signals when the tank is approaching full. As mentioned above, a diesel spill will not be allowed to flow to a manhole or be conveyed by any means to the treatment process.

The diesel tanks are double walled. There is a sensor in the void space between the double wall diesel tank; if diesel fuel is detected in this area an alarm will go out to SCADA and operators can respond immediately. If both walls of the tank are breached, the spill will flow onto the concrete pad that the generator sits on, and operators will need to respond to the spill with a spill response kit. If the diesel spills from the pad, it will reach the ground and a ground cleanup will need to happen. It is unlikely that the double walled steel diesel tank will rupture causing a catastrophic release of diesel.

All incoming automotive/maintenance oil arrives in 55-gallon drums or smaller quantities at the Maintenance Building, where they are placed in designated oil storage areas. Alternatively, materials will be placed in an area of the maintenance building that drains to the maintenance sump for containment. Empty drums are stored on the solids demo pad until vendors haul them away. Any spills would be cleaned up using sorbent pads and socks from the spill response kit located in the Maintenance Building.

There are transformers placed throughout the Facility; some are dry and those that have oil are identified in Table 11.1. In the unlikely event of a spill, there are spill response kits available to cleanup any spills.

Small quantities of oil will be removed using sorbent pads. Large quantities will be contained using sorbent pads or socks and can be absorbed using a dry absorbent. If possible the top layer of loose materials such as soil will be removed as soon as possible.

12.2 Critical Materials (non-oil) Discharge Prevention Measures

There will be totes filled with chemicals at four locations, the chemical storage room in the Membrane Facility, the cationic polymer room in the Solids Facility, the anionic polymer area in the Headworks Building and extra chemicals will be stored in the Maintenance Building and behind the east rollup door in the solids building.

Headworks

The chemical stored in the Headworks Building is anionic polymer. It sits in a permanent spill containment area 19 feet by 8 feet and has a six-inch curb around it. The capacity of this spill containment area is 568 gallons, which is sufficient for one chemical tote. This containment area has two floor drains that direct flow to the headworks sump and then is pumped to the influent stream. There is a valve on the pipe from the floor drains. This valve will remain closed at all times. If a spill occurs, operators will have the ability to slowly feed the spilled polymer into the headworks sump and subsequently to the influent flow stream.

Totes will be delivered full to the Membrane Building and will go directly from a delivery truck (parked on a paved surface) to the building by forklift, then moved by forklift to a permanent containment area where polymer is pumped to the process system. The empty totes are stored on the solids demo pad and hauled back by the vendor for refilling at their site. If a spill were to occur, operators will need to respond to the spill with a spill response kit that is stored at the Headworks Building.

Membrane Facility

The chemicals stored in the Membrane Facility are citric acid and sodium bisulfate. These chemical totes are sized for 330 gallons, but are only filled to 300 gallons, and are the feed totes as well as storage. They will sit within individual curbed spill containment areas. Each spill containment area is large enough to hold two totes (measures 12 feet by 15 feet by 8-inch). These spill containment areas have an 889 gallon capacity and drain to the spill containment vaults via sump drains in the corners of the containment areas. The feed systems for these chemicals sit in the spill containment area. Also, all chemical feed piping is double-walled.

Totes will be offloaded from delivery trucks to the solids building by forklift and then to the membrane building. Totes are not anticipated to be defective and leak in transport, but if that were to happen, a spill response kit that is stored in the Membrane Facility would be used for containment and cleanup.

Citric acid will be contained utilizing universal sorbent pads and socks and neutralized as needed using a purchased acid neutralizer. It's important to not add water to acid of any volume before neutralizing. Larger volumes of citric acid can be neutralized with a dilute caustic if needed.

Sodium bisulfate will be contained utilizing universal sorbent pads and socks. The bulk of chemical will be removed utilizing a dry absorbent. It is important to not spray down with water due to the release of toxic sulfur dioxide gas.

Chemical Storage Area

Chemicals stored in the chemical storage area include ferric chloride, sodium hypochlorite and sodium hydroxide. The tanks are double contained so that a leak of the inner wall will be contained by the second wall. There are two permanently constructed spill containment vaults that are isolated from each other, one for acids and one for sodium based compounds. They are also isolated from the main plant drain pump station by manually operated valves.

Ferric chloride (40%) will be stored in three separate tanks of 8,700 gallons each (26,100 gals total), sodium hydroxide will be stored in two 8,700 gallon tanks (17,400 gals total) and sodium hypochlorite will be stored in two 4,400 gallon tanks (8,800 gals total). Therefore, the largest tank at the chemical area tank farm is 8,700, which will only be filled to 90% capacity

and contain 7,820 gallons of material when full. There are SCADA alarms that signal when the tank has reached desired fullness. Also, all chemical tanks are double contained with double-walled piping (both tanks and piping have leak detection monitors).

Containment curbing is on three sides of the chemical tank storage area, directing any spills into vaults, and then into sumps and the plant drain pump system to be diluted and pumped to headworks. The dimensions of the vaults are 24 feet by 7 feet by 5 feet deep and the sumps are 2 feet by 2 feet by 1.67 feet. This gives each containment unit a 6,333 gallon capacity. Should for some reason the containment vaults fill completely and the chemical tanks continue to leak beyond capacity of the spill containment, the spill will drain to the plant drain and into the main plant drain pump station. From there it is pumped to the plant influent and into the treatment system.

Any caustic (sodium hydroxide) spills that might not drain to a containment sump would be contained utilizing universal sorbent pads and socks neutralized using a purchased caustic neutralizer. Larger volumes of chemical in containment can be neutralized using dilute citric acid if needed.

Bleach spills (sodium hypochlorite) will be washed to containment areas using water, and larger volumes in containment will be diluted with water. Neutralization with sodium bisulfite will be used as needed.

Ferric chloride will be washed to containment areas using water. Larger volumes in containment will be diluted with water, and a dilute caustic solution as needed.

Solids Facility and Maintenance Building

There will be 9 totes of 35% cationic polymer stored onsite, three will be in the Solids Facility at all times and the remaining 6 totes will be stored in the Maintenance Building until replacement is needed. The totes being stored will have 330 gallon capacities and typically only be 90% filled.

Transport of these totes from the Maintenance Building will over non permeable areas, primarily asphalt. Polymer is a non-hazardous chemical and, therefore, spill containment during transport should not be necessary. Should a spill occur during transport, it can be responded to quickly by operators by using a spill response kit that is stored at the Maintenance Building or Membrane Facility. Minor polymer spills would be contained utilizing physical barriers and cleaned up utilizing Oil-Dri or similar absorbent product.

There is a 1,250 gallon polymer aging tank and it will hold 0.5% polymer at the Solids Facility so it is mostly water. If the tank was to rupture, there would be a mess but no threat to the environment. In the event of a catastrophic failure of the aging tank, the dilute polymer could conceivably leave the building under the door. It would, however, remain on pavement and be diverted to a plant drain, which flows to the main plant drain pump station and is pumped back to the headworks for treatment.

