

# Preparing for and Executing Major Operations Changes

---

Christen Wood

Operations Administrator

Summit County

Upper  
Tuscarawas:  
Transition from  
RBC to BNR

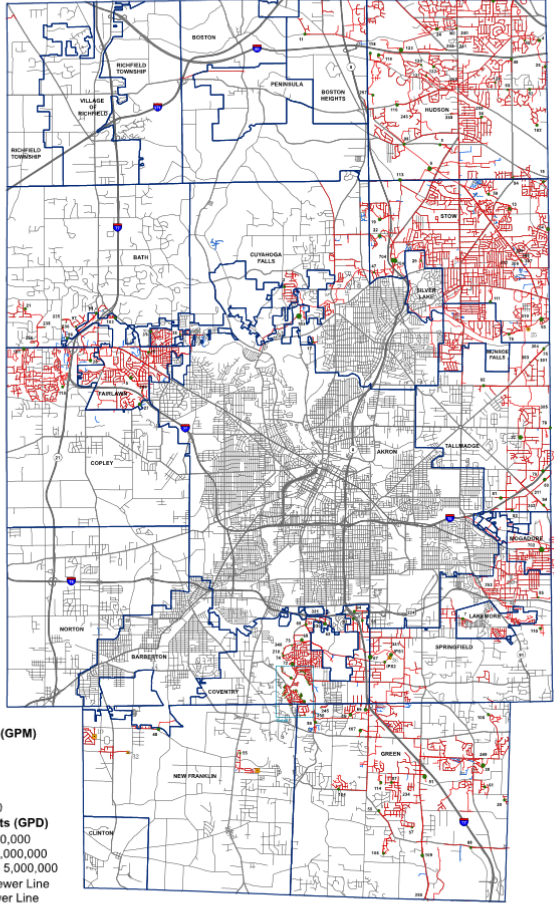
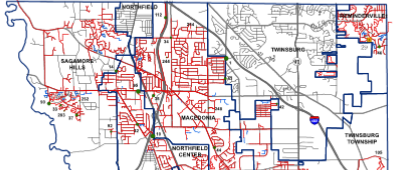
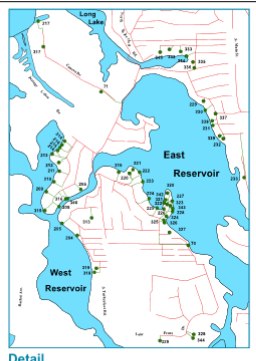
- Overview of previous and upgraded plant
- Documentation
- Training
- Preventive Maintenance
- Sampling and Analysis
- Workplace cultural awareness
- Lessons learned

# Summit County, Ohio



- 50,000 people
- 20 communities
  - Akron is the largest city, but is independently sewerred and treated

Summit County  
Department of Environmental Services  
**Pump & Plant Locations**



- Pump Stations (GPM)**
- 10 - 25
  - 26 - 100
  - 101 - 500
  - 501 - 1500
  - 1501 - 3000
- Treatment Plants (GPD)**
- 10,000 - 100,000
  - 100,001 - 1,000,000
  - 1,000,001 - 5,000,000
- D.O.E.S. Sewer Line  
— Private Sewer Line

