Doc# NSCS-M-P-7093-02-48 Last Review Date: 12/03/2018
Title: Chrome Treatment Process Control Practices
Issue Dt: 10/01/2018
Revision Dt: 12/03/2018 Review Interval:12
Cat: Quality Doc Type: SOP
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Loc: Midwest - Utilities-Midwest - Plant Maintenance-Midwest-Gary Works

| Process Name | Operating Control System: | Frequency<br>Recording data and abnormal conditions | Reference SOP/SJP/EMP | Potential upset state<br>Potential Abnormal condition(s) | Potential problem source | Reaction if Abnormal Conditions are Encountered |
|---|---|---|---|---|---|---|
| EQ Tank<br>Chrome Wastewater Transfer Pipe influent pH monitoring | [redacted] Control Computer continuous monitoring of Influent wastewater pH. Expected range [redacted] > pH > [redacted]<br>pH probe in sample stream from Chrome Wastewater Transfer Pipeline<br>Rosemount 3500VP, or similar | Automatic:<br>[redacted] Control Computer | NSCS-M-P-7093-02-03<br>NSCS-M-P-7093-02-42 | pH below [redacted] The [redacted] Control Computer will initiate a local alarm at the Chrome Treatment Plant. | Chrome Line Plater sump low pH. | May be an indication of higher than normal acid concentration reaching the sump. Call the Shift Manager, ask them to check the sump and then call you to report condition.<br>If the pH is too low the pH Adjustment Tank may not be able to deliver enough sodium hydroxide to raise the pH to the proper treatment requirement. Alarms should alert the Operator if pH is not in the acceptable range. |
| EQ Tank<br>Chrome Wastewater Transfer Pipe influent ORP monitoring | [redacted] Control Computer continuous monitoring of influent wastewater ORP<br>ORP probe in sample stream from Chrome Wastewater Transfer Pipeline<br>Rosemount 3500VP, or similar | Automatic:<br>[redacted] Control Computer | NSCS-M-P-7093-02-03<br>NSCS-M-P-7093-02-26<br>NSCS-M-P-7093-02-42<br>NSCS-M-P-7093-02-32<br>NSCS-M-P-7093-02-17 | ORP above [redacted] The [redacted] Control Computer will initiate a local alarm at the Chrome Treatment Plant. | 1) Increase in hexavalent chromium concentration in incoming wastewater<br>2) Chrome Line Plater sump or Tin Line Chemtreat Sump low or high pH | 1) If the pH of the incoming wastewater to the EQ Tank is within the normal range, the concentration of hexavalent chromium is likely higher than normal. Increase the sodium bisulfite dose setpoint to ensure proper conversion. Measure the hexavalent chromium concentration in the Reduction Tank using the benchtop Hach meter more frequently to check if the chrome is reduced to the trivalent state.<br>2) The ORP measurement is highly pH dependent. As incoming pH increases or decreases, the ORP will shift. The operator should check the pH display for the EQ tank if an ORP alarm is initiated. Make sure the pH is within the proper range before making a process change to the chemical feed. |
| EQ Tank<br>Chrome Wastewater Transfer Pipe influent Conductivity monitoring | [redacted] Control Computer continuous monitoring of influent wastewater conductivity (mS/cm)<br>Conductivity probe in the sample stream from Chrome Wastewater Transfer Pipeline<br>Hach 3700 sc-series, or similar | Automatic:<br>[redacted] Control Computer<br>Operator:<br>Record conductivity every 2 hours on Form [redacted] | NSCS-M-P-7093-02-03<br>NSCS-M-P-7093-02-26<br>NSCS-M-P-7093-02-42 | Conductivity at [redacted] mS/cm or greater will alarm the Operator | Either or both the Tin Line Chemtreat and Chrome Line Plater sumps may be receiving a higher than normal concentration of chrome. | The operating lines will receive local alarms if the sump conductivity reaches [redacted] mS/cm or greater. Call the Tin/Chrome Shift Manager to determine the problem.<br>Watch that the Reduction and pH Adjustment Tanks are operating correctly. If not you may need to request that the problem line shutdown and initiate repairs. |

