Consistent Compliance Using PCMP

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OTCO Compliance Workshop for Water and Wastewater Treatment

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Agenda

- What is PCMP
- PCMP Responsibilities
- PCMP Procedures
- Key Control Parameters
- Key Performance Indicators
- PCMP Tracking and Limits
- PCMP Reports and Forms
- Unit Process Strategies
- Summary

PCMP

What is PCMP?

PCMP

What is PCMP?

- **P**rocess **C**ontrol **M**anagement **P**lan for Water or Wastewater Operations
- Documented procedures to control process operations and performance
  - Meet regulatory compliance
  - Improve reliability, resiliency, performance
  - Based on best practice metrics
  - Control operating costs

PCMP

- Comprehensive approach to manage treatment plant operations
- Assessment of process control using established target parameters and best practice metrics
- Better means to track performance and meet regulatory compliance
  - Much more than just checking effluent quality for MOR's
- Verify data input from multiple sources
  - (lab data, operations data, online sensors, consultant projects, special studies)

PCMP

- Track process performance for compliance requirements
- Track performance to control operating costs
- Report performance exceptions that signal abnormal operations
- Identify corrective actions before non-compliance arises
- Provide operator guidance on expected performance and operating adjustments

PCMP

- Scientific approach to operational control of unit processes
  - Evaluations and study data suggest performance improvements
  - Benchmark metrics used to track performance against best practices
  - Trending and forecasting from historical data
  - Means to establish flags for parameters monitored
  - Alert system to maintain regulatory compliance

PCMP

- Plan development is a very detailed process and procedures
  - Outlines responsibilities and tasks
  - Defines data collection and key control parameters
  - Requires tracking and reporting
  - Uses key operational targets based on science and benchmarking metrics
  - Establishes written **U**nit **P**rocess **S**trategies to follow when tracking suggests abnormal operations
  - Encourages comprehensive review of operations performance and steps for corrective actions

PCMP Responsibilities

- Management
- Process control directors
- Process control specialists
- Plant operators
- Lab analysts
- Maintenance personnel
- Consultants
- Contracted staff

PCMP Responsibilities

- Management Responsibilities
  - Establish PCMP documentation and procedures
  - Review key control parameters (KCPs) and key performance indicators (KPIs)
  - Review overview/compliance reports
  - Review UPRs/exceptions reports
  - Review operating trends/graphical data
  - Review other custom reports
  - Define assistance where needed
  - Define investigations and special studies where necessary
    - In-house or contracted

PCMP Responsibilities

- Process Control Director
  - Establishes PCMP targets, limits, and parameters
  - Establishes process control database and data collection procedures
  - Implements PCMP
  - Manages Process Control meetings
  - Assigns tasks from meeting minutes
  - Ensures PCMP procedures are followed
  - Prepares/submits PCMP reports
  - Assigns follow-up investigations or studies
  - Suggests changes to PCMP or targets

PCMP Responsibilities

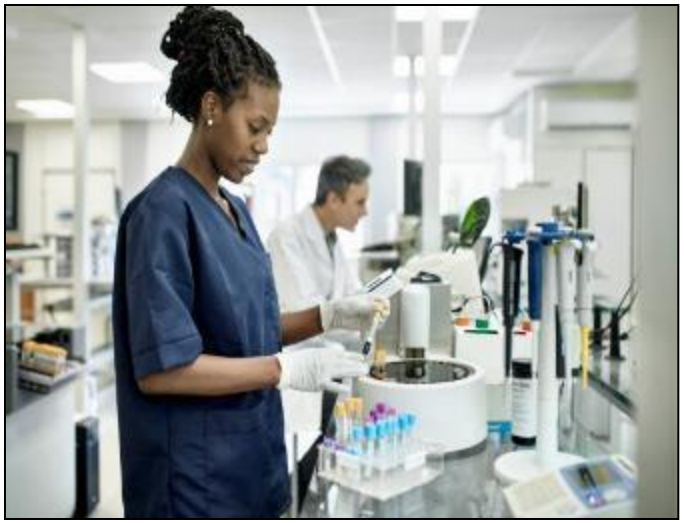
- Process Control Specialists
  - Participate in Process Control meetings
  - Conduct investigations or special assignments
  - Work with lab analysts and operators to control process performance
  - Help define corrective actions and adjustments
  - Ensure data collection is accurate and accountable
  - Review and analyze process performance
    - Target values, trend charts, compliance, abnormal operations, special studies

PCMP Responsibilities

- Plant Operators
  - Follow established PCMP guidance
  - Control process performance within established target parameters and limits
  - Input data to selected database system
  - Verify data collection and input values
  - Participate in Process Control meetings
  - Conduct assigned PCMP tasks
  - Follow SOPs and suggested adjustment procedures
  - Make necessary operating adjustments
    - Suggest changes to process targets based on data trends

PCMP Responsibilities

- Lab Analysts
  - Follow established PCMP guidance
  - Manage sample collection and sample analyses
    - Includes contract lab services
  - Input data to selected database system
  - Verify data collection and input values
  - Participate in Process Control meetings
  - Maintain lab QA/QC
  - Maintain chain-of-custody
  - Maintain process control records
  - Maintain database



PCMP Responsibilities

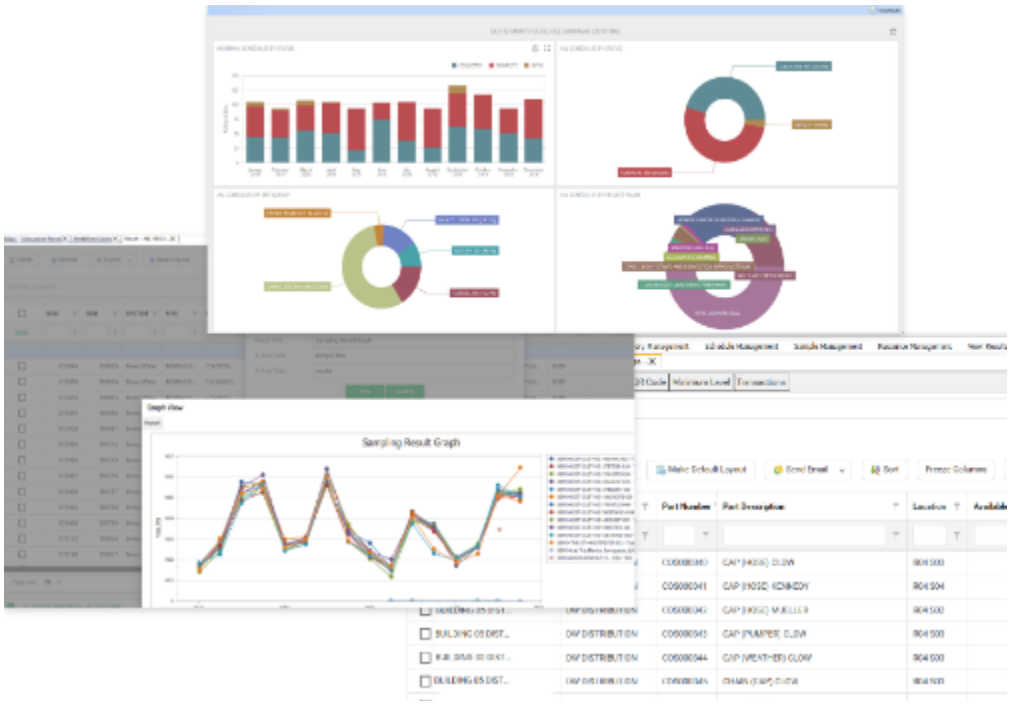
- Maintenance Personnel
  - Participate in Process Control meetings
  - Maintain process equipment to meet performance expectations
  - Understand role in PCMP procedures
  - Conduct investigations and special studies as assigned
  - Maintain energy consumption records
    - Electric utility or generated power
    - Water/sewer
    - Natural gas or biogas
    - Petroleum or diesel