Wastewater Pumping Stations

ID	Name	Capacity (GPM)	Location
101	Adams	100	Adams
102	Adams	100	Adams
103	Adams	100	Adams
104	Adams	100	Adams
105	Adams	100	Adams
106	Adams	100	Adams
107	Adams	100	Adams
108	Adams	100	Adams
109	Adams	100	Adams
110	Adams	100	Adams
111	Adams	100	Adams
112	Adams	100	Adams
113	Adams	100	Adams
114	Adams	100	Adams
115	Adams	100	Adams
116	Adams	100	Adams
117	Adams	100	Adams
118	Adams	100	Adams
119	Adams	100	Adams
120	Adams	100	Adams
121	Adams	100	Adams
122	Adams	100	Adams
123	Adams	100	Adams
124	Adams	100	Adams
125	Adams	100	Adams
126	Adams	100	Adams
127	Adams	100	Adams
128	Adams	100	Adams
129	Adams	100	Adams
130	Adams	100	Adams
131	Adams	100	Adams
132	Adams	100	Adams
133	Adams	100	Adams
134	Adams	100	Adams
135	Adams	100	Adams
136	Adams	100	Adams
137	Adams	100	Adams
138	Adams	100	Adams
139	Adams	100	Adams
140	Adams	100	Adams
141	Adams	100	Adams
142	Adams	100	Adams
143	Adams	100	Adams
144	Adams	100	Adams
145	Adams	100	Adams
146	Adams	100	Adams
147	Adams	100	Adams
148	Adams	100	Adams
149	Adams	100	Adams
150	Adams	100	Adams
151	Adams	100	Adams
152	Adams	100	Adams
153	Adams	100	Adams
154	Adams	100	Adams
155	Adams	100	Adams
156	Adams	100	Adams
157	Adams	100	Adams
158	Adams	100	Adams
159	Adams	100	Adams
160	Adams	100	Adams
161	Adams	100	Adams
162	Adams	100	Adams
163	Adams	100	Adams
164	Adams	100	Adams
165	Adams	100	Adams
166	Adams	100	Adams
167	Adams	100	Adams
168	Adams	100	Adams
169	Adams	100	Adams
170	Adams	100	Adams
171	Adams	100	Adams
172	Adams	100	Adams
173	Adams	100	Adams
174	Adams	100	Adams
175	Adams	100	Adams
176	Adams	100	Adams
177	Adams	100	Adams
178	Adams	100	Adams
179	Adams	100	Adams
180	Adams	100	Adams
181	Adams	100	Adams
182	Adams	100	Adams
183	Adams	100	Adams
184	Adams	100	Adams
185	Adams	100	Adams
186	Adams	100	Adams
187	Adams	100	Adams
188	Adams	100	Adams
189	Adams	100	Adams
190	Adams	100	Adams
191	Adams	100	Adams
192	Adams	100	Adams
193	Adams	100	Adams
194	Adams	100	Adams
195	Adams	100	Adams
196	Adams	100	Adams
197	Adams	100	Adams
198	Adams	100	Adams
199	Adams	100	Adams
200	Adams	100	Adams

Wastewater Treatment Plants

ID	Name	Capacity (GPD)	Location
1	Broken Fence	40,000	Broken Fence
2	Melody Village	100,000	Melody Village
3	Zelray Park	132,000	Zelray Park
4	Upper Tuscarawas	4.0 MGD	Upper Tuscarawas
5	Fishcreek	5.0 MGD	Fishcreek

# Collection and Treatment Systems

- 219 pump stations
- 6 wastewater treatment plants
  - Broken Fence (40,000gpd)
  - Melody Village (100,000gpd)
  - Zelray Park (132,000gpd)
  - Upper Tuscarawas (4.0 MGD)
  - Fishcreek (5.0 MGD)



Plant 36 aerial



# Upper Tuscarawas (Plant #36)

- Designed and built in the late 1970s
- First in service in 1980
- 25% of flow (up to 1 MGD) belongs to Stark County
- 4.0 MGD average and 10.0 MGD Max (hydraulic)