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| EQ Tank<br>Level monitoring | [redacted] Control Computer will continuously monitor the level in the tank.<br><br>There are 2 level sensors. One will provide the current volume level. The other will alert the Operator that the tank level is too high.<br><br>Level Sensor:<br>Rosemount 5300 series, or similar<br><br>Float Switch:<br>Little Giant RFSN series, or similar | Automatic:<br>[redacted] Control Computer<br><br>Operator:<br>Record abnormal conditions on Form [redacted]. | NSCS-M-P-7093-02-03 | 1) Tank level at [redacted] or less<br><br>2) Tank level at [redacted] or higher | 1) Operating lines<br><br>2) [redacted] operations | 1) At level [redacted] or less [redacted] Control Computer will shutdown the operating train(s) to prevent pump cavitation.<br>a. Operating line(s) have shutdown or the flowrate through the treatment trains is greater than the flow from the operating lines. Either event Operator must adjust processing rate.<br><br>2) At [redacted] the [redacted] Control Computer will alert the Operator<br>a. If there is a heavy rain event the outside trench may be pumping a large volume of water into the EQ Tank. Monitor conditions, the event may pass quickly and the tank level may drop.<br>b. Increase processing rate through the treatment trains<br>c. If CTP plant conditions prevent increasing processing rate, contact operating lines, ask them to minimize effluent stream.<br>d. If necessary, ask that one or both operating lines shutdown until EQ Tank level has decreased |
| Reduction Tank<br>Sulfuric Acid (pH) regulation | [redacted] Control Computer will continuously monitor the pH at the tank discharge birdbath.<br><br>There are 2, pH meters monitoring tank conditions. The pH will be adjusted by Sulfuric Acid pump skid.<br><br>Rosemount 3500VP, or similar<br><br>At the HIGH or LOW pH setpoint the Operator will receive an ALERT.<br><br>At the HIGH HIGH or LOW LOW pH setpoint (for 2 minutes) the Train will automatically start RECYCLE mode. | Automatic:<br>[redacted] Control Computer<br><br>Operator:<br>Perform a comparison bench test for pH every 2 hours and record results on Form [redacted]. | NSCS-M-P-7093-02-03<br><br>NSCS-M-P-7093-02-08 | 1) Sulfuric acid feed<br>a. Erratic acid feed rate<br><br>b. Tank pH at [redacted] or higher. The computer will alert the Operator.<br><br>c. Tank pH at [redacted] or lower. The computer will alert the Operator | 1) Sulfuric acid<br>a. pH probe(s)<br><br>b. Pump skid strainer<br><br>c. Pump overfeeding | 1) Sulfuric acid<br>a. High or Low pH – Confirm that the primary pH meter is reading correctly. This provides the parameter the computer uses to regulate pump skid.<br>b. High pH<br>i. Pump skid strainer may be plugged<br>ii. Pump control may be underfeeding Sulfuric Acid. Check the computer settings<br><br>c. Low pH<br>i. Pump control may be overfeeding Sulfuric Acid. Check the computer settings.<br>ii. Check the Acid Trench sump pH. The Acid Trench sump may be feeding acid to the EQ Tank which will lower the pH of the feed to the Reduction Tank. A sulfuric acid pipe in the Acid Trench may be leaking. |