PCMP Responsibilities

- Consultants/Contract Staff
  - Participate in Process Control meetings if requested
  - Review process performance when assigned
  - Conduct special studies and investigations
    - Develop targets from studies and reports
  - Report on process performance capabilities from studies and investigations
  - Suggest process control parameters, targets, limits from special studies and investigations

PCMP Procedures

- Select a database software
  - Microsoft Access
  - Hach Wims
  - Operator 10
  - WaterTrax
  - Locus Technologies
  - Lablite (LIMS)
  - Versa
  - fluence™
  - Brightly
  - Cartegraph
  - Samswater
  - Customized Microsoft Excel sheets



PCMP Procedures

- Develop written plan and documentation, forms and reports
- Establish tracking parameters and sample frequencies
  - Regulatory limits, guidance limits, process control data, benchmark metrics
- Set parameter targets and limits
- Develop data collection activities
  - Include validation and QA/QC
- Hold regular Process Control meetings and prepare minutes

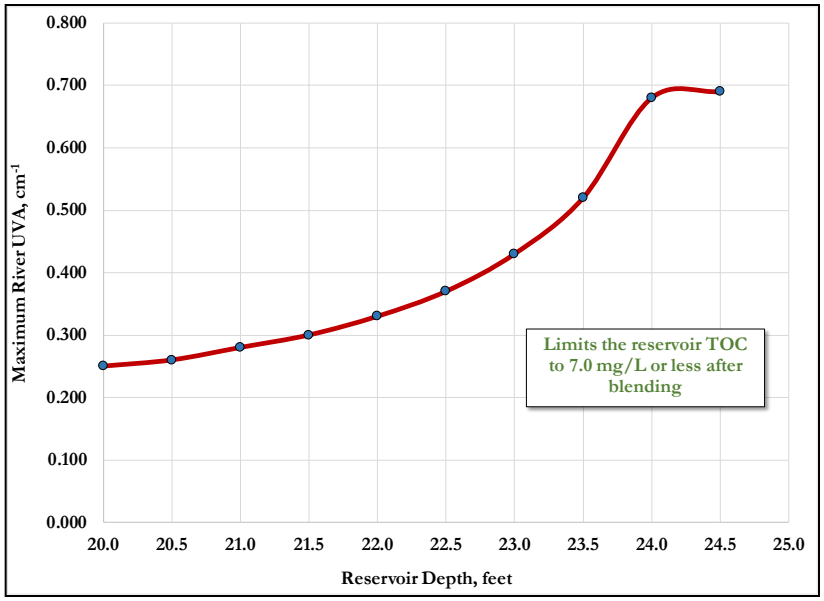
PCMP Procedures

- Develop reports and documentation
  - Exceptions, Process control
  - Compliance review
  - Unit process, change authorization
  - Consumables (if needed)
- Develop Unit Process Strategies (UPS)
  - Process design data
  - Typical performance data
  - Suggested corrective actions for abnormal operations
- Develop trending parameters and protocols

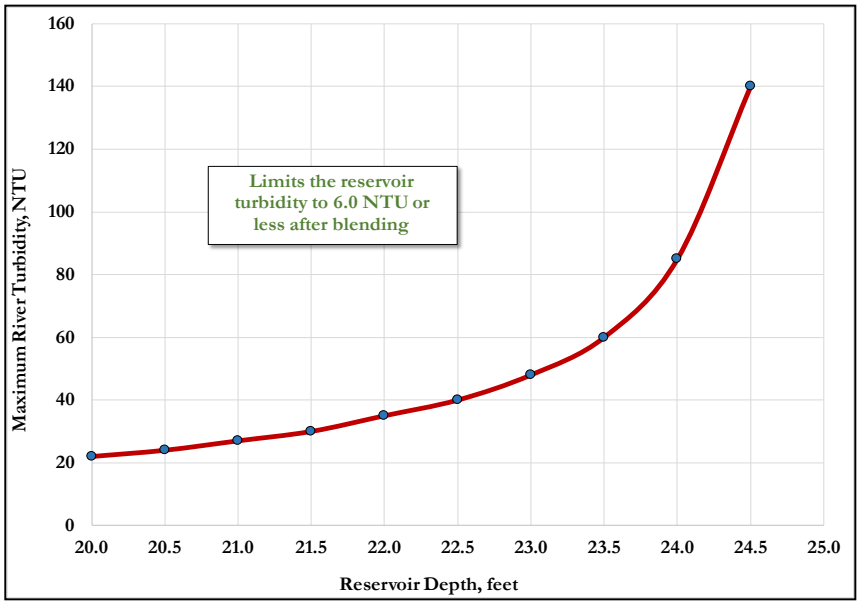
PCMP Procedures

- Select Key Control Parameters (KCPs) for plant operations
  - Track the most important data
  - What could produce non-compliance?
  - What could create plant upsets?
  - What could increase operating costs?
- Define Key Performance Indicators (KPIs) that suggest compliance with establish metrics
  - Industry standards
  - Best practices
  - Published data metrics