# Previous Process Units

---

Influent pump stations

---

Manual bar rack

---

Grit removal

---

Fine screen

---

Primary clarification

---

Chemical phosphorus removal

---

Rotating Biological Contactors

---

Final Clarifiers

---

Tertiary Filters

---

Post aeration

---

UV Disinfection

---

Aerobic Digestion

---

Belt Press

---

# Current Process Units

---

Influent pump stations

---

Manual bar rack

---

Grit removal

---

Fine screen

---

~~Primary clarification~~

---

Chemical phosphorus removal

---

~~Rotating Biological Contactors~~ Biological Nutrient Removal

---

Final Clarifiers

---

Tertiary Filters

---

Post aeration

---

UV Disinfection

---

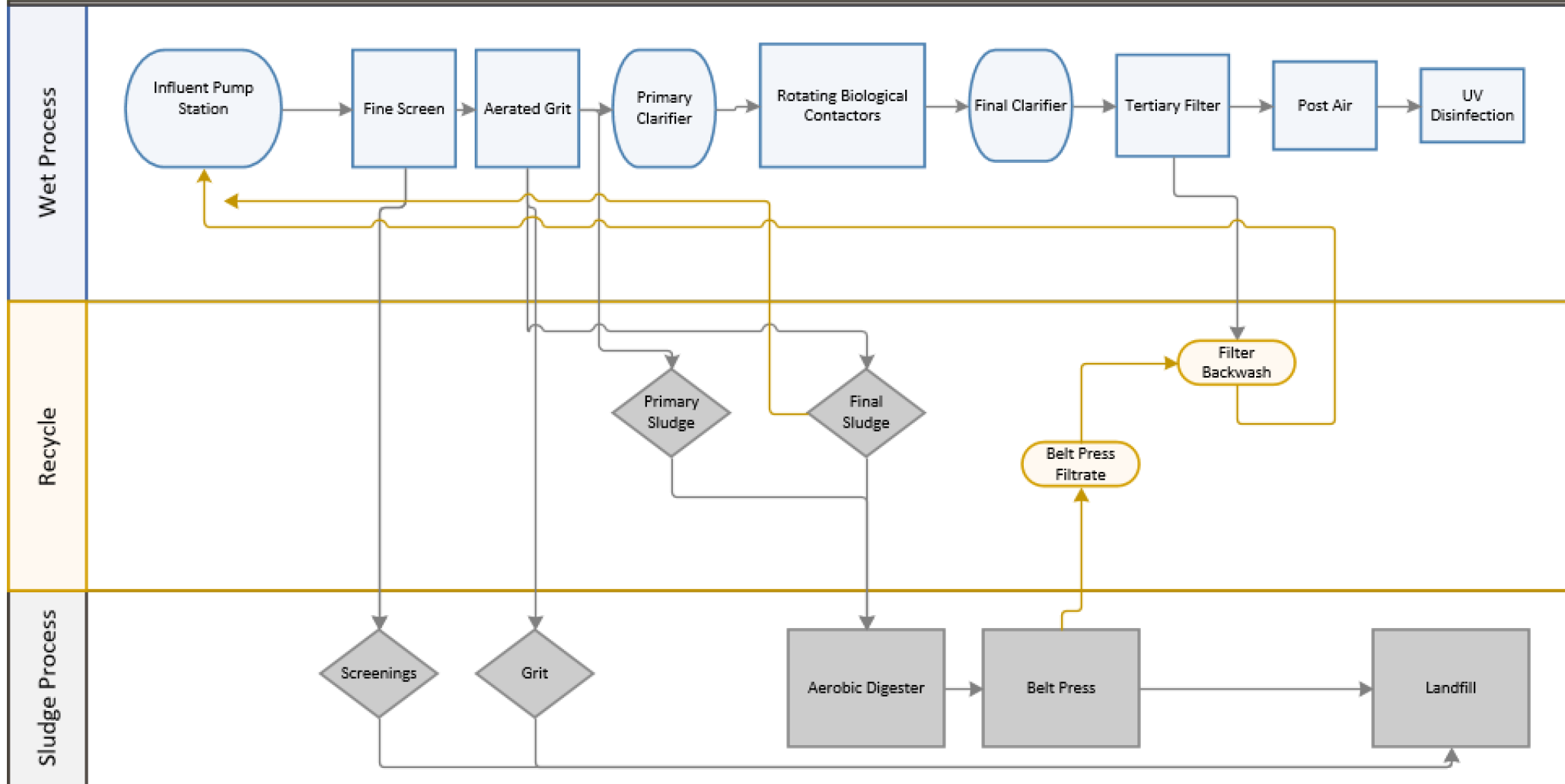
Aerobic Digestion

---

Belt Press

---

# Upper Tuscarawas Plant 36 Process Flow





The VIP process is illustrated below

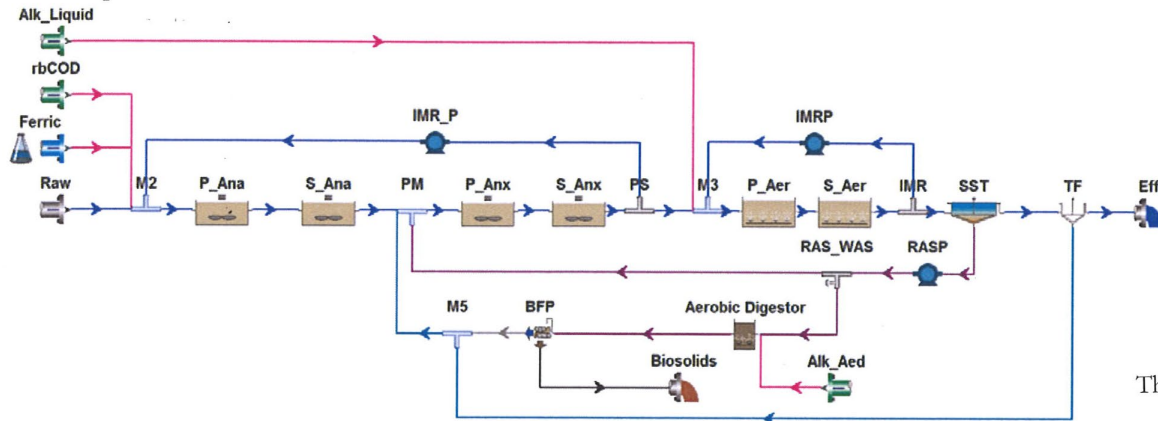


Figure 4-10: Virginia Initiative Plant (VIP) Process

The modified UCT process is illustrated below in Figure 4-6.

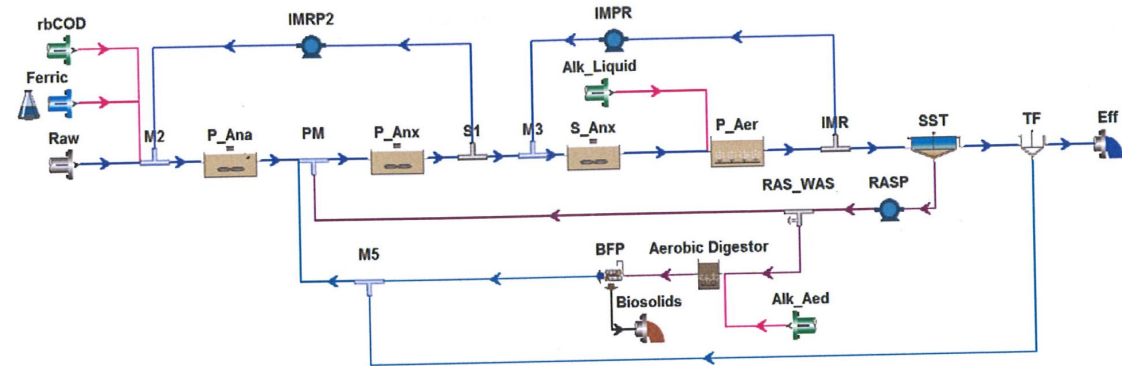


Figure 4-6: Modified UCT Process

## VIP/MUCT Process Diagrams

Prepared by MS Consultants

“Upper Tusc WWTP #36 RBC Replacement Basis of Design” June 2017



# BNR Facility

- Anaerobic/ Anoxic/ Aerobic zones
- Scum removal
- Fiberglass baffles will allow plant to choose between VIP and MUCT design style

# Documentation

- Write down everything you can, early and often
  - “Quick to start, slow to finish”
- Transfer to a master file on a computer
  - Continuous improvement- add and remove as you go!
- As you think through all the little details, write it down.