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| Reduction Tank<br>Sodium Bisulfite (ORP) regulation | [redacted] Control Computer will continuously monitor the ORP at the tank discharge birdbath.<br><br>There are 2, ORP meters monitoring tank conditions. The ORP will be adjusted by the Sodium Bisulfite pump skid.<br><br>Rosemount 3500VP, or similar<br><br>At the HIGH ORP setpoint the Operator will receive an ALERT.<br><br>At the HIGH HIGH ORP setpoint (for 2 minutes) the Train start RECYCLE mode. | Automatic:<br>[redacted] Control Computer | NSCS-M-P-7093-02-03<br><br>UT04-10-SJP | 1) ORP above [redacted]. The computer will alert the Operator.<br><br>2) ORP below [redacted]. The computer will alert the Operator. | 1) Sodium Bisulfite<br>a. ORP probe(s)<br>b. Pump overfeeding<br>c. Pump skid strainer | 1) Sodium Bisulfite<br>a. High or Low ORP – Confirm that the primary ORP meter is reading correctly. This provides the parameter the computer uses to regulate pump skid.<br>b. Low ORP<br>i. Pump control may be overfeeding Sodium Bisulfite. Check the computer settings. Check the chemical feed pump.<br>c. High ORP<br>i. Pump skid strainer may be plugged. Clean as necessary.<br>ii. Pump control may be underfeeding Sodium Bisulfite. Check the computer settings. Check the chemical feed pump. |
| pH Adjustment Tank | [redacted] Control Computer will continuously monitor the pH at the tank discharge birdbath.<br><br>There are 2, pH meters monitoring the tank conditions. The pH will be adjusted by the Sodium Hydroxide pump skid<br><br>Rosemount 3500VP, or similar<br><br>At the HIGH or LOW pH setpoint the Operator will receive an ALERT.<br><br>At the HIGH HIGH or LOW LOW pH setpoint (for 2 minutes) the Train start RECYCLE mode. | Automatic:<br>[redacted] Control Computer<br><br>Operator:<br>Perform a comparison bench test for pH every 2 hours and record on Form [redacted] | NSCS-M-P-7093-02-03<br><br>NSCS-M-P-7093-02-08 | 1) Low pH condition<br>a. computer will alert Operator<br>b. If condition persists the computer will automatically recycle the train.<br><br>2) High pH condition –<br>a. computer will alert Operator<br>b. If condition persists the computer will automatically recycle the train. | 1) Low pH<br>a. The Sodium Hydroxide feed insufficient<br>b. The pH in the Reduction Tank may be too low<br><br>2) High pH<br>a. The Sodium Hydroxide is being overfed<br>b. The pH is high in the Reduction Tank due to an acid dosing issue | 1) Low pH<br>a. Confirm that the primary pH meter is reading correctly. This provides the parameter the computer uses to regulate pump skid.<br>b. Pump skid strainer may be plugged. Clean as necessary.<br>c. Pump may not be delivering proper volume.<br>i. Confirm that pump is running and stroke and speed settings are correct<br>ii. Perform a draw down test at the pump skid<br>iii. May need to manually adjust the feed rate<br><br>2) High pH<br>a. Confirm that the primary pH meter is reading correctly. This provides the parameter the computer uses to regulate pump skid.<br>b. Pump may not be delivering proper volume.<br>i. Confirm that pump is running and stroke and speed settings are correct<br>ii. Perform a draw down test at the pump skid<br>iii. May need to manually adjust the feed rate<br>c. The effluent from the Reduction Tank may be at a high pH. See the Reduction Tank High pH reaction steps above. |

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| Lamella fast mix tank<br>Coagulant addition | [redacted] Control Computer will add coagulant to the delivery concentration set in the computer. Feed rate will be adjusted to the Train processing rate.<br><br>Coagulant feed rate will vary according to conditions and concentrations from the pH Adjustment tank. Rates may vary from [redacted] ppm to [redacted] ppm. | Automatic:<br>[redacted] Control Computer | NSCS-M-P-7093-02-03 | 1) Pin floc is not being formed | 1) Coagulant delivery<br><br>2) Mixer | 1) Coagulant pump skid<br>a. Pump skid strainer may be plugged. Clean as necessary.<br>b. Pump may not be delivering proper volume.<br>i. Confirm that pump is running and stroke and speed settings are correct<br>ii. Perform a draw down test at the pump skid<br>c. Check the computer setpoint. Adjust as needed. Perform another draw down test to confirm pump is adjusting to the new setpoint.<br>d. May need to manually adjust the feed rate. If the pump failed, called Maintenance for repair/replacement.<br>e. Check the coagulant tank volume is sufficient and no leaks occurred.<br>2) Check that the mixer is operating. If the mixer failed, restart it. If still failed, contact Maintenance. If the mixer is operating too fast or too slow, have maintenance adjust speed as needed. |
| Lamella slow mix tank<br>Flocculant addition | [redacted] Control Computer will add flocculant to the delivery concentration set in the computer. Feed rate will be adjusted to the Train processing rate.<br><br>Flocculant feed rate will vary according to conditions and concentrations from the pH Adjustment tank. Rates may vary from [redacted] ppm to [redacted] ppm. | Automatic:<br>[redacted] Control Computer | NSCS-M-P-7093-02-03 | Pin floc is not forming into larger clusters | 1) Polymer delivery problem<br><br>2) Mixer | 1) Polymer pump skid<br>a. Pump skid strainer may be plugged. Clean as necessary.<br>b. Pump may not be delivering proper volume.<br>i. Confirm that pump is running and stroke and speed settings are correct<br>ii. Perform a draw down test at the pump skid<br>c. May need to manually adjust the feed rate.<br>i. Increase the polymer feed rate slowly. You want to see the pin floc forming into larger particles.<br>ii. If you increase the rate too fast you may even overshoot the correct polymer feed rate. The pin floc may be forming larger particles but not the size needed for properly settling in the Lamella inclined plate section.<br>iii. Evaluate the particle size. As mentioned above there may already be too much polymer added. Therefore at times you may even need to reduce the polymer feed. Make an adjustment, wait [redacted] – [redacted] minutes then evaluate the change in particle size.<br>2) Check that the mixer is operating. If the mixer failed, restart it. If still failed, contact Maintenance. If the mixer is operating too fast or too slow, have maintenance adjust speed as needed. |