13.0 Spill Response Procedures – 112.7 (a) (3)(iv)

For all spills, both minor and major, the spill identification and notification flow chart (See forms in Appendix C) is to be followed.

13.1 Non-Reportable Response

The responder to the spill will perform an identification of the spilled materials to ensure that it poses no safety threat. If any condition exists that could pose a temporary safety hazard such as slips, trips or falls, then the operator will ensure that the area is secured from traffic. Securing the area will also ensure that the contaminant is not tracked out of the area. Cleanup activities will commence as soon as possible and the material will be disposed of properly.

If a minor spill should occur, plant personnel are to immediately:

1. Stop the source if action can be completed safely
2. Secure the area
3. Contain the spilled material
4. Dispose of the material properly
5. Notify a Supervisor or Project Manager

13.2 Reportable Response

Upon notification, the Facility Manager or the person responsible will immediately assess the situation to determine the severity of the incident and resources required to mitigate the situation. If the situation can be handled safely in-house proceed with the cleanup.

In the event of a major incident, personnel are not allowed to provide information or comment to the public, agency, or news media. They are to refer all individuals requesting information to the Facility Manager or Spokane County Water Reclamation Manager for details. Additionally, access should be controlled at the scene of the spill or if in the Facility at the main gate.

If a major spill should occur, plant personnel are to:

1. If an emergency, call 911(refer to Emergency Response Plan), if not, then
2. Notify your Project Manager
3. Secure the area
4. Attempt to stop the source safely
5. If there are hazardous materials report immediately to the appropriate agencies including the National Response Center within 15 minutes of discovery if quantities exceed the amounts listed in Section 5.2.
6. Attempt to contain the spilled material if safe to proceed
7. Begin cleanup operations when directed

8. A Spill/Release report for the agencies will be completed by the Facility Manager when cleanup is complete.

14.0 Site Specific Situations

The following section contains equipment or site specific spill response procedures that attempt to address realistic approaches to possible events that may initiate or cause a spill. Although each scenario presents one response option for the incident, it must be realized that the option may vary for actual responses and that it serves only as one of many possible tactical approaches. Every incident is unique and impacted by many variables that can change constantly. Therefore, each incident has to be approached cautiously and evaluated on a case by case basis. The most important thing you can do in the event of a spill is to err on the side of safety.

14.1 Leaking Concrete Tanks

Description:

If operators observe process water leaking through the concrete walls of a process basin such as the grit basin, primary clarifiers, aeration basins, membrane tanks, aerobic digester, anaerobic digesters, effluent channel, or chlorine contact chamber.

Procedure:

- Follow the spill determination and notification flow chart
- Isolate the unit if the spill cannot be contained by other measures.
- Drain the tank to a level below the leak elevation.
- Direct the liquid portion to a drain that leads back to the site pump station so it can be returned to the plant.
- Cleanup any spilled materials
- Leak repair of the concrete structures shall be per the two crack injection repair methods developed during initial construction of the facility. Leak repair of the concrete structure must be completed prior to reapplying any coatings.

14.2 Spilled Chemical at Delivery to Chemical Storage Area

Description:

When trucks unload chemicals (Ferric Chloride, Sodium Hydroxide, or Sodium Hypochlorite) at the bulk chemical storage Facility there is the potential for spills and/or leaks. The transfer of chemicals will be monitored by operators and the truck driver. A spill control response kit will be readily available whenever a truck is unloading chemicals.

Procedure:

- Follow the spill determination and notification flow chart.
- The contaminant will drain to the Chemical Spill Containment Vaults located on the south side of the Bulk Chemical Storage Facility.
- The spill containment vault is isolated from any other system by manually operated valves.
- All personnel not directly involved in cleanup will be removed from the area.
- Review the MSDS for the chemical in question to determine the appropriate PPE and clean up procedures.
- Spilled chemicals will either be removed by hazardous waste contractors or purposefully fed back to the plant at a rate low enough to avoid harming plant processes.

14.3 Broken Chemical Feed Line

Description:

There is the potential for a chemical spill in the membrane Facility at the chemical feed pumps.

Procedure:

- Follow the spill determination and notification flow chart.
- Review the MSDS for the chemical in question to determine the appropriate PPE and clean up procedures.
- Isolate the leak and transfer the chemical feed to the redundant feed pump.
- Drains in the chemical feed pump area drain to the spill containment vaults located south of the bulk chemical storage Facility.
- Spilled chemicals will either be removed by hazardous waste contractors or purposefully fed back to the plant at a rate low enough to avoid harming plant processes.

14.4 Loss of Containment, Headworks

Description:

There is potential for loss of containment of raw sewage in the Headworks Building via an overflow from the screening or grit removal process equipment.

Procedure:

- Follow the spill determination and notification flow chart.
- If safe to do so switch to the redundant unit.
- If unable to switch to the redundant remove screenings utilizing the manual bar screen by opening the gate to its respective channel.

- Resolve the equipment/process issue causing the overflow.
- Remove any spilled liquid or debris back to the treatment channel.
- In the case of failure of downstream equipment it may become necessary to contact Spokane County Utilities Division to cease influent pumping to the plant from the North Valley Interceptor and South Valley Interceptor pump stations.

14.5 Spilled Sludge or Septage, Truck Accident

Description:

Once the sludge (biosolids) has been digested according to design and dewatered to greater than 20 percent solids, it is hauled offsite. Also, septage is transported from offsite to Headworks Building for disposal. If a truck hauling biosolids or septage is involved in an accident and biosolids or septage are spilled on site, initiate spill response procedures. If a spill or accident occurs off site by a subcontractor or third party, notify contractor to execute the instructions in their Ecology approved spill plan.

Procedure:

- Follow the spill determination and notification flow chart.
- Isolate the spilled area and follow all applicable traffic safety regulations.
- Clean up sludge as soon as possible and dispose of as class B material. Clean up septage and dispose at the Headworks Building for treatment.

14.6 Tote Spill

Description:

Totes are delivered to the Facility by trucks and/or moved with forklifts when replacement is needed. If a tote should leak or spill during delivery and transport, initiate spill response procedures.

Procedure:

- Follow the spill determination and notification flow chart.
- Review the MSDS for the chemical in question to determine the appropriate PPE and clean up procedures.
- Isolate and contain the spill with materials available in the spill response kit.
- When possible, direct flow and feed back into the treatment plant at a rate low enough to avoid harming plant processes.
- Otherwise contact hazardous waste contractors to remove spill from site

15.0 Methods of Disposal – 112.7(a)(3)(v)

Spilled material, contaminated soil and water, and contaminated materials used in response will be handled by outside or in-house reclamation, energy recovery, incineration, or other methods in compliance with the Clean Water Act, the Resource Conservation and Recovery Act and amendments, applicable state regulations, and as approved by CH2M management.