  - Forces you to think and re-think processes.
- If you write it down, you won't have to work so hard to remember later!!
- Startup alarm log



# Documentation



## Round sheets

Collect important information

Ensure consistency

Guide observations

Include targets or limits



## Checklists

Good for training, too!

## Physical Rounds

- Physical inspection of all equipment
  - Does it sound right? Smell right? Look right?
- Check old plant
  - EQ tanks empty unless above 5 MGD
- Check all pumping rates
  - Influent (2.5 MGD/tank)
  - RAS (80-100% influent)
  - IMLR Anoxic (50-150% influent)
  - IMLR Anaerobic (200-400% influent)
- Check all mixers (good roll pattern, no faults, no dead spots)
- Sludge Blankets (around 2 feet)
- Check weirs (clean, not blocked, no bulking sludge)
- Skim (not operable yet)
- Check chemical tank levels
  - Also check for signs of leaks around pumps and tanks
  - Tank reorder level is 24 inches
  - Maximum fill level is 10 feet
- Complete round sheets
- Fill out logbook
- Collect samples
  - Phosphorus: influent, anaerobic, effluent
  - Ammonia: effluent
  - Mixed Liquor
  - RAS Well

## Computer/SCADA Rounds

- Adjust wasting (12-day SRT)
- Check/ adjust chemical dosing
- Check alarms (Alarms can NOT be ignored, must be responded to, or reported)
- Check instrumentation
  - pH
    - (7.2 - 8.0)
  - DO
    - Primary Aerobic: (2.0– 3.0)
    - Secondary Aerobic: (1.5 - 2.0)
  - ORP
    - Anaerobic: (-250 to -150)
    - Primary Anoxic: (-100 to 100)
    - Secondary Anoxic: (-100 to 0)
  - Nitrates
    - Anaerobic (less than 5)