PCMP Procedures



Suggested Maximum UV Absorbance Values for River Pumping



Suggested Maximum Turbidity Values for River Pumping

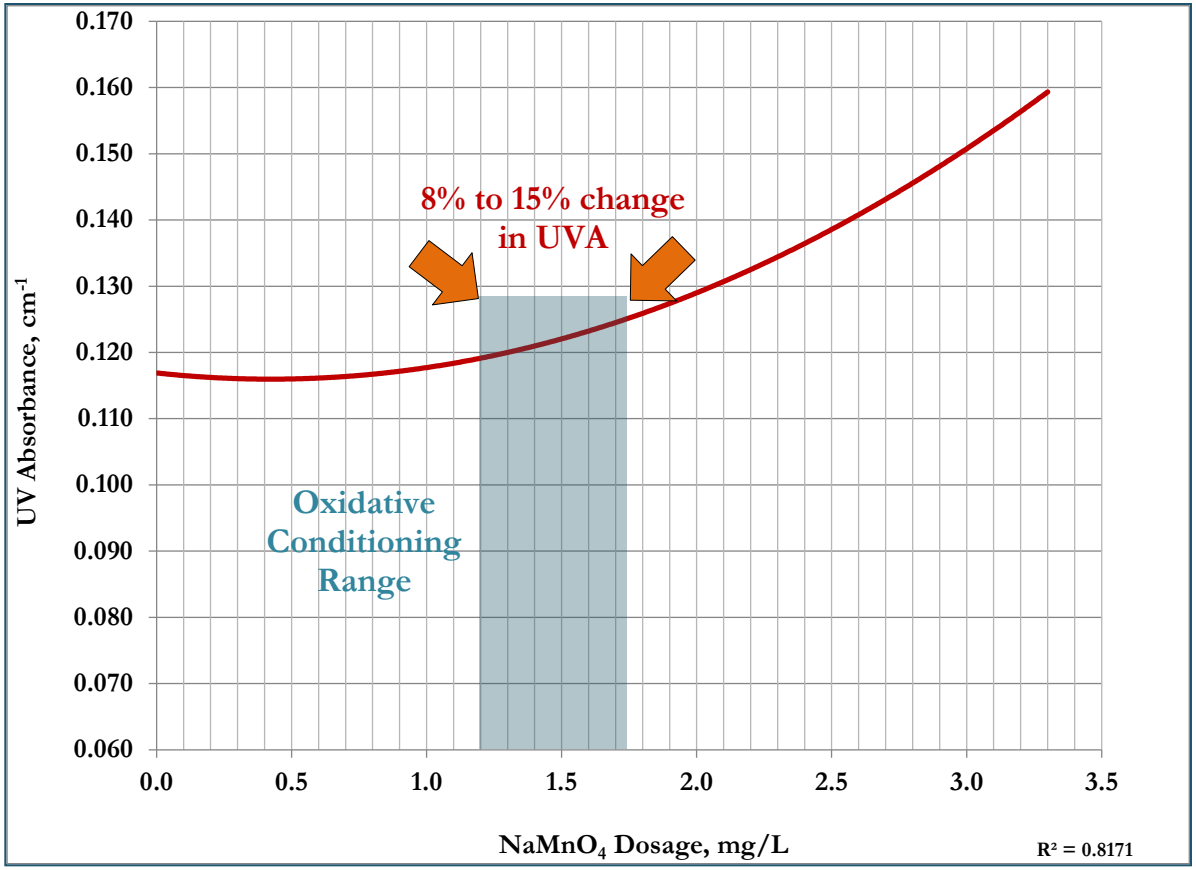
PCMP Procedures

- Key Control Parameters (KCPs) for may have required calculations
  - Document the calculations to be used
  - Define the parameters needed for calculations
- Key Performance Indicators (KPIs) may have required calculations
  - Document the calculations to be used
  - Define the parameters needed for calculations

$$\frac{In-out}{In} * 100 = \%$$

PCMP Procedures

- Permanganate oxidative conditioning to enhance TOC removals
- Control range for dosing
  - 1.2 mg/L to 1.7 mg/L
  - UVA measurements verify proper dosing and avoid overdosing



Key Control Parameters (KCPs)

- Every treatment plant will have 25 to 40 key parameters that evidence process performance
  - Critical components that make the biggest impact
  - May include several process variables (PVs)
  - Directly influence process performance
  - Meet compliance or permit limits
  - Track targeted process control
  - Performance driven management of unit processes
  - Cost control
  - Data for calculated tracking and trending

Key Control Parameters (KCPs)

- Selected to provide a snapshot of process performance
  - Control of unit processes
  - Control of contaminant removal (special studies or compliance monitoring)
  - Enhancement of unit processes
  - Specific data indicating how overall treatment is performing
  - Some KCPs are used to track Key Performance Indicators (KPIs)

Key Control Parameters (KCPs)

- Water Treatment Examples

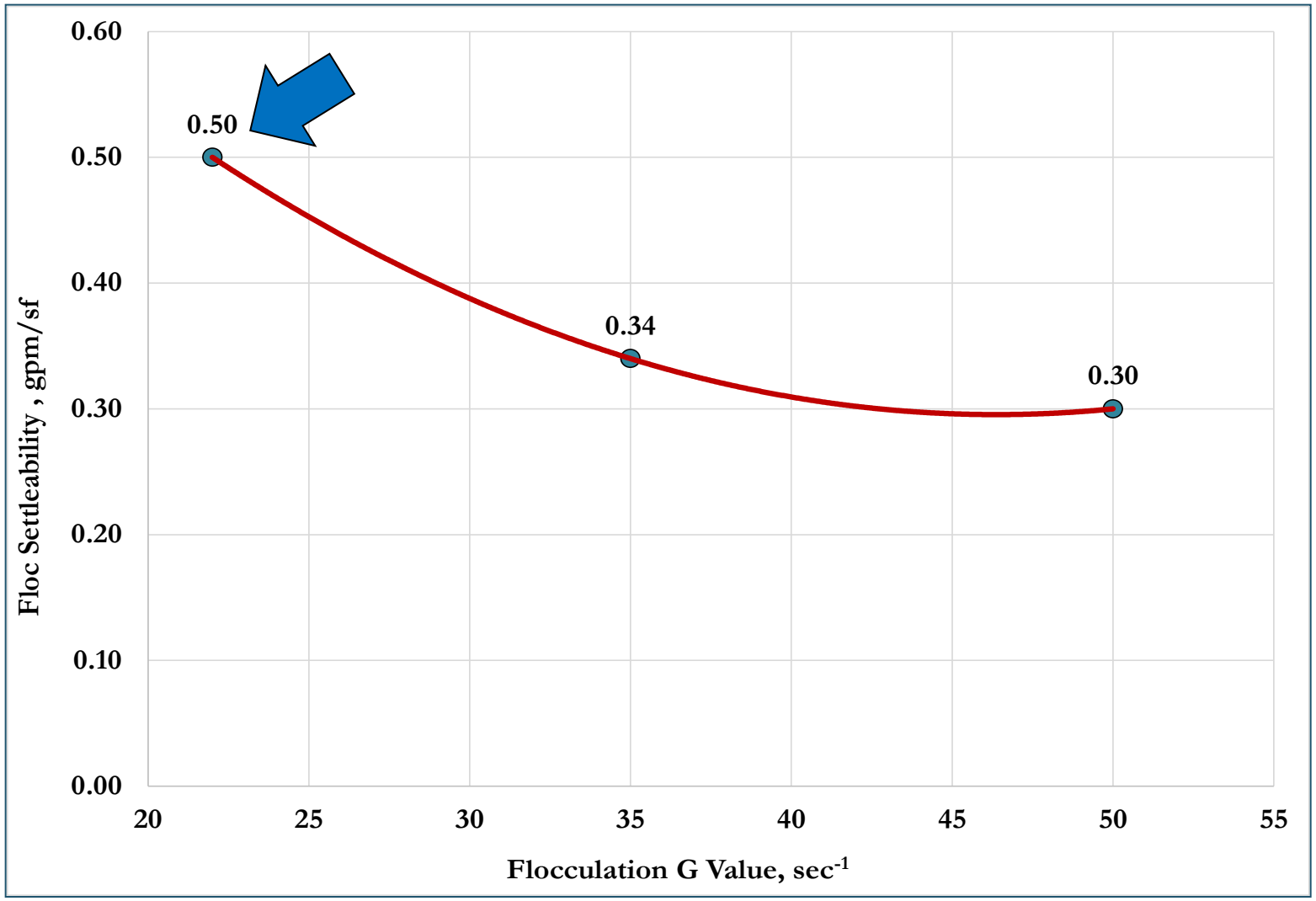
Pre-oxidant residual	CFE NTU	Free NH_3 residual
CO_2 efficiency	Log Giardia	Solids capture
LACR	Log Crypto	Cake solids
Settled NTU	Permeate ratio	Recycle ratio
Sand dose (Actiflo)	Membrane integrity	Lime per dry ton
CO_3/OH ratio	Membrane TMP	Overflow solids
CO_3/HCO_3 ratio	GAC breakthrough	Overflow pH
Salt dose (regen)	Finished pH	Overflow Cl_2 residual
Filtration rate	PO4 residual	Sludge generated
GWP	CT ratio	
Filtration efficiency	kwh/#O_3 generated	
Washwater usage	Cl_2:N ratio	

Key Control Parameters (KCPs)

- Wastewater Treatment Examples

Pre grit VS	ST blanket depth	ST Anox pH	D-Cl_2 Eff residual
Pre recycle BOD	ST RAS flow	ST Anox NH_3-N	UV dose
Pre recycle TSS	ST WAS TSS	TF organic loading	DW solids loading
Pre recycle NH_3-N	ST WAS lbs	TF NH_3-N	DW capture
Pre recycle P	ST Anox ORP	TF hydraulic load	DW cake solids
PT SOR	ST Anox NO_3	TF recycle ratio	DW centrate TSS
PT blanket depth	ST NO_3	TER Filter loading	DG loading
PT sludge generated	ST pH	TER NTU	DG VA:Alk ratio
ST SOUR	ST RAS %influent	TER run time	DG VS reduction
ST DO	ST F/M ratio	Cl_2 contact time	
ST MLSS	ST Aeration HDT	Cl_2 residual	
ST MCRT	ST MLVSS invent.	D-Cl_2 bisulf #/MG	