Materials, soil, and other debris removed in a cleanup activity must be disposed of in a manner acceptable to the appropriate regulatory agencies. This process may require analytical testing of the contaminated materials to determine if the materials are solid waste or characteristic hazardous waste. Wastes resulting from a major discharge will be removed and disposed of by a cleanup contractor.

16.0 Emergency Contacts – 112.7(a)(3)(vi)

The Facility Manager is also the designated Emergency Coordinator for the site, and is responsible for preventing and controlling spills, directing response to a site emergency, and reporting spills to the appropriate officials. The CH2M staff responsible for spill response and the federal and state emergency and spill reporting contacts are listed in Table 16.1.

TABLE 16.1
Federal and State Emergency and Spill Reporting Contacts¹
Spokane County Regional Water Reclamation Facility

Organization	Work Number	Cell Number
Adam McClymont, Facility Manager (primary contact)	(509) 536-3702	(509) 979-4926
Anthony Benavidez, Operations Supervisor (alternate contact)	(509) 536-3703	(509) 688-3862
Neil DeJonge, Safety Lead	(509) 536-3710	Not Available
Devlan Pool, Maintenance Supervisor	(509) 536-3701	(509) 979-4761
Contractor (who handles emergencies) NRC Environmental	(509) 536-5960	Not Available
National Response Center	(800) 424-8802	Not Available
Washington State Department of Emergency Management	(800) 258-5990	Not Available
Ecology – Eastern Regional Office	(509) 329-3512	
Spokane County Fire Department and Local Emergency Management Center	911	

TABLE 16.1
Federal and State Emergency and Spill Reporting Contacts¹
Spokane County Regional Water Reclamation Facility

Organization	Work Number	Cell Number
Spokane Regional Clean Air Agency (spill results in air emissions)	(509) 477-4727	

¹Also refer to the Emergency Response Plan for emergency events.

17.0 Emergency Response Plan – 112.7(a)(4 and 5)

The SCRWRF has an *Emergency Response Plan* (ERP), which consolidates contingency and emergency planning, and is revised as operational needs change. The ERP is available from the Project Manager, Operations Supervisor, and Health and Safety Coordinator; copies are kept in Treatment Operations Facility and the Maintenance Building for reference on emergency response actions.

18.0 Oil Spill Potential – 112.7(b)

There is a low potential for oil spillage (such as tank overflow, rupture, or leakage) at the SCRWRF. This is attributed to the following factors:

- The volume of oil used onsite is relatively small (only 3,555 gallons total). Most of the diesel (3,170 gals) is stored in tanks that will seldom be refilled because the diesel powers generators are only used during emergencies.
- The remaining 385 gals of oil will be used in the Maintenance Building where spills would be contained within the building
- Secondary containment has been provided for totes, tanks, and piping that might leak, and thereby be contained
- Tanks, pumps, valves and piping are routinely inspected by trained personnel during each shift and any maintenance problems are recorded on a Facility inspection log, and corrected as soon as possible
- Trained employees regularly review proper tank filling, and drum delivery and use

Because of these factors, there is not a reasonable potential that systems would fail to the extent that an oil spill would reach navigable waters. However, in the unlikely event of a spill, a site map in Appendix A shows the direction of flow and Table 18.1 describes the total

quantity of oil that could be discharged from the Facility as a result of each type of major equipment failure.

TABLE 18.1
Potential Discharge Volumes and Direction of Flow
Spokane County Regional Water Reclamation Facility

Type of Storage Area	Type of Failure	Maximum Volume Released (gal)	Maximum Discharge Rate	Direction of Flow
Outside of Buildings				
Bulk Storage	Spill while filling diesel tank at emergency generator or double-walled tank leaks	2,630	Gradual to instantaneous	If not contained at tank vicinity, direction of flow would be southeast of Headworks Bldg
	Leak at Blend Tank	12,000	Gradual to instantaneous	To spill containment area and then released to plant for treatment
Oil-filled Operational Equipment	Failure of transformer	566	Gradual to instantaneous	To spill containment vault southeast of transformer; pumped for disposal
Product Transfer Area	Dropped and spilled tote outside of any building	300	Gradual to instantaneous	To plant drain system and released to plant for treatment or pumped for disposal
Inside Buildings/Facilities				
Bulk Storage	Chemical storage tank leaking at Chemical Storage Area	7,830	Gradual to instantaneous	If not contained inside Facility, to spill containment vault and pumped for disposal
	Leak from drum	55	Gradual to instantaneous	If not contained inside the Facility, to plant drain system and released to plant for treatment or pumped for disposal
Product Transfer Area	Dropped tote inside Membrane Facility and outside containment unit	300	Gradual to instantaneous	If not contained inside the Facility, spill would flow to spill containment vault and pumped for disposal
	Dropped tote inside Solids Handling Facility	300	Gradual to instantaneous	If not contained inside the Facility, spill would flow to plant drain system and pumped for disposal
Piping/Valves	Piping throughout the Facility	Varies	Gradual to instantaneous	To containment areas and on to plant drain pump station for release to plant

TABLE 18.1
Potential Discharge Volumes and Direction of Flow
Spokane County Regional Water Reclamation Facility

Type of Storage Area	Type of Failure	Maximum Volume Released (gal)	Maximum Discharge Rate	Direction of Flow
				for treatment or pumped for disposal

19.0 Containment and Diversion Structures and Oil Spill Contingency Plan and Staff – 112.7(c) and 112.7(d)

The following preventive systems are used at the site to prevent discharge of oil and oil products from reaching navigable waters.

19.1 Containment and Diversionary Structures – 112.7(c)

Containers and tanks located inside and outside buildings have properly sized spill containment units (spill pans, curbed containment, or spill containment vaults) that will hold critical materials without any escape before cleanup occurs (See Table 19.1 for calculations). Transformers holding oil and other potential outdoor spill sites are all located near spill response kits that have sorbent materials. Outside piping that carry critical materials have been provided with secondary containment where they are exposed above ground. Inside piping carrying chemical materials are double-walled.