## Lab Work

- Mixed Liquor Suspended Solids (MLSS)
  - East Aeration
  - West Aeration
  - East RAS
  - West RAS
- Settleability
  - East Aeration
  - West Aeration
- Microscopic Analysis
  - East Aeration
  - West Aeration
- Phosphorus
  - Influent
  - Anaerobic
  - Effluent
- Ammonia
  - Effluent
- Calculations
  - Desired Wasting (SRT=12 day)
  - SVI (50-150)

## Anaerobic Zone East

Parameter	Primary ORP	Secondary ORP	Mixers	NO3	IMLR	Micro-C Dose	Micro-C Flow
Targets	-250 to -150	-250 to -150	(2) On	Less than 5	200%-400% Influent	n/a	n/a
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

# Documentation

- Daily log
  - “Anything with the potential to affect effluent quality or quantity”
  - During new process startups-that is EVERYTHING
    - Better notes, better chance of being able to recreate a chain of events

80

5/20/21 C. Wood  
 Digestive blowers off - putting air line  
 Cleaning BCRs  
 Finished w/ draining digesters  
 Troubleshoot BKR flow meter  
 Package plants - vanilla mash tank  
 32 sand beds need cleaned (2 sludges, 1 weeks)

PIT 86 7:00-10:30 & 12:30-15:00  
 PIT 48 10:50-11:05  
 PIT 32 11:20-11:25

5/21/21 C. Wood  
 Tested BKR flow meter - maybe needs driped?  
 Bubbles went back into influent tank  
 V. Ferrant of Sigma tested positive for Covid  
 administered tests to both H. Chosset  
 R. Yazoue Close, ans at work already  
 and Yazoue claimed to have no access  
 to a laptop or webcam enabled  
 computer. I offered to bring mine to  
 him, he refused. Called back and  
 agreed to come into work.  
 Digester blower 1 off @ VFD - why?  
 PIT 86 7:00-15:00

5/22/21 C. Wood  
 Start @ Fishweek - on call back to Long

UPPER TUSC  
 June 2021  
 - Requires 20.00 hrs/wk; 5 days/wk

DATE	TIME IN	TIME OUT	TIME IN	TIME OUT	TOTAL HOURS	PERSON - Name or signature (initials)	ID#	Collection Sys Name & Lic #
11/7/00						C. Wood	1113905	
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								

75.00  
 1  
 TIGHT  
 'S MATERIA  
 CHARGE

75.00  
 21  
 154

1

VALUE  
 EVERY  
 The  
 digester  
 gates  
 BACK

in down on VFDs for paper pumps  
 influent flow meter  
 acidic high discharge  
 1/2 off in clarifier room  
 bic to 0.00% = 50% 150% @ 4/24 (2662.00)  
 BNR 1 400% = 8000 (pump needed at 6500)  
 Probably accurate, but scale is wrong  
 SUR 2 400% = 4000 (pump at 16,7200)  
 Wrong - very wrong  
 Change to correct % influent range  
 Ds on Main add decimals  
 use timing on air valves to slow wild swings  
 max treatment = 5% per minute (17min to fill tank?)  
 5% per 5 minutes (95 minutes full travel)  
 2 minutes  
 to anaerobic 200% 400%  
 et as 100-300  
 @ 300% = SP=3000, Pp=ppm=300  
 Should be 6186?  
 @ 300% = SP 6000 (Pp=4742-6200)  
 accurate, but scale is wrong  
 set influent control valve?  
 at scale inaccurate (not 32ft)  
 pumps  
 panel view  
 SCADA  
 Her - Gates are shown in wrong position/direction  
 either 1 to BNR2 goes to 1  
 from clarifier 2

Plant 36  
 Date: 5/27/2021  
 Operator: Christen Wood

OPERATIONS

Actions we took TODAY  
 BNR East and west running - east in manual and west in auto  
 Decanted digester 4 on 5/26  
 Decanted digester 3, 3 on 5/27  
 Digester 2 full, air on. Please begin rotating the digesters twice a shift. (see guidance sheet)  
 SCADA has alarms! Tested clarifier overtorque-successful!