Key Control Parameters (KCPs)



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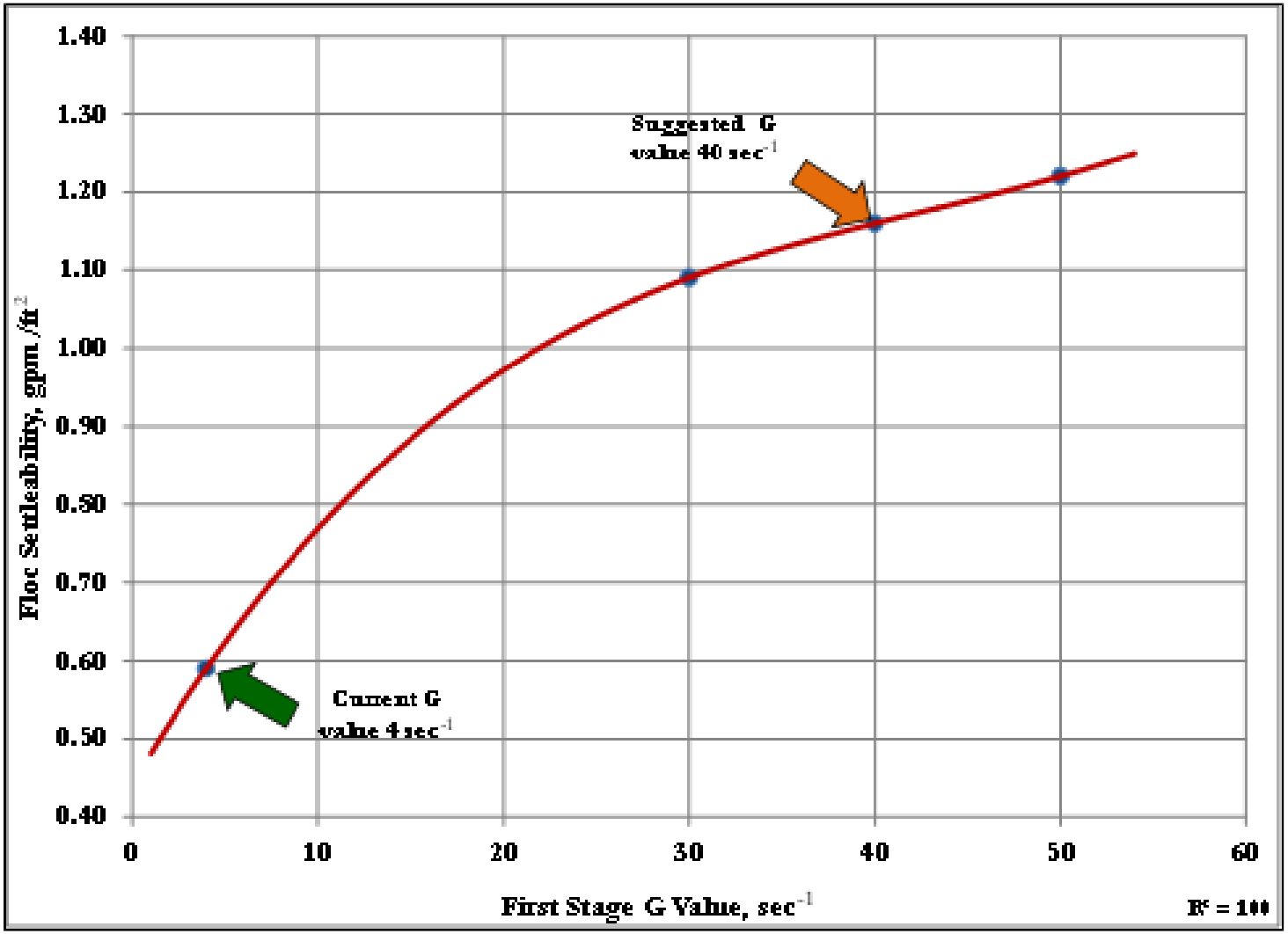

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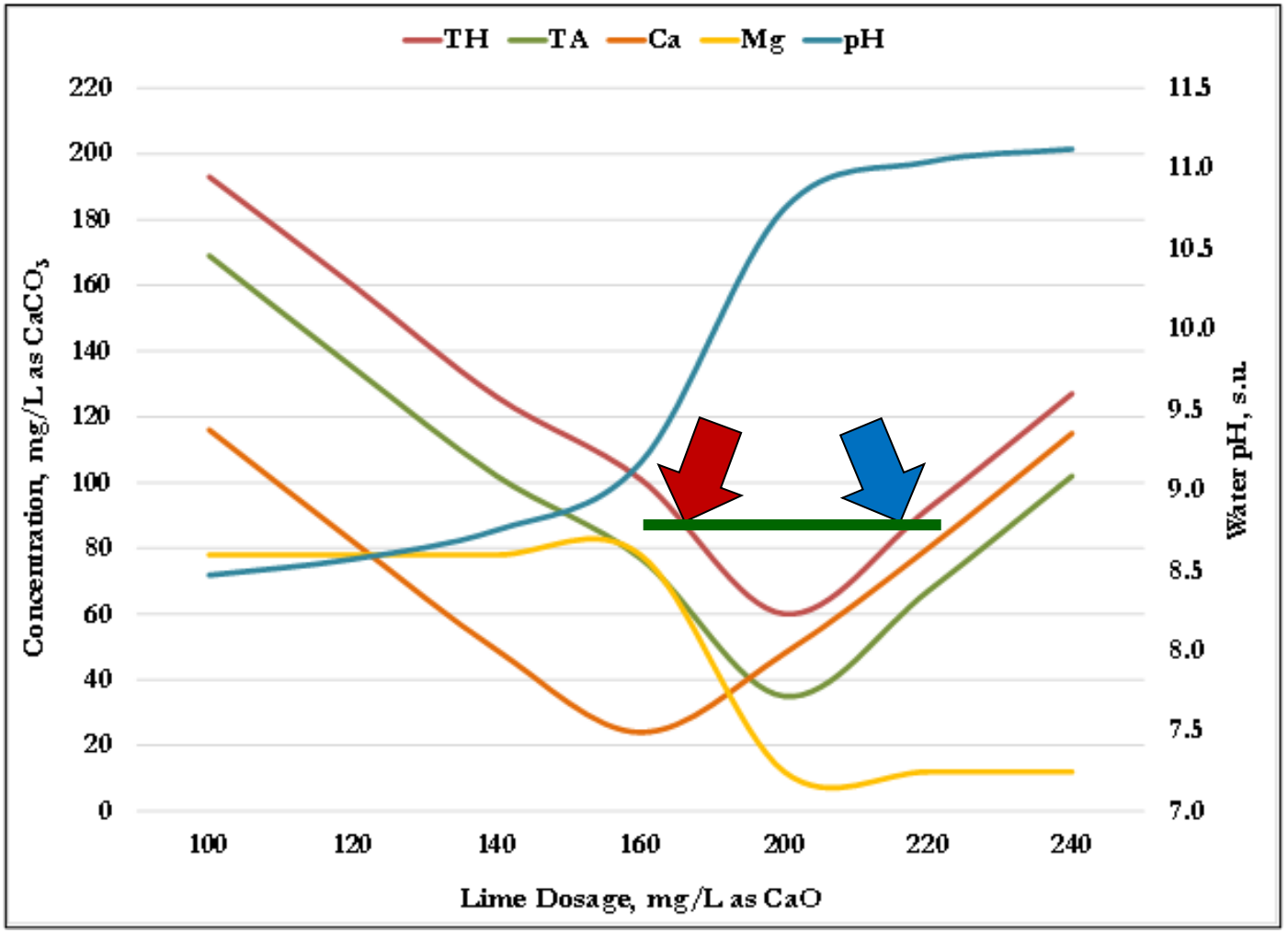