TABLE 19.1 SECONDARY CONTAINMENT CALCULATIONS
Spill Prevention Control and Countermeasures (SPCC) Plan
Spokane County Regional Water Reclamation Facility

Tank/Container	Largest Container in Area (gal)	Containment Dimensions	Containment Volume (cu ft)	Containment Volume (gal)
Outside				
Transformer (SE corner of Membrane Facility)	566 ¹	24' x 7' x 6.5' vault plus 2' x 2' x 2' sump	1100 ¹	8,228
Membrane Diesel Tank Generator Container	2,630 ²	84" x 294" x 35 "	500	3,740
Headworks Diesel Tank Generator Container	600 ²	82" x 170" x 19"	153.3	1,146
Headworks				

TABLE 19.1 SECONDARY CONTAINMENT CALCULATIONS
 Spill Prevention Control and Countermeasures (SPCC) Plan
 Spokane County Regional Water Reclamation Facility

Tank/Container	Largest Container in Area (gal)	Containment Dimensions	Containment Volume (cu ft)	Containment Volume (gal)
Totes	330 ²	19' x 8' x 6"	76 ²	568 ²
Membrane Building				
Totes	330 ²	12' x 15' x 8"	118.8 ²	889 ²
Chemical Storage				
Tanks	7,830 ³	24' x 7' x 6.5' vault plus 2' x 2' x 2' sump	1,100 ¹	8,228 ¹
Solids Handling Facility				
Totes	330 ²	56" x 56" x 29"	51.5 ²	385 ²
Blend Tank	12,000 ³	Curbs direct flows to plant drain pump station and to plant for treatment	N/A ³	N/A ³
Maintenance Building				
Totes	330 ²	56" x 56" x 29"	51.5 ²	385 ²

¹Containment vaults are connected to the wastewater treatment system, therefore precipitation does not need to be included in calculations because treatment plant has capacity for millions of gallons.

²Containment volumes do not need to include precipitation in the calculations because all of the containment structures are inside of structures or buildings.

³Containment volume is the capacity of the wastewater treatment system (millions of gallons) because flows are directed back into the plant for treatment.

Table 19.2 shows the locations of spill cleanup kits throughout the Facility and lists the emergency equipment available.

TABLE 19.2
 Descriptions of Spill Cleanup Kits
 Spokane County Regional Water Reclamation Facility

Item	Quantity
Process Area	
Spill defense universal spill kit (for 95 gallons)	1
Oil-Dri 40 lb bags	10
Dry chemical neutralizer (50 lb bag)	3
Dry chemical neutralizer (50 lb bag of sodium sesquicarbonate)	3
7500 half mask respirator	4
Acid gas cartridges for respirator	4 packages (2/pkg)
Treatment Operations Facility (laboratory)	
Small-scale spill cleanup	1

There is also a spill response kit located at the TOF for any potential spills that might occur in the laboratory. Basically, the laboratory cleanup kit consists of containers of kitty litter-like materials with a dust pan and scoop to contain, absorb, mix thoroughly and dispose of material in a dumpster once it is neutralized.

19.2 Oil Spill Contingency Plan and Staff – 112.7(d)

CH2M management of the SCRWRF is committed to providing adequate staff, equipment, facilities, and materials to establish precautionary measures and to expeditiously implement corrective actions, including containment, control, and removal of oil discharged from the Facility. A certification of management responsibility is found on page 1 of this SPCC Plan.

As shown in Table 18.1 and described in Sections 11 and 12, CH2M has containment structures and plans that are appropriate for preventing discharged oil from reaching a navigable waterway, as required by 40 CFR 112.7(c). The Facility also has a contingency/emergency plan *Emergency Response Plan*.

20.0 Inspections, Tests and Records – 112.7(e)

20.1 Inspections and Records

A maintenance management program will be conducted at the SCRWRF that consists of five functions:

1. Routine maintenance
2. Preventive maintenance
3. Predictive maintenance or condition-based maintenance
4. Corrective maintenance
5. Emergency maintenance.

These functions are controlled through the computerized maintenance management system (CMMS). The effectiveness and performance of the maintenance system is measured using a quality assurance/quality control (QA/QC) matrix. This program prevents operational deficiencies, and makes certain that corrective and preventive actions are taken in a timely manner.

In addition to the CMMS and the SCADA system that monitors plant operations, an overall Facility tour will be conducted and observations noted on the daily rounds checklist (available in the *Operations Plan*) when operators move through the Facility. These inspections will be done to assure that:

- Equipment is maintained and operating properly
- Repair and replacement of equipment, parts, and machinery is done in a timely fashion
- Spill clean-up kits are readily available and fully stocked

- Good housekeeping is performed
- Proper procedures and management policies are being followed
- Sampling and measurements are meeting contractual requirements

Additional inspections will be done for tanks, containers, valves and piping as part of the CMMS program. These inspections will include:

- Observing the exterior of aboveground storage tanks, pipes and other equipment for signs of deterioration, leaks, corrosion, and thinning
- Observing tank fill and pipes for signs of poor connection that could cause a discharge, and observe tank vents for obstructions and proper operation
- Verifying the proper functioning of overfill preventive systems

The inspection program is implemented by qualified and trained individuals who are assigned responsibility for detecting unsafe conditions at the Facility and preventing adverse consequences. The designated individuals have training and authority to:

- Implement the required inspections
- Perform necessary evaluations and hazard assessments
- Recommend appropriate corrective or remedial actions

All problems regarding tanks, piping, containment, or response equipment must be reported immediately to a supervisor. Visible oil or critical materials leaks from tank walls, piping or other components must be repaired as soon as possible to prevent a larger spill or discharge. Pooled oil would be removed immediately upon discovery.

Records of inspections and tests, signed by the appropriate supervisor or inspector, will be filed with the SPCC Plan for a period of three years. See Appendix C for inspection form/checklists (monthly and annually) that will be used when inspecting oil handling procedures, oil holding equipment and reviewing management of oil SPCC program.

20.2 Integrity Testing of Oil Containers

All aboveground oil tanks will be tested for integrity by an outside contractor every five years or whenever repairs are made (40 CFR 112.8(c)(6)). Testing will include visual inspections with another testing technique such as hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or another system of nondestructive shell testing. Furthermore, the generators will be part of routine Facility maintenance and inspections.

Inspections must include container's supports and foundations, the outside of the container for signs of deterioration, discharges, or accumulation of oil inside curbed areas. Records of inspections and tests will be kept and reviewed for comparison.

21.0 Training and Discharge Prevention Procedures – 112.7(f) (1-3)

Training will be provided to operators regarding the implementation of the SPCC Plan and will include:

- Operation and maintenance of equipment to prevent discharges
- Discharge procedure protocols
- Applicable pollution control laws, rules and regulations
- General Facility operations
- Contents of the SPCC Plan

Briefings will be conducted annually to assure adequate understanding of the SPCC Plan and must highlight and describe known discharges as described in 112.1(b) or failures, malfunctioning components, and any recently developed precautionary measures. The level of detail for employee training depends on the person's level of responsibility with regard to spill control. All employees who could influence the management of processes are mandated to complete SPCC training. See Appendix C for a SPCC training form.

The Facility Manager of Operations is responsible for all spill prevention at the Facility and for directing response to a site emergency, and for reporting spills to the appropriate officials. Day to day responsibilities and spill prevention programs and activities also lie with the Facility Manager of Operations.