Actions we are planning for NEXT WEEK  
 Necessary start bug juice dose 1.5 jugs per side, Monday and Thursday for 2 weeks. Then 1/2 jug per side once a week on  
 Thursdays  
 Next Wednesday (7) bypass BNR flow ~4 hours for air release tap  
 Open BKR bypass after influent cleaned  
 Clocking in/out to resume June 7<sup>th</sup>

MAINTENANCE

Equipment unavailable (include reason and work order #):  
 IPS isolation gate repair  
 Filter transducer 3  
 Pump IPS1 16907  
 BKR #2 leaking and mixer chamber  
 IPS 3 pump 2 PM-in process  
 Belt press pump replacements-in process

PROCESS CONTROL

Amount wasted today: 96,000 (auto)

SLUDGE

Belt Press gallons pressed:  
 Sludge truck status: (full/half/empty) 1/4  
 Hauler notified? n/a  
 Est pickup time? n/a

OTHER NOTES  
 Alarm status, Chemical deliveries, Staffing concerns, Construction updates, etc.

Location	Operator
Package Plant	Arnold
Maintenance	
Belt Press	Saulic
Plant	
BNR	Close

ORC Hours Name/License Hours  
 Plant 36 Christen Wood 1113905 6.0

Pull bypass gate  
 Gates -  
 prescription  
 Start phosplans @ 0.00%, anaerobic, etc.

2 1/2 jugs per side  
 Air on 5/27  
 Digester 2 full  
 for pass

recheck  
 overtorque?

Her -  
 Can we do  
 extra rotation  
 Pp truck  
 VFD alarm - low pressure



# Internal Training

## Contact Hours

- 7-part series


## Simulator Software

- Hydromantis

## Walkthrough/Talkthrough

# Vendor Training

Important BUT difficult to get  
operations training



Video training for review later



# Hands-On



Most operators learn best hands-on



Allow (Or Force!) workers to assist with testing, programming, equipment checks, etc.



Use checklists and round sheets

# Preventive Maintenance

- Collect as much preventive maintenance information from the vendor training as possible
- Write it down! Manuals are cumbersome, and you are likely to forget anything that isn't written down.
- Create a schedule that works best and write the schedule down too.
- Accountability for completing work

# Preventive Maintenance

- Don't forget the old equipment!
- Cleaning
- Use process shutdowns to do maintenance work, too
- Exercising both new and old equipment

# Sampling and Analysis

- Think through the data analysis you need for:
  - Day-to-day process control
  - Regulatory requirements
  - Optimization goals
  - Emergency operations
  - Troubleshooting

# Sampling and Analysis

- Put all the data in one place.
  - Easier cross-checking
  - Include:
    - Sample location
    - Volume needed
    - Tests
    - Calculations
    - Limits or targets
- Collect data both before and after the major process change. (Baseline)

# Excel: Index Match

=IF(INDEX(Historian!A7:BE7,MATCH("FLWAVG",Historian!A3:BE3,0))=0,"",INDEX(Historian!A7:BE7,MATCH("FLWAVG",Historian!A3:BE3,0)))

	Plant	Plant	Effluent	INFLUENT			
	Flow (AVG)	Flow (Week)	Flow (Max)	TSS	BOD	NH3	P
Sample ID	FLWAVG	FLWTOT	EFFFLWMAX	INFTSS	INFBOD	INFNH3	INFTPO
Units	MGD	MGD	MGD	mg/L	mg/L	mg/L	mg/L
Source	Historian	Historian	Historian	Lab	Lab	Lab	Lab
05-Jan-19 00:00:00	3.13	21.94	5.43	206.67	261.33	22.3	4.5

EFFLUENT					
TSS	BOD	NH3	P	E. coli	DO
EFFTSS	EFFBOD	EFFNH3	EFFTPO	EFFECO	EFFDOX
mg/L	mg/L	mg/L	mg/L	CFU	mg/L
Lab	Lab	Lab	Lab	Lab	Historian
12.00	11.00	5.90	1.40		8.05

Effluent							
TSS	TSS	BOD	BOD	P	P	NH3	NH3
Loading	% Removal (Plant)	Loading	% Removal (Plant)	Loading	% Removal (Plant)	Loading	% Removal (Plant)
Calculate	Calculate	Calculate	Calculate	Calculate	Calculate	Calculate	Calculate
314	94.2%	287.526461	95.8%	36.5942769	68.9%	154.218738	73.5%