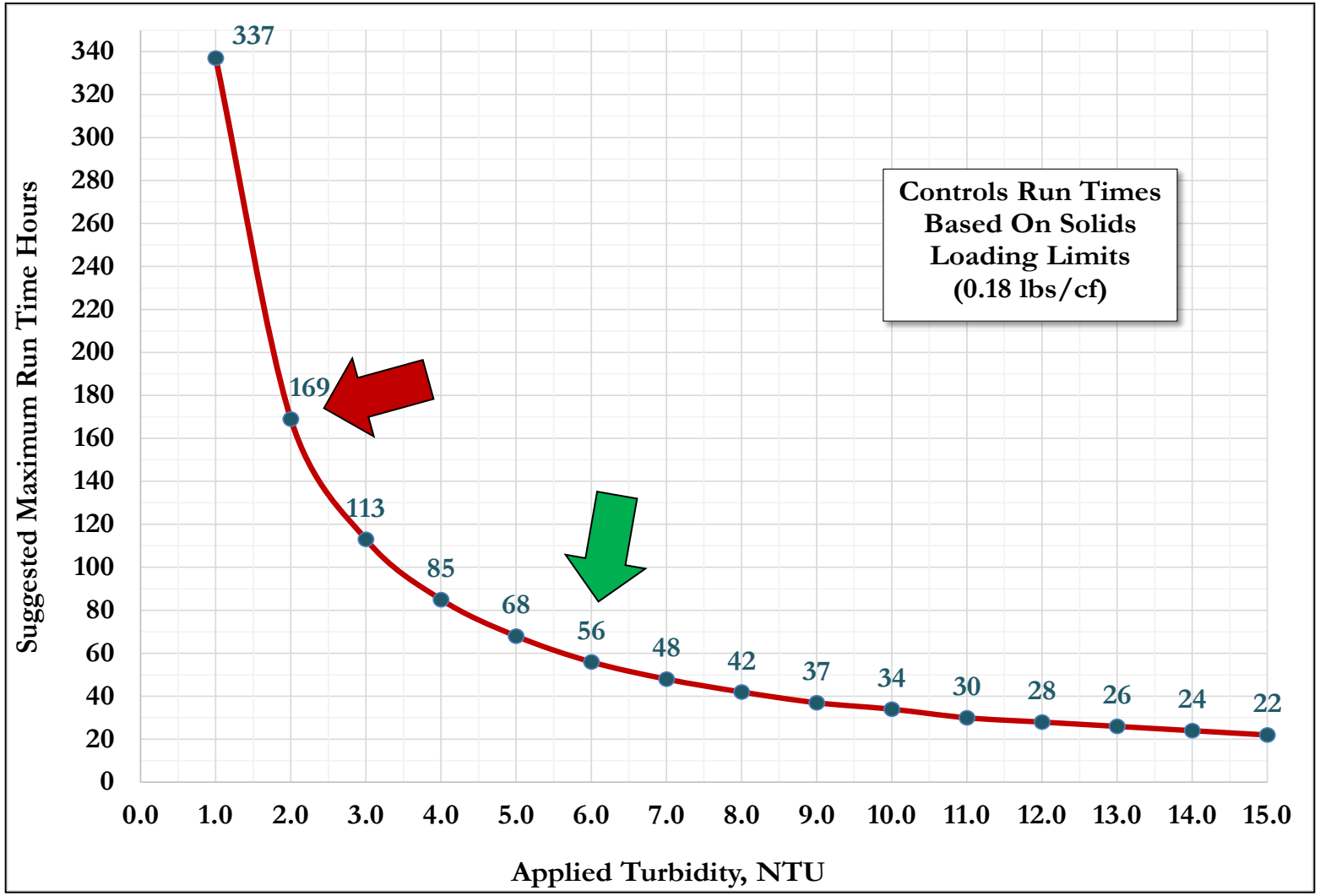
Key Performance Indicators (KPIs)

- Published best practice indicators for process performance
  - Established by trade organizations
  - Established by optimized treatment systems
  - Data from plant studies
  - Research projects data
  - Manufacturer's performance data
  - Best practice efforts to control key processes
    - Gauge performance against known metrics
    - Indicate progress toward expected process goals
    - Control operating costs

Key Performance Indicators (KPIs)

- Provide evidence towards treatment goals
- Measure performance to assist in decision-making
- Compare actual metrics against other best practices
- Track effectiveness and compliance
- Balance between process behaviors and expectations
- Example
  - All filters should operate for more than 72 hours run time
    - May only be true if applied water is properly pre-conditioned and the filter media meet specific standards
    - May be tied to solids loadings applied to filtration

Key Performance Indicators (KPIs)



Key Performance Indicators (KPIs)

- Water Treatment Examples

Production versus Raw pumpage ratio	Fin MG/Raw MG
Production versus plant capacity ratio	Fin MG/Design MG
Electric consumption versus raw water ratio	kwh/MG pumped (raw)
Electric consumption versus plant production	kwh/MG produced (fin)
Coagulant to turbidity ratio	mg/L/MG/NTU
Coagulant to TOC ratio	mg/L/MG/TOC
Polymer consumption (dewatering)	lbs polymer /dry ton solids

Key Performance Indicators (KPIs)

- Wastewater Treatment Examples

Pump efficiency, Influent	kwh/MG
Pump efficiency, RAS	kwh/MG
Electric consumption Aeration	kwh/lb BOD (COD) removed
Blower efficiency	kwh/scfm/ft depth
Carbon source versus nitrogen removed	lbs COD/lb N removed
Chlorine consumed for disinfection	lbs chlorine/MG
UV power required	kWH/MG
Biogas production	cf gas versus dry lbs VS fed
Dewatered sludge solids	% solids

Key Performance Indicators (KPIs)

- Wastewater Treatment Examples

Polymer usage (dewatering)	lbs active polymer /dry ton solids
Fuel consumption incineration	kwh (net caloric value) /dry ton
Electric self-sufficiency from digestion	% total power used
Electric consumption versus volume treated	kWH/MG
Electric consumption versus treated loading	kWH/lbs BOD (COD) treated
Coagulant versus phosphorus removed	lbs metal ion per lb P removed
Production versus design capacity	%
BOD removal versus Design BOD capacity	%

PCMP Tracking and Limits

- Selected parameters for PCMP are agreed upon by the PCMP team and management
  - Guidance exists from technical staff, PCMP experts, benchmarking metrics, etc.
    - Each process should have a dedicated process control scheme that suggests monitoring parameters
  - Monitoring frequencies should be made at least daily
    - Some parameters may need to be monitored multiple times per day or by automated equipment and sensors
  - Calculated values should be defined by equations and labels
    - Actual PVs and details how to calculate the value along with the proper units

GWP, gal/sf/run = run time hours * 60 * filtration rate, gpm/sf

PCMP Tracking and Limits

- Targets Values
  - Target values should be established using average historical performance parameters
    - Settled turbidity averaged 0.84 NTU from the clarifier for the period evaluated
    - Total chlorine residuals from disinfection averaged 1.81 mg/L for the period evaluated
- Limits or flags
  - Each target value should have limits or flags established that trigger process control actions
    - Upper Alarm Limit (UAL) - critical action needed to avoid non-compliance
    - Upper Warning Limit (UWL) – action needed to regain process control
    - Lower Warning Limit (LWL) – action needed to regain process control
    - Lower Alarm Limit (LAL) – critical action needed to avoid non-compliance