In addition, CH2M has a strong safety policy and uses a companywide *Safety Manual* and a *Site-Specific Safety Manual* to conduct safe operations. CH2M operated facilities are required to provide safe tools, equipment, layout and materials. Managers, Supervisors, and Project Safety Team Leaders must provide adequate education and training in accepted safety procedures.

22.0 Security – 112.7(g)

The SCRWRF has a security fence with a locked gate that surrounds the entire property, plus the process area of the Facility is fenced-off and has its own gate that separates it from that area that is available to the public (where the administrative offices are located). In addition all buildings are locked and alarms can notify operators of any trespassers onsite. Surveillance cameras and videos are also used at the Facility.

Ample lighting is provided throughout the Facility to allow for safe night-time operation of

the Facility, spill detection, and prevention and discovery of vandalism. Storage tanks with master flow valves, allowing direct outward flow of the contents of a tank, are maintained in the closed position when not in operation. During operations, operators monitor the site 24-hours a day. Refer to the *Security Plan* for more details.

23.0 Tank Car and Tank Truck Loading and Unloading – 112.7(h)

The only oil tanks filled by trucks are those that deliver fuel to the emergency generators diesel storage tanks. Remaining oil is delivered to the Facility in 55 gallon drums. No rail cars or loading racks are used at this Facility.

The Headworks Building generator does not have containment at the truck unloading area, however, the general provisions for containment are provided for because if a spill or release were to occur, a portable spill kit is readily available at the Headworks Building to contain and clean up the spill.

The Membrane Facility emergency generator does not have containment at the truck unloading area, but spills would flow towards the chemical storage area spill containment vaults and there is a portable spill kit readily available at the Membrane Facility to contain and clean up spills.

In addition, the delivery fuel truck driver is required to be present to observe all unloading operations, which means that a spill or release would be detected long before it spread very far from these generators. These delivery personnel are responsible for securing the truck during unloading. Prior to departure, they must also inspect the truck for discharges at the lowest most drain and all outlets of such vehicles, and if necessary, ensure that they are tightened, adjusted, or replaced to prevent liquid discharge while in transit. In addition the Facility's SCADA system and monitoring would detect potential tank over-fill before it occurred.

24.0 State and Local Spill Prevention Rules - 112(j)

CH2M must comply with all local and state regulations, which is required in the Service Contract. In addition to the SPCC Plan, CH2M has a *Safety Plan*, *Operations Plan*, SCADA System, CMMS, and an *Emergency Response Plan* that provides a common framework for emergency preparedness and response to emergencies. These plans provide additional information on knowledge of alarms, guidelines for response, evacuation procedures,

emergency equipment shutdown procedures, communication, coordination, and training. Furthermore, CH2M must operate the Facility under a State Waste Discharge Permit, which provides specific regulatory requirements for spill protection and for a spill prevention plan.

25.0 Qualified Oil-filled Operational Equipment 112(k)

The only oil-filled operational equipment at the Facility are transformers that have already been discussed under Sections 11 and 12, and are included in the overall SPCC program requirements as described in this plan.

26.0 SPCC Plan Requirements for Onshore Facilities – 112.8

This section describes structures and procedures in place to comply with general requirements of the Plan and specific discharge prevention and containment procedures of 40 CFR 112.8.

26.1 General SPCC Plan requirements – 112.8(a)

Compliance with general requirements listed under §112.7 has been discussed earlier. A compliance schedule for this plan wasn't necessary because this is a new Facility and currently has no deficiencies or any historical spills.

26.2 Facility Drainage – 112.8(b)

The SCRWRF is located on relatively flat terrain that has been graded and designed so that there will be no discharges from the site. Most of the process area is covered with impervious surfaces. Buildings are designed with roof drains that are directed to the onsite plant drain collection system; a system designed for a 100-yr event. There are no diked areas at the Facility so discharge from diked areas is not applicable to this Facility. Paved surfaces are sloped to convey all stormwater and any spills onsite to be either locally contained or directed to the plant drain pump station and pumped to the Headworks for treatment. Run-on drainage is minimal to none.

26.3 Bulk Storage Tanks – 112.8(c)

Table 11.1 lists all oil storage tanks and storage areas at the SCRWRF and Table 11.2 includes non-oil critical materials used at the Facility. The tables include the containment and/or diversionary structures that are applicable for each storage tank. All of the tanks are aboveground and are double walled.

26.3.1 Tank Compatibility – 112.8(c)(1)

Diesel tanks are made of welded steel. Totes are made of polyethylene. Curbed containment is constructed using concrete. All containers are compatible with the contents they hold and the environmental conditions to which they are exposed. None of the tanks are used to store oil products at greater than atmospheric pressure.

26.3.2 Secondary Containment – 112.8(c)(2)

Diesel tanks have secondary containment and are double-walled. Spill response kits are stored in close proximity to these tanks should a spill or leak occur. All other materials are stored in spill containment units or spills will flow to a containment area or vault (Table 19.1 has secondary containment calculations). Any spills that might not be captured in a containment unit would be cleaned up with spill response materials or would flow to the plant drain pump station and then to the headworks for treatment. The site is designed to prevent discharges from the site.

26.3.3 Draining Diked Areas – 112.8(c)(3)

There are no diked areas at the SCRWRF.

26.3.4 Buried Metallic Storage Tanks – 112.8(c)(4)

There are no buried metallic storage tanks at the SCRWRF.

26.3.5 Partially Buried Storage Tanks – 112.8(c)(5)

There are no partially buried storage tanks at the SCRWRF.

26.3.6 Periodic Integrity Testing – 112.8(c)(6)

All tanks/containers are visually inspected on a regular basis to assess tank integrity. Inspections and testing are performed as described in Section 20.0. Special emphasis is placed on:

- Evidence of leaks or spills or accumulation of oil in secondary containment area
- Corrosive deterioration
- Foundation deterioration
- Tank auxiliary equipment (valves, piping, and pumps)
- Containment structures

26.3.7 Internal Heating Coils – 112.8(c)(7)

There are no internal heating coils or steam systems at SCRWRF.

26.3.8 Fail-Safe Engineering – 112.8(c)(8)

The SCRWRF is a newly constructed Facility that has included the following in its design:

- High liquid level alarms for containers that signal operators
- Filling of tanks and replacement of totes are constantly attended and are under surveillance by trained staff or contractors
- Routine inspection of tanks and auxiliary equipment

- Tanks/containers located so that they are within view during daily operations conducted at the Facility
- Formal SPCC training and regular review programs for employees
- The site is designed to be a non-discharge Facility

26.3.9 Effluents into Navigable Waters – 112.8(c)(9)

The SCRWRF is a wastewater treatment Facility and would treat all water discharged from the site in accordance with the Facility's NPDES permit and effluent limit requirements.

26.3.10 Correction of Tank Deficiencies – 112.8(c)(10)

Visible oil leaks will be brought to the attention of Facility operations and/or environmental staff, and problems will be corrected as soon as possible by appropriately trained in-house maintenance staff. This would include prompt removal of any accumulations of oil. There are no diked areas at this Facility that would be affected from an oil spill.