Location Codes	
<i>Wet Side</i>	
ANE	Anaerobic Zone-East
ANW	Anaerobic Zone-West
ARE	Aerobic Zone-East
ARW	Aerobic Zone-West
AXE	Anoxic Zone- East
AXW	Anoxic Zone-West
BYE	Equalization Train/Bypass
BYF	Tertiary Filter Bypass
CAE	Caustic East
CAW	Caustic West
CLE	Final Clarifier-East
CLW	Final Clarifier-West
EFF	Plant Effluent
FIL	Tertiary Filter
IBN	Influent BNR
INF	Plant Total Influent
MCE	Micro-C East
MCW	Micro-C West
SAE	Sodium aluminate east
SAW	Sodium Aluminate West
<i>Dry Side</i>	
BAW	Filter Backwash
BPF	Belt Press Filtrate
BPI	Belt Press Influent (Digester Eff)
CAK	Sludge Cake
NRE	Anaerobic Internal Mixed Liquor Return- East
NRW	Anaerobic Internal Mixed Liquor Return- West
RSE	Return Activated Sludge-East
RSW	Return Activated Sludge-West
WSE	Waste Sludge East
WSW	Waste Sludge West
XRE	Anoxic Internal Mixed Liquor Return- East
XRW	Anoxic Internal Mixed Liquor Return- West

Test Codes	
ALK	Alkalinity
BLA	Sludge Blanket
BOD	cBOD
COD	Chemical Oxygen Demand
DOX	Dissolved Oxygen
ECO	E. coli
FLO	Flow (gpm)
FLW	Flow (MGD)
NH3	Ammonia
ONO	NO2 +NO3
ORP	Oxidation-Reduction Potential
PHX	pH
PO4	Ortho-Phosphorus
PTS	Percent Total Solids
PVS	Percent Volatile Solids
SBO	sBOD
SET	Settlability
TON	Wet Tons Hauled
TPO	Total Phosphorus
TSS	Total Suspended Solids
UIS	Units In Service

ANEONO	AXWONO	EFFNH3
ANEORP	AXWORP	EFFPO4
ANEPO4	AXWPO4	EFFTPO
ANWONO	BPFCOD	IBNFLW
ANWORP	BPF FLO	INFALK
ANWPO4	BPFNH3	INFCOD
AREALK	BPFONO	INFFLW
AREDOX	BPFTPO	INFNH3
ARENH3	BPIPTS	INFONO
AREONO	BPIPVS	INFPO4
AREPHX	BYEBOD	INFTPO
AREPO4	BYEFLW	MCEFLO
ARESET	BYETSS	MCWFLO
ARETSS	BYFBOD	NREFLW
ARWALK	BYFFLW	NRWFLW
ARWDOX	BYFTSS	RSEFLW
ARWNH3	CAEFLO	RSEPVS
ARWONO	CAKPTS	RSETSS
ARWPHX	CAKTON	RSWFLW
ARWPO4	CAWFLO	RSWPVS
ARWSET	CLEBLA	RSWTSS
ARWTSS	CLETSS	SAEFLO
AXEONO	CLWBLA	SAWFLO
AXEORP	CLWTSS	XREFLW
AXEPO4	EFFFLW	XRWFLW
		WSEFLW
		WSWFLW

<b>Wet Side</b>	ALK	BLA	BOD	COD	DOX	FLO	FLW	NH3	ONO	ORP	PHX	PO4	SET	TPO	TSS
Plant Total Influent	L			L			I	L	L			L		L	
Anaerobic Zone-East and West									I	I		O			
Anoxic Zone- East and West									I	I		O			
Aerobic Zone-East and West	L				I			L	L		I	O	O		O
Final Clarifier-East and West		O													L
Plant Effluent							I	L				O		L	
Equalization Train/Bypass			L				I								L
Tertiary Filter Bypass			L				O								L
Micro-C East and West						I									
Caustic East and West						I									
Sodium Aluminate East and West						I									

<b>Dry Side</b>	COD	FLO	FLW	NH3	ONO	PTS	PVS	TOM	TPO	TSS
Belt Press Filtrate	L	I		L	L				L	
Belt Press Influent (Digester Eff)						L	L			
Sludge Cake						L		O		
Anaerobic Internal Mixed Liquor Return- East and West			I							
Anoxic Internal Mixed Liquor Return- East and West			I							
Return Activated Sludge-East and West			I				L			O
Waste Sludge East and West			I							