PCMP Tracking and Limits

- Different methods of setting limits
  - Average based limits
  - Standard deviation (1 for warnings, 2 for alarms)
  - Historical data and percentile occurrence
- Method selection is not important, be consistent
  - Avoid setting limits too close to regulatory levels
  - Avoid setting limits that constantly result in warnings or alarms
  - Avoid changing limits setting just to stop warnings or alarms
  - PCMP team and management must approve each parameter and limits established
  - Use Change Authorization Form if limits need to be re-established due to a change in regulations or a significant change in process

PCMP Tracking and Limits

- Average based limits example

Daily chlorine residuals, mg/L		Average and limit settings
2.35	1.57	Average value of the data is 1.81 mg/L
2.14	2.08	Setting the UAL
1.47	1.72	1.81 mg/L * 1.25 = 2.26 mg/L
1.31	1.83	Setting the UWL
1.78	1.46	1.81 mg/L * 1.15 = 2.08 mg/L
2.51	1.69	Setting the LWL
2.08	2.21	1.81 mg/L * 0.85 = 1.54 mg/L
1.50	1.58	Setting the LAL
1.65	1.73	1.81 mg/L * 0.75 = 1.36 mg/L

PCMP Tracking and Limits

- Standard Deviation limits example

Daily chlorine residuals, mg/L		Average and limit settings
2.35	1.57	1 STDEV of the data is 0.34 mg/L
2.14	2.08	Setting the UAL
1.47	1.72	1.81 mg/L + (2 *0.34) = 2.49 mg/L
1.31	1.83	Setting the UWL
1.78	1.46	1.81 mg/L + 0.34 mg/L = 2.15 mg/L
2.51	1.69	Setting the LWL
2.08	2.21	1.81 mg/L - 0.34 mg/L= 1.47 mg/L
1.50	1.58	Setting the LAL
1.65	1.73	1.81 mg/L – (2 * 0.34) = 1.13 mg/L

PCMP Tracking and Limits

- Historical Data percentile limits example

Daily residuals, mg/L		Percentiles	Average and limit settings
2.35	1.57	95% – 2.37	Average value of the data is 1.81 mg/L
2.14	2.08	85% – 2.17	Setting the UAL
1.47	1.72	75% – 2.08	95th percentile = 2.37 mg/L
1.31	1.83	65% – 1.84	Setting the UWL
1.78	1.46	55% – 1.75	75th percentile = 2.08 mg/L
2.51	1.69	45% – 1.71	Setting the LWL
2.08	2.21	35% – 1.65	35th percentile = 1.65 mg/L
1.50	1.58	25% – 1.57	Setting the LAL
1.65	1.73	15% - 1.49	15th percentile = 1.49 mg/L

PCMP Report Forms

- Reports generated each week for management review and approval
  - Process Overview Reports – overall plant performance
    - Treatment Stream – influent, effluent, key unit processes
    - Consumables – chemical and utility usage
    - Production – water quality overview
  - Compliance Reports – monitoring and sampling record
  - Unit Process Reports – key unit process performance
  - Report by Exception – exceedance of flag limits
  - Change Authorization Form – change in target values or flag values

PCMP Report Forms - Overview

PROCESS STREAM REPORT OVERVIEW

START DATE 8/25/13
END DATE 8/31/13

REPORT DATE 9/4/13

VARIABLE NUMBER	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	TREND	FLAG	FORECAST	TARGET	LAL	LWL	UWL	UAL	No. OF SAMPLES
1	**RAW WATER FLOW (RWF)**	**MGD**	**68.703**	**46.195**	**80.818**				**65.000**	**30.000**	**43.000**	**85.000**	**95.000**	**7**
2	**RAW TURBIDITY (RAWTURB)**	**NTU**	**34.06**	**6.20**	**99.91**		**UWL**		**5.00 - 10.00**	**NA**	**NA**	**20.00**	**40.00**	**7**
12	COAGULATION pH (TREATEDpH)	SU	6.67	6.55	6.73				6.70	6.30	6.50	6.90	7.20	7
14	CLARIFIER TURBIDITY (CLARTURB)	NTU	0.98	0.76	1.53		**LAL, LWL, UAL**		1.50	**0.55**	**0.70**	1.75	**2.25**	7
49	BASINS IN SERVICE (# BASIN IN)	NUMBER	4.0	4.0	4.0				4.0	3.0	3.5	NA	NA	7
50	**SLUDGE REMOVAL (FM-5)**	**GAL/DAY**	**513,596**	**496,420**	**527,275**				**500,000**	**350,000**	**425,000**	**650,000**	**800,000**	**7**
53	CLARIFIER ELEVATION (CF ELEV)	FEET (MSL)	766.60	766.35	766.85				766.8	766.3	766.5	767.0	767.2	7
54	RIVER ELEVATION (ALGH ELEV)	FEET (MSL)	723.36	722.40	724.59				NA	722.0	723.0	728.0	730.0	7
13	FILTERED WATER FLOW (FWF)	MGD	58.817	47.162	68.533				65.000	30.000	43.000	85.000	95.000	7
15	FILTERED pH (FILTpH)	SU	8.50	8.36	8.59				8.50	8.10	8.30	8.65	8.80	7
16	**FINISHED pH (FINpH)**	**SU**	**8.43**	**8.28**	**8.55**				**8.50**	**8.10**	**8.30**	**8.65**	**8.80**	**7**
43	FILTERED CHLORINE RES. [FREE] (FIL C	mg/L	1.11	1.07	1.14				1.10	0.80	0.90	1.30	1.40	7
44	**FINISHED CHLORINE RES. [FREE] (F**	**mg/L**	**0.63**	**0.56**	**0.86**		**UWL**		**0.50**	**0.30**	**0.35**	**0.60**	**0.75**	**7**
26	**FILTERED TURBIDITY (FILTTURB)**	**NTU**	**0.092**	**0.059**	**0.153**		**UWL**		**0.030**	**NA**	**NA**	**0.070**	**0.100**	**7**
172	NO. GALLERY TURBIDITY (NGTURB)	NTU	0.085	0.051	0.155		**UAL**		0.030	NA	NA	0.050	0.070	7
173	SO. GALLERY TURBIDITY (SGTURB)	NTU	0.098	0.068	0.152		**UAL**		0.030	NA	NA	0.050	0.070	7
177	**BACKWASH FLOW (BWFLOW)**	**GAL/DAY**	**922,075**	**534,565**	**1,192,903**		**UWL**		**600,000**	**300,000**	**450,000**	**800,000**	**1,000,000**	**7**
178	FILTERED FLUME LEVEL (FF ELEV)	FEET (MSL)	763.5	763.3	763.9				763.4	763.0	763.2	763.7	763.9	7
51	**FINISHED WATER FLOW (FIN PUMP)**	**MGD**	**56.336**	**44.593**	**66.550**				**65.000**	**30.000**	**43.000**	**85.000**	**95.000**	**7**
52	CLEARWELL LEVEL (CW ELEV)	FEET (MSL)	747.15	746.53	748.08				747.0	744.8	745.3	748.5	749.0	7

COMMENTS:

Clarified water turbidity LWL of 0.70 NTU should trigger closer monitoring of turbidity levels and a reduction in primary polymer (Clarifloc) dosage.
If the clarified water turbidity falls to 0.55 NTU (LAL) it should alarm a low turbidity value and the primary polymer (Clarifloc) should be turned off.
Clarified water turbidity UAL of 2.25 NTU should trigger closer monitoring of turbidity levels and an increase in primary polymer (Clarifloc) dosage.