26.3.11 Mobile/Portable Oil Storage Tank – 112.8(c)(11)

The Facility uses portable 55 gallon drums that are stored in spill containment units.

26.4 Transfer Operations and In-Plant Processes – 112.8(d)

26.4.1 Buried Piping Installations – 112.8(d)(1)

There are no buried pipelines containing oil at SCRWRF.

26.4.2 Piping Support Design – 112.8(d)(2)

All equipment has been properly designed to minimize abrasion and allow for expansion and contraction.

26.4.3 Inspection of Valves and Piping – 112.8(d)(3)

All equipment and the entire Facility are routinely inspected.

26.4.4 Aboveground Piping – 112.8(d)(5)

There is no aboveground piping that carries oil.

Appendix A

Figures

Certification of the Applicability of the
Substantial Harm Criteria
Appendix B

Certification of Substantial Harm Criteria

Name: Spokane County Regional Water Reclamation Facility

Facility Address: 1004 N Freya Street, Spokane, WA 99202

1. Does the Facility transfer oil over water to or from vessels and does the Facility have a total oil storage capacity greater than or equal to 42,000 gallons?

Yes _____ No X

2. Does the Facility have a total oil storage capacity greater than or equal to 1 million gallons and does the Facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground oil storage tank area?

Yes _____ No X

3. Does the Facility have a total oil storage capacity greater than or equal to 1 million gallons and is the Facility located at a distance (as calculated in accordance to 40 CFR, Part 112.20(f)(1) such that a discharge from the Facility could cause injury to fish and wildlife and sensitive environments?

Yes _____ No X

4. Does the Facility have a total oil storage capacity greater than or equal to 1 million gallons and is the Facility located at a distance (as calculated in accordance to 40 CFR, Part 112.20(f)(1) such that a discharge from the Facility would shut down a public drinking water intake¹?

Yes _____ No X

5. Does the Facility have a total oil storage capacity greater than or equal to 1 million gallons and has the Facility experienced a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last 5 years?

Yes _____ No X

¹ For the purposes of 40 CFR part 112, public drinking water intakes are analogous to public water systems as described at 40 CFR 143.2(c).

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

Signature: _____

Date: _____

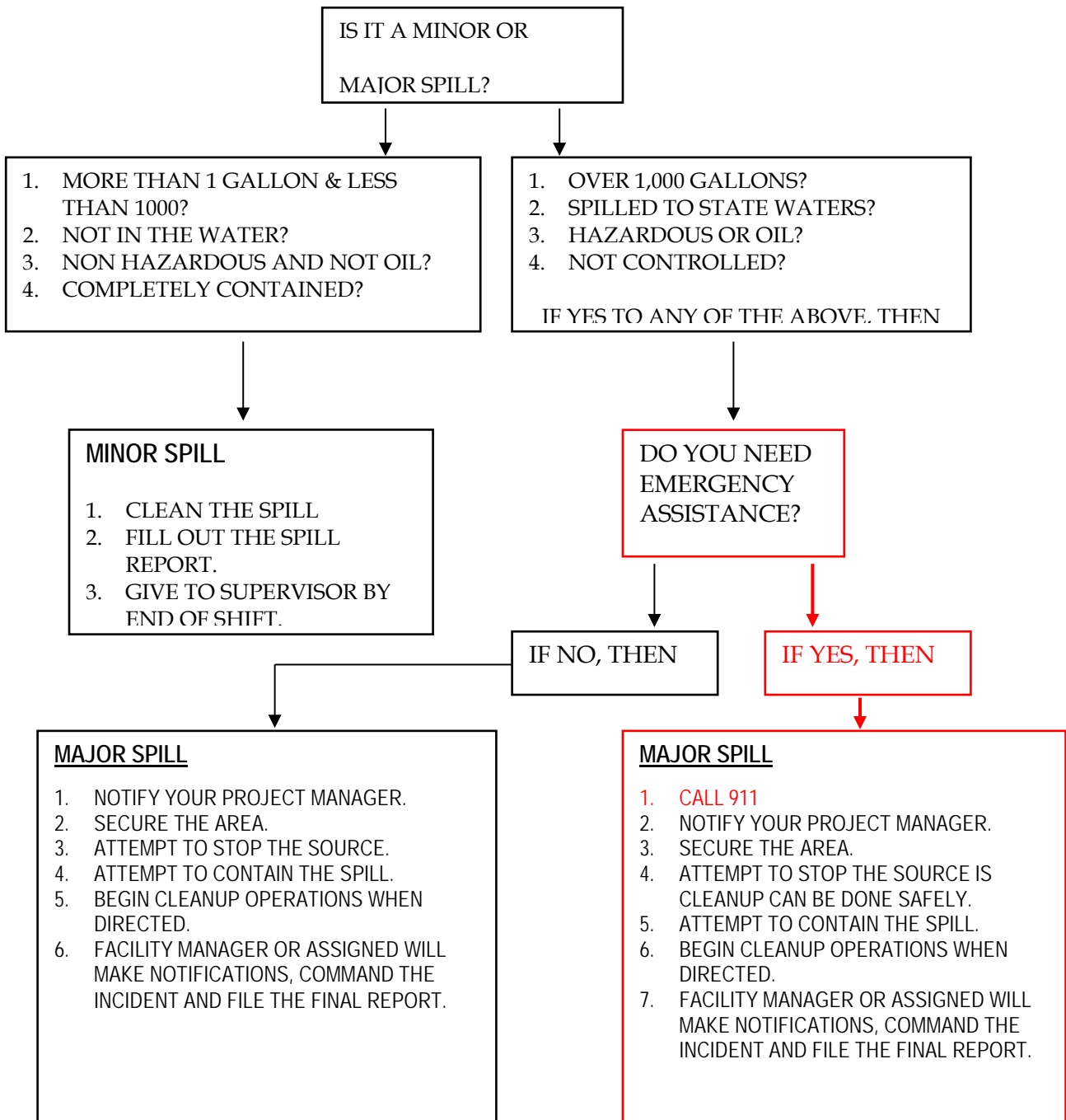
Name (please type or print): Adam McClymont

Title: Facility Manager

Spill Determination Flow Chart, Notification and Other Forms

Appendix C

SPILL DETERMINATION AND NOTIFICATION FLOW CHART



Inspection Records

Training Record

SPCC Training Record

Spokane County Regional Water Reclamation Facility
1004 N Freya Street
Spokane, WA 99202

Date: _____ Instructor: _____
Course Title: _____

Attendees

Name	Area/Shift	Initial for Attendance

Topics covered include:

SOPs

Process Example

Attached are the SOPs for the Primary Clarifier process. These nine SOPs are an example of what is provided for all the equipment at the facility. All SOPs will be stored on a server within a database driven document management system and linked to their corresponding equipment within the SCADA interface. Since each SOP is a living document it will be reviewed and revised on a regular basis.