I=Instrumentation

O=Operator

L=Laboratory

N=N/A



# Data Flagging

- Use conditional formatting to highlight data that doesn't “match”
  - Top or bottom %
  - Values exceeding a limit
  - Duplicates
  - Min, Max, Avg

SCADA.P55048_STATION_FLOW_TOT_YESTER.F_CV			1/1/2020	12/31/2020						
	TAG NAME	START	END							
Timestamp	Value									
02-Jan-20 00:00:00	63748.27311	63748.27								
03-Jan-20 00:00:00	61272.66504	61272.67								
04-Jan-20 00:00:00	56449.96191	56449.96								
05-Jan-20 00:00:00	52854.68359	52854.68								
06-Jan-20 00:00:00	68810.93848	68810.94								
07-Jan-20 00:00:00	64377.52604	64377.53								
08-Jan-20 00:00:00	59188.10335	59188.10								
09-Jan-20 00:00:00	52018.5612	52018.56		Min	38185.89					
10-Jan-20 00:00:00	52776.17611	52776.18		Max	160517.18					
11-Jan-20 00:00:00	54612.52507	54612.53		Avg	54988.37					
12-Jan-20 00:00:00	56776.81836	56776.82		Sum	19960777.87					
13-Jan-20 00:00:00	75463.74837	75463.75								
14-Jan-20 00:00:00	78124.00911	78124.01								
15-Jan-20 00:00:00	65596.24772	65596.25								
16-Jan-20 00:00:00	58738.58008	58738.58								
17-Jan-20 00:00:00	51820.12565	51820.13								
18-Jan-20 00:00:00	52945.15072	52945.15								
19-Jan-20 00:00:00	53502.09375	53502.09								
20-Jan-20 00:00:00	76777	76777.00								
21-Jan-20 00:00:00	81402.59245	81402.59								
22-Jan-20 00:00:00	72337.03646	72337.04								
23-Jan-20 00:00:00	64455.81445	64455.81								
24-Jan-20 00:00:00	66620.84049	66620.84								
25-Jan-20 00:00:00	60915.2054	60915.21								
26-Jan-20 00:00:00	68985.99902	68986.00								
27-Jan-20 00:00:00	86034.92513	86034.93								
28-Jan-20 00:00:00	81577.35807	81577.36								
29-Jan-20 00:00:00	67658.17188	67658.17								
30-Jan-20 00:00:00	66441.85156	66441.85								
31-Jan-20 00:00:00	63452.71973	63452.72								
01-Feb-20 00:00:00	60926.96517	60926.97								
02-Feb-20 00:00:00	59367.28939	59367.29								
03-Feb-20 00:00:00	66169.33431	66169.33								
04-Feb-20 00:00:00	68312.15039	68312.15								
05-Feb-20 00:00:00	68322.91833	68322.92								
06-Feb-20 00:00:00	68184.59059	68184.59								

Conditional Formatting Rules Manager

Show formatting rules for: Current Selection

New Rule... Edit Rule... Delete Rule

Rule (applied in order shown)	Format	Applies to	Stop If True
Top 10%	AaBbCcYyZz	= \$C\$4:\$C\$366	<input type="checkbox"/>

OK Close Apply



# Workplace Cultural Awareness

- Set groundwork early
  - But don't get overly technical until later
- Make the new process your “north star”
  - Can also be a trojan horse...
- Identify strengths and weaknesses
  - Who can become a leader in areas?
  - How do we begin to learn the skills?

# Workplace Cultural Awareness

- Get staff involved and exposed to as much of the change as possible
- Encourage problem solving
  - Troubleshoot problems that would normally be left for maintenance
- Encourage tough questions
  - Be willing to concede on some decisions/documentation you've already done
    - If you wrote it down in the computer- its easy to update or change!

# Workplace Cultural Awareness

There will be MAJOR problems

Construction

Equipment

Process

People

Accept the problems as a vehicle for  
building a resilient workforce

“We’ll either get it right, or we’ll learn something”

# Lessons Learned

- Get involved!
- Effluent quality always wins
- Check, check, check, and check again
- The best tests include all points of failure, so simulate bad conditions instead of using fake signals
- Document early in the process. You can always edit it once you have a baseline
- Most importantly: **Panic early and often.**
  - Not sure it helps, but I will be willing to commiserate with you!