Plant Manager **Date** **Process Control Director** **Date**

PCMP Report Forms - Overview

WATER TREATMENT PLANT
CONSUMABLES REPORT

START DATE 8/25/13
END DATE 8/31/13
REPORT DATE 9/4/13

VARIABLE NUMBER	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	TREND	FLAG	FORECAST	TARGET	LAL	LWL	UWL	UAL	# OF SAMPLES
28	CLARIFLOC (CATFLOC)	GAL/DAY	22.4	0.0	110.0		LAL		65.0	50.0	55.0	80.0	100.0	7
29	FERRIC CHLORIDE DOSAGE (FeCl3 DOSE)	mg/L	26.1	23.6	29.5				25.00	20.00	22.50	27.50	30.00	7
30	FERRIC CHLORIDE (FeCl3 TOT)	LBS/DAY	14759.2	11376.1	18009.0		UAL		1391.3	1113.1	1252.2	1530.4	1669.6	7
31	KMnO4 DOSAGE (KMnO4 DOSE)	mg/L	0.51	0.46	0.56				0.40 - 0.60	0.20	0.30	0.70	0.80	7
32	KMnO4 TOTAL (KMnO4 TOT)	LBS/DAY	291.6	178.0	354.4				200-300	125.0	150.0	350.0	375.0	7
34	LIME TOTAL (LIME TOT)	LBS/DAY	3880.0	0.0	4560.0				2600 - 3800	1800.0	2400.0	5000.0	6000.0	7
35	CARBON TOTAL (CARB TOT)	LBS/DAY	1482.1	1329.0	1606.0				500 - 1500	300.0	400.0	2500.0	>2500	7
					7									
37	FLUORIDE TOTAL (F TOT)	LBS/DAY	321.5	312.7	331.7		UAL		56.7	42.5	49.6	63.8	70.9	7
36	FLUORIDE DOSAGE (F DOSE)	mg/L	0.67	0.56	0.82		LWL		0.80	0.60	0.70	0.90	1.00	7
39	SODA ASH TOTAL (SA TOT)	LBS/DAY	17763.0	13651.5	23699.7		LWL		23000.0	14000.0	18000.0	28000.0	320000.0	7
40	PHOSPHATE (POLYP)	LBS/DAY	1.0	1.0	1.0				1.00	0.33	0.67	1.33	1.67	7
42	CAUSTIC SODA TOTAL (CAUS TOT)	LBS/DAY	185.6	0.0	1299.2				0.0	N/A	N/A	3000.0	4500.0	7
45	PRE CHLORINE (PREHYP)	GAL/DAY	0.0	0.0	0.0				0.0	N/A	N/A	1250.0	1500.0	7
46	PRE-FILTER CHLORINE (PREFHYP)	GAL/DAY	381.4	270.0	650.0				120-600	60	90	400	480	7
47	POST-FILTER CHLORINE (POSTFHYP)	GAL/DAY	638.6	300.0	900.0				240-720	180	210	840	900	7
200	**ELECTRICAL CONSUMPTION (ELEC TOTAL)**	**KW**								**N/A**	**N/A**			**7**
201	NATURAL GAS CONSUMPTION (GAS TOTAL)	CU FT								**N/A**	**N/A**			7

COMMENTS:

Plant Manager **Date** **Process Control Director** **Date**

PCMP Report Forms - Overview

WATER TREATMENT PLANT
PRODUCTION REPORT

START DATE 8/25/13
END DATE 8/31/13

REPORT DATE 9/4/13

VARIABLE NUMBER	PARAMETER	UNITS	AVERAGE	MINIMUM	MAXIMUM	TREND	FLAG	FORECAST	TARGET	LAL	LWL	UWL	UAL	No. OF SAMPLES
1	**RAW WATER FLOW (RWF)**	**MGD**	**6.546**	**6.733**	**0.000**		**LAL**		**65.000**	**30.000**	**43.000**	**85.000**	**95.000**	**7**
13	FILTERED WATER FLOW (FWF)	MGD	8.358	8.590	0.000		LAL		65.000	30.000	43.000	85.000	95.000	7
51	**FINISH WATER FLOW (FINPUMP)**	**MGD**	**746.525**	**748.079**	**0.000**		**UAL**		**65.000**	**30.000**	**43.000**	**85.000**	**95.000**	**7**
177	**BACKWASH FLOW (BWFLOW)**	**GAL/DAY**	**763**	**764**	**0**		**LAL**		**600000**	**300000**	**450000**	**800000**	**1000000**	**7**
	INFLUENT CONCENTRATION													
10	**RAW ALKALINITY [CaCO3] (RAWALK)**	**mg/L**	**45.90**	**42.00**	**49.00**				**35.00**	**15.00**	**20.00**	**55.00**	**60.00**	**7**
5	RAW HARDNESS (RAW (CaCO3))	mg/L	111.81	88.00	128.00				100.00	N/A	N/A	130.00	150.00	7
2	**RAW TURBIDITY (RAWTURB)**	**NTU**	**0.76**	**1.53**	**0.00**				**5.00 - 10.00**	**N/A**	**N/A**	**20.00**	**40.00**	**7**
6	**RAW IRON [TOTAL] (RAW Fe TOT)**	**mg/L**	**0.13**	**0.03**	**0.24**				**VARIABLE**	**N/A**	**N/A**	**150.0**	**170.0**	**7**
8	**RAW MANGANESE [TOTAL] (RAW Mn TOT)**	**mg/L**	**0.03**	**0.00**	**0.05**				**0.05 - 0.20**	**N/A**	**N/A**	**0.20**	**0.25**	**7**
3	**RAW pH (RAWpH)**	**SU**	**7.30**	**7.20**	**7.44**				**7.80**	**7.00**	**7.20**	**8.40**	**8.60**	**7**
	EFFFLUENT CONCENTRATION													
25	FINISHED ALKALINITY [CaCO3] (FINALK)	mg/L	60.00	55.00	70.00				55.00	25.00	30.00	70.00	75.00	7
17	FINISHED HARDNESS [CaCO3] (FINHARD)	mg/L	116.00	100.00	138.00				100.00	N/A	N/A	130.00	150.00	7
174	SETTLED TURBIDITY (SETT TURB)	NTU	0.440	0.158	1.671				0.600	N/A	N/A	0.900	1.200	7
20	**FINISHED IRON [TOTAL] (FIN Fe)**	**mg/L**	**0.008**	**0.00**	**0.03**				**<0.02**	**N/A**	**N/A**	**0.05**	**0.07**	**7**
21	**FINISHED MANGANESE [TOTAL] (FIN Mn)**	**mg/L**	**0.012**	**0.00**	**0.03**				**<0.02**	**N/A**	**N/A**	**0.03**	**0.04**	**7**
16	**FINISHED pH (FINpH)**	**SU**	**1.07**	**1.14**	**0.00**		**LAL**		**8.50**	**8.10**	**8.30**	**8.65**	**8.80**	**7**
44	**FINISHED CHLORINE RES. [TOTAL] (FIN Cl)**	**mg/L**	**0.06**	**0.15**			**LAL**		**0.50**	**0.30**	**0.35**	**0.60**	**0.75**	**7**

COMMENTS:

Plant Manager **Date** **Process Control Director** **Date**

PCMP Report Forms - Compliance

Compliance Report Form												
Treatment Plant												
Month												
Year												
	Sample Description	**Assigned to**	**Date Scheduled**	**Parameter**	**Sample Type**	**Number of samples**	**Visual Inspection of Sample**	**In-house or Contract laboratory**	**Person Collecting & Transferring Sample**	**Pickup Date**	**Chain of Custody review (initials)**	**QA/QC Review (initials)**
Comments												
(*) NPDES, DWR, Storm water, Drinking water, Ground water, Solids, Special studies, Process control, other												
Signatures												
							Date					
Regulatory Review QA/QC												
							Date					
Laboratory Supervisor												
							Date					
Plant Manager												

PCMP Report Forms - UPR

WATER TREATMENT PLANT
UNIT PROCESS REPORT - Clarification & Filtration

START DATE 8/25/13
END DATE 8/31/13
REPORT DATE 9/4/13

VARIABLE NUMBER	PARAMETER	UNITS	MINIMUM	MAXIMUM	AVERAGE	TARGET	LAL	LWL	UWL	UAL	No. OF SAMPLES
1	**RAW WATER FLOW (RWF)**	**MGD**	**46.195**	**80.818**	**68.703**	**65.000**	**45.000**	**55.000**	**80.000**	**90.000**	7
29	FERRIC CHLORIDE DOSAGE (FeCl3 DOSE)	mg/L	23.63	29.53	26.14	25.000	20.00	22.50	27.50	30.00	7
	CLARIFLOC [POLYMER] DOSAGE	mg/L	0.00	1.65	0.38	0.00	n/a	n/a	n/a	n/a	7
	ACTIVATED CARBON DOSAGE	mg/L	2.23	3.75	2.67	1.00 - 3.00	0.60	0.80	3.50	5.00	7
33	LIME DOSAGE (LIME DOSE)	mg/L	0.00	11.52	7.16	6.0-10.0	4.00	5.00	11.00	12.00	7
	FeCl3 FEED PUMP SETTING; MOTOR/TRANS	%									7
63	CLARIFLOC FEED PUMP SETTING; (CAT SET)	%	0	10	3	0	n/a	n/a	n/a	n/a	7
64	PRE-FILTER CLARIFLOC PUMP SETTING; (PF CAT SET)	%	100	190	113	100	25	50	>100	>115	7
30	FERRIC CHLORIDE TOTAL	LBS/DAY	11376.1	18009.0	14759.2	14324.7	11459.7	12892.2	15757.1	17189.6	7
28	CLARIFLOC [POLYMER] (CATFLOC)	GAL/DAY	0.0	110.0	22.4	0.0	n/a	n/a	n/a	n/a	7
34	LIME TOTAL (LIME TOT)	LBS/DAY	0.0	4560.0	3880.0	2600 -3800	1800.0	2400.0	5000.0	6000.0	7
41	CAUSTIC SODA DOSAGE RWF (CAUS DOSE RWF)	mg/L	0.00	2.10	0.30	6.00 -10.00	3.00	4.00	12.00	13.00	7
42	CAUSTIC SODA TOTAL RWF (CAUS TOT RWF)	GAL/DAY	0.0	203.0	29.0	450-800	350.0	450.0	800.0	900.0	7
27	PRE FILTER CLARIFLOC (FILT CAT)	GAL/DAY	20.0	31.0	26.1	30	10	15	35	40	7
35	CARBON TOTAL (CARB TOT)	LBS/DAY	1329.0	1606.0	1482.1	400.0 - 1000.0	300.0	375.0	1000.0	1750.0	7
12	COAGULATION pH (TREATEDpH)	SU	6.55	6.73	6.67	6.70	6.30	6.50	6.90	7.20	7
14	CLARIFIER TURBIDITY (CLARTURB)	NTU	0.76	1.53	0.98	1.50	**0.55**	**0.70**	1.75	2.25	7
49	BASINS IN SERVICE (#BASIN IN)	NUMBER	4	4	4	4	2	3	NA	NA	7
13	FILTERED WATER FLOW (FWF)	MGD	47.162	68.533	58.817	65.00	30.00	45.00	80.00	90.00	7
175	FILTERS IN SERVICE	NUMBER	16	17	16.4	18	14	16	NA	NA	7
176	FILTERS BACKWASHED AVERAGE/DAY	NUM/DAY	2	5	3.9	4 - 5	<3	3	6	>6	7
177	**BACKWASH FLOW (BW FLOW)**	**GAL/DAY**	**534565**	**1192903**	**922075**	**600000**	**300000**	**450000**	**800000**	**1000000**	**7**
26	**FILTERED TURBIDITY (FILTTURB)**	**NTU**	**0.059**	**0.153**	**0.092**	**0.030**	**NA**	**NA**	**0.070**	**0.100**	**7**
172	NORTH GALLERY TURBIDITY (NGTURB)	NTU	0.051	0.155	0.085	0.030	NA	NA	0.050	0.070	7
173	SOUTH GALLERY TURBIDITY (SGTURB)	NTU	0.068	0.152	0.098	0.030	NA	NA	0.050	0.070	7
174	SETTLED TURBIDITY (SETT TURB)	NTU	0.158	1.671	0.440	0.5 - 0.7	NA	NA	0.750	>1.0	7
50	**SLUDGE REMOVAL; FM-5 (SLUDGE TOTAL)**	**GAL/DAY**	**496420**	**527275**	**513596**	**500000**	**350000**	**425000**	**650000**	**800000**	**7**

COMMENTS:

Plant Manager **Date** **Process Control Director** **Date**

PCMP Report Forms - Exceptions

Report by Exception Memo

Treatment Plant	
Date	

Parameter Exception	Flag Exception (LAL, LWL, UWL, UAL)	Actual Value	Target Value

1. Are Permit, Contractual, or other Excursions a possibility in the next 7 days?	
2. Description of event(s) (e.g., equipment failure, shock load, operator error, missed samples, QA/QC issues, missed analysis, missed reports, etc.)	
3. What steps are being taken to alleviate the Control Limit Exceedance, missed sample(s) or report(s)?	
4. Is on -site assistance needed?	
5. Are new contingency plans needed? If so what?	
(Attach additional sheets as necessary for each line item)	

Process Control Director		Date		
Project Manager		Date		

PCMP Report Forms - Change Auth.

Process Control - Alarm/Flag - Change Authorization Form

Treatment Plant _____

Index/Variable Number [ ]

Parameter Description/Name: _____

Report Description: _____

Date of Change: _____

Data Review Period: from _____ to _____

Data Review Average: _____

Data Review Maximum: _____

Data Review Minimum: _____

Data Review Std. Deviation: _____

Existing Upper Alarm Limit _____

Existing Upper Warning Limit _____ New Upper Warning Limit _____

Existing Lower Warning Limit _____ New Lower Warning Limit _____

Existing Upper Warning Limit _____ New Upper Warning Limit _____

Change Requested By: _____

Process Control Manager Signature

Change Approved By: _____

Plant Manager Signature

Unit Process Strategies

- Unit Process Strategies are written description of unit process and design characteristics (SOP) along with expected operating criteria
  - Scientific basis for process and control
  - Current target values and flags (LAL, LWL, UWL, UAL)
  - Compliance requirements
  - Troubleshooting guides
  - SOPs available for process control
  - Operator tool kit for process control adjustments
    - Expected water quality ranges
    - Adjustments necessary due to abnormal operation
    - Process operations to achieve water quality targets and compliance

Summary

- Proper deployment of PCMP provides a consistent means of regulatory compliance
  - Team approach to process control
  - Documented procedures and tasks
  - Verification and QA/QC
  - Tracking of KCPs and KPIs
  - Meetings and Reporting
  - Keyed in on regulatory limits and benchmarking metrics
  - Proven success obtaining more consistent compliance efforts

Questions

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