The SOPs provided in this example are:

- Primary Clarifier Fill
- Primary Clarifier Launder Inspection
- Primary Clarifier Odor Control System Startup
- Primary Scum Pump Startup
- Primary Scum recirculation
- Primary Scum to Digester
- Primary Scum Wetwell
- Primary Sludge Blanket Monitoring
- Primary Sludge Pump Start



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary Clarifier Start Up/Fill
SOP ID #	60
Area Name	Primary Clarifier
Category	Clarifier
Sub Category	Basin
Date Created	March 28, 2011
Date Revised	

SAFETY WARNING

Review MSDS for Ferric chloride and polymer. All machine guards must be in place before running.

PRESTART CHECKS

Step	Action	Description	Remarks
1	Ferric chloride	Check delivery system	
2	Polymer	Check delivery system	
3	Drive	Check drive for proper operation	
4	Prepare	Ensure effected processes are ready	

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Foul Air	Prepare odor control fans and system	See other SOP
2	Foul Air	Open foul air removal butterfly valve 59VBF10505	Valve listed for clarifier 1
3	Foul Air	Open foul air transfer butterfly valve 59VBF10503	If directing foul air from screens through clarifier
4	Spray Water	Prepare plant water pump system	See other SOP
5	Spray Water	Open ball valve 59VBL10506	Valve listed for clarifier 1
6	Scum	Prepare primary scum system	See other SOP
7	Mode Select	Place the drive in OFF position at local control panel	
8	Jog	Jog the clarifier drive by placing in ON position at local control panel	Check for unusual noise, vibration, torque
9	Mode Select	Place the drive in REMOTE at local control panel	
10	Drive	Turn drive on from HMI	Utilizing RUN command 6000101
11	Open Gate	Open effluent sluice gate 60GTE00801	Gate listed for clarifier 1
12	Upstream	Prepare aerated grit basin	See other SOP
13	CEPT	Prepare Ferric chloride and polymer dosing systems	See other SOP
14	Sludge	Prepare sludge removal pumps	See other SOP
15	Open Gate	Open gate valve 59VGT10504 from aerated grit basin	Gate listed for clarifier 1



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Clarifier Launderers Inspection
SOP ID #	60
Area Name	Primary Clarifier
Category	Clarifier
Sub Category	Launderers
Date Created	March 28, 2011
Date Revised	

SAFETY WARNING**PRESTART CHECKS**

Step	Action	Description	Remarks
1	Observation	Watch for walkway/access hazards	
2	Observation	Alert personel on deck of work	
3	Tools	Flashlite/ Rake	
4			
5			
6			

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Open Hatch	Open access hatch	
2	Inspect	Using a flashlite look at launders through access hatch	
3	Note	Remove any debris breaching launders	
	Collect	Place debris in appropriate container, e.g. bucket	
4	Observe	Check that launder is level throughout circumference of clarifier	
	Closure	Close hatch	
5	Continue	Repeat procedure at next hatch	
6	Completion	Check that all hatches are closed	
7			



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Clarifier odor control system startup
SOP ID #	60
Area Name	Clarifier
Category	Odor control system
Sub Category	Clarifier
Date Created	March 29,2011
Date Revised	

SAFETY WARNING**PRESTART CHECKS**

Step	Action	Description	Remarks
1	Alert	Inform plant personel of activity	
2	Ventilation	if not operating it may be nesseccary to open two hatchs on lic	

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Open Valve	Open valve VBF 10505	
2	Open Valve	Open valve VBF 10503	
3	Close valve	Close valve VBF10502	
4	Open Valve	Open valve VBF 10501	
5	Open Valve	Open valve VBF 10500	
6	Start fans	Start fans 09-N-0139	
7	Start fans	Start fan 59FAN02800	



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary scum pump startup
SOP ID #	60
Area Name	Primary clarifier
Category	Scum handling
Sub Category	Scum pump
Date Created	March 29, 2011
Date Revised	

SAFETY WARNING

Verify that all guards and grates are in place.

PRESTART CHECKS

Step	Action	Description	Remarks
1	Observation	Verify wetwell level sufficient to provide flow for pump	
2	Observation	Verify valve positions	
3	Observation	Level monitor functional	
4	Observation	Verify/Input pump operating levels	Plant Control System HMI
5	Observation	Verify condition/ operation of valve	
6	Observation	Verify that pump discharge pressure and stator temperature allow system to operate	Plant Control System HMI

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Level check	Verify wetwell level	
2	Recirculation valve control	Control using REMOTE-MANUAL control for OPEN-CLOSE	Valve controlled via wetwell level at HMI
3	Discharge valve control	Control using REMOTE-MANUAL control for open-close	Valve controlled via wetwell level at HMI
4	Scum pump control	Control using LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO mode of operation and ON-OFF Status of pump	Pump cycle controlled by wetwell level at HMI
5	Verify	Note condition of check valve between recirculation valve(602) and digester transfer valve(601)	

This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary scum recirculation
SOP ID #	60
Area Name	Primary clarifier
Category	Scum handling
Sub Category	Primary scum recirculation
Date Created	March 30, 2011
Date Revised	

SAFETY WARNING

Verify that all guards and grates are in place.

PRESTART CHECKS

Step	Action	Description	Remarks
1	Observation	Verify wetwell level sufficient to provide flow for pump	
2	Observation	Verify valve positions	
3	Observation	Level monitor functional	
4	Observation	Verify/Input pump operating levels	
5	Observation	Verify condition/ operation of valve	
6	Observation	Verify that pump discharge pressure and stator temperature allow system to operate	

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Verification	Note that if system is in AUTO when pump turns on recirculation valve(602) is OPEN for two minutes then discharge valve(601) OPEN and 602 CLOSE, pump runs until receives low level signal from SCADA	
2	Set levels	Set/Verify wetwell levels for pump operation	Wetwell control levels are set at Plant Control System HMI
3	Level check	Verify wetwell level	Wetwell level needs to be sufficient for pump operation
4	Recirculation valve(6000602)	OPEN valve, Control using REMOTE-MANUAL control for OPEN-CLOSE	Valve controlled via wetwell level and at HMI
5	Discharge valve(6000601)	CLOSE valve, Control using REMOTE-MANUAL control for OPEN-CLOSE	Valve controlled via wetwell level and at HMI
6	Scum pump control	START pump, Control using LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO mode of operation and ON-OFF Status of pump	Pump cycle controlled by wetwell level through LCP or Plant Control System HMI
7	Verify	Note condition of check valve between recirculation valve(602) and digester transfer valve(601)	



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary scum to digester
SOP ID #	60
Area Name	Primary clarifier
Category	Scum handling
Sub Category	Scum to digester
Date Created	March 29, 2011
Date Revised	

SAFETY WARNING

Verify that all guards and grates are in place.

PRESTART CHECKS

Step	Action	Description	Remarks
1	Observation	Verify wetwell level sufficient to provide flow for pump	
2	Observation	Verify valve positions	
3	Observation	Level monitor functional	
4	Observation	Verify/Input pump operating levels	Plant Control System HMI
5	Observation	Verify condition/ operation of valve	
6	Observation	Verify that pump discharge pressure and stator temperature allow system to operate	Plant Control System HMI

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Level check	Verify wetwell level	
2	Discharge valve(600060 1)	OPEN discharge valve(601), Control using REMOTE-MANUAL control for open-close	Valve controlled via wetwell level at HMI
3	Recirculation valve(600060 2)	CLOSE recirculation valve(602) Control use REMOTE-MANUAL at HMI	Valve controlled via wetwell level at HMI
4	Scum pump control	Control using LOCAL-MANUAL, REMOTE-MANUAL, REMOTE-AUTO mode of operation and ON-OFF Status of pump	Pump cycle controlled by wetwell level at HMI
5	Verify	Confirm that digesters have the capacity to hold pumped volume	
6	Verify	Note condition of check valve between recirculation valve(602) and digester transfer valve(601)	
7	Verify	If system is in AUTO the pump turns on, recirculation valve(602) is OPEN for two minutes then discharge valve(601) OPEN and 602 CLOSE, pump runs until receives low level signal from SCADA	If activated manually the wetwell recirculation procedure will not occur unless also implemented manually. Valve controlled via wetwell level at HMI



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary scum wetwell fill
SOP ID #	60
Area Name	Primary clarifier
Category	Scum handling
Sub Category	vault fill
Date Created	March 30, 2011
Date Revised	

SAFETY WARNING

Verify that all guards and grates are in place.

PRESTART CHECKS

Step	Action	Description	Remarks
2	Observation	Verify valve positions	
3	Observation	Level monitor functional	
4	Observation	Verify/Input pump operating levels	Plant Control System HMI
5	Observation	Verify condition/ operation of valve	
6	Observation	Verify that pump discharge pressure and stator temperature allow system to operate	Plant Control System HMI

MAIN PROCEDURES

Step	Action	Description	Remarks
1	Level check	Verify wetwell level	
1	Level check	Verify that clarifier is full and operating	See SOP
1	Verify	Check that scum rake is functioning	Floating scum should be discharged into wetwell



This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary sludge blanket monitoring
SOP ID #	60
Area Name	Primary clarifier
Category	Sludge blanket
Sub Category	Sludge blanket monitoring
Date Created	March 31, 2011
Date Revised	

SAFETY WARNING

Verify that all guards and grates are in place.

PRESTART CHECKS

Step	Action	Description	Remarks
1	Observation	Survey walk paths, steps and clarifier lid for hazards	
2			
3	Pump Verification	Verify that the primary sludge pump is functioning	
4	Display SCADA	Pull up proper screen for TSS and pump rate viewing	
5			
6			

MAIN PROCEDURES

Step	Action	Description	Remarks
1	TSS Monitoring	At a SCADA monitor observe and note the TSS level in the Primary Clarifier Sludge Line	Verify that sludge pump is on
2	Note trend	Observe the TSS concentration trend	
3	Set pump speed	If the TSS concentration is not steady or not at the proper level adjust the pump flow to achieve the proper/even concentration	
4	Observe	Watch TSS concentration to confirm appropriate action was taken	

This procedure does not include extraordinary conditions and may need to be modified to ensure personal safety and to prevent harm to equipment or processes. If procedures are unclear ask for training or clarification and always adhere to safety protocol.

Title	Primary Sludge Pump Start Up
SOP ID #	60
Area Name	Primary Clarifiers
Category	Primary Sludge
Sub Category	Pumping
Date Created	March 28, 2011
Date Revised	

SAFETY WARNING

All machine guards must be in place before operating equipment.

PRESTART CHECKS			
Step	Action	Description	Remarks
1	Power	Check local disconnect/breaker	
2	Downstream	Prepare destination to receive sludge	
MAIN PROCEDURES			
Step	Action	Description	Remarks
1	Open Valve	Open plug valve 59VPL10600	Valves listed from primary clarifier 1 to pump 1
2	Open Valve	Open plug valve 59VPL10605	
3	Valve	To recycle to clarifier open 59VPL10607 and close 59VPL10606	
4	Valve	To go to blended sludge storage tank close 59VPL10607 and open 59VPL10606	Also open 59VPL10608
5	Valve	To bypass blended sludge storage tank to anaerobic digester open plug valve 78VPL14407	
6	Upstream	Confirm process liquid/sludge is available in clarifier	
7	Standby pump	Valve a second pump similar to above	To serve as standby, with two clarifiers valve all 3 pumps
8	Mode Select	Place pump(s) in local mode by placing LR switch 59HS03001A in LOCAL	Listed for pump 1
9	Jog	Jog pump(s) by placing SS switch 59HS03001B in START	Check for unusual noise, vibration, and pressure at 59 PE03201
10	Mode Select	STOP pump by placing SS switch 59HS03001B in STOP and place LR switch 59HS03001A in REMOTE	
11	Mode Select	Select Remote-Auto-Flow or Remote-Auto-Mass	See related UPCP
12	Check	Check flow meter 59FE03300	If going to blended sludge storage tank
13	Check	Check TSS analyzer 59AE03500	If going to blended sludge storage tank

Document Management System

Description

All electronic Operations and Maintenance information will be stored in a document management system on a local server, available on-line via a web interface. The document management system uses an ODBC compliant database, and organizes information by process.

Appendix A. Reporting Schedule

Due Date	Frequency	Name	Location
90 days year's end	Annual	Annual Operations and Maintenance Summary	Service Contract Appendix 9
180 days year's end	Annual	Company wide financial report	Service Contract Article VIII
NA	Annual	IPP Report	Service Contract Article IX
120 days prior to year's end	Annual	Budget "Estimate of the Aggregate Service Fee for Each Annual Reset Group"	Service Contract Article VIII
30 days contract year's end	Annual	Annual Settlement Statement	Service Contract Article VIII
15 days month's end	Monthly	Facility Operation, Maintenance and Performance Report	Service Contract Appendix 9
15 days month's end	Monthly	Monthly Odor Control Practices Report	Service Contract Appendix 9
15 days month's end	Monthly	Monthly Complaint Log	Service Contract Appendix 9
15 days month's end	Monthly	Monthly Performance Report	Service Contract Appendix 9
Immediate	NA	Major injuries/incidents	Service Contract Appendix 9
15 days quarter's end	Quarterly	Quarterly Maintenance, Repair, Replacement Report	Service Contract Appendix 9
TBD	TBD	Regulatory Agency Reports	Service Contract Appendix 9