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| Lamella incline settling plates | Automatic:<br>[redacted] Control Computer<br><br>There are 3 effluent flumes in each train. Each flume has a turbidity monitor. If the turbidity in a flume reaches the HIGH limit the computer will ALERT the Operator. If the turbidity reading reaches the HIGH HIGH limit for[redacted] minutes the computer will SHUTDOWN the train.<br><br>Hach Solitax sc sensor, or similar | Automatic:<br>[redacted] Control Computer | NSCS-M-P-7093-02-03 | 1) High solids discharge through effluent channel<br><br>2) Effluent has a high content of floc being discharged<br>a. Floc too small - carrying through<br>b. Floc too large and sticky<br><br>3) Uneven discharge of sludge across the plates | 1) Flow volume too high<br><br>2) Polymer addition incorrect<br>a. Improper feed of polymer<br>b. Small floc discharge<br><br>c. Large floc discharge<br><br>[redacted] | 1) The Lamella is designed to handle[redacted] gpm. We would not expect more than[redacted] gpm flow through the Train. Even so a high volume of solids may be channeled through a small discharge area not allowing proper settling across the surface of the plates. If the system flow rate is[redacted] gpm, see Reaction #3 below.<br>2) Polymer addition<br>a. Confirm that polymer feed pump is operating properly<br>b. Not enough polymer addition. Solids will not build and become heavy enough to settle in required time.They'll be carried out with the effluent.<br>c. Too much polymer is added creating sticky solids. Can plug some of the plates and perhaps the hopper. Channeling of solids discharge may occur preventing proper settling.<br>3) Buildup of solids in the hopper and a flow rate of sludge removal may clear the center but not the sides. The solids may continue to build up the sides of the hopper and clog plates along the sides.<br>a. May need to stop train and pump out Lamella bottom sludge.<br>b. May need to insert air lance between plates to clear solids buildup. |

[redacted]

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| Sand filter | The sand filter operates independently of the [redacted] Control Computer | | NSCS-M-P-7093-02-03 | 1) Air lift tower has no scrubbing air<br>2) High or Increasing headoss through the bed<br>3) Sand not falling through sand washer | 1) Air delivery to the lift tower<br>2) Air lift tower<br>3) Obstructed Sand washer | 1) Air flow issues:<br>a. Check the air delivery panel. Does it show air flow and pressure to each tower on the sand filter?<br>b. When flow passes through the sand filter the water level increases. This will raise a float that triggers a relay to allow the flow of air to the air lift. Determine if float is working properly.<br>c. The air hose to the lift tower has come disconnected. Reconnect hose and monitor operation.<br>2) Check the air lift tower:<br>a. Check that the screen is clear in the vertical section of the feed pipe<br>b. Check that air bubbles or foreign matter are not causing a false reading in the headloss gauge<br>c. Check that the air lifts are transporting sand<br>d. Overdosing with polymer can cause increased headloss and can even plug the sand bed<br>3) Check sand washer:<br>a. May be plugged with trash. Sand must be free to fall through the full circumference of the washer.<br>b. Washer is obstructed. If sand is obstructing, the bottom discharge opening for sand in the washer cannot fall freely<br>c. The washer assembly may have become displaced. Check the wash rings and spider rings.<br>d. The sand bed may be too high. Assuming that the unit has not recently been filled with sand, the sand bed is expanding due to calcium scaling. [redacted]<br>e. If the top of the airlift and the bottom of the splash hood is piled up with sand this indicates that the washer is obstructed and the sand is unable to fall down onto the sand bed:<br>i. Usually occurs because the sand bed has become plugged with solids due to overloading. Stop the feed to the filter until the airlift is again working.<br>ii. Turn off the air and “bump” the airlift by suddenly turning it on at maximum flow. Try this repeatedly. Try waiting for one minute between bumps. It is worth persevering with this technique for some time before moving on to the next step.<br>iii. If the above steps do not work contact maintenance. They can start more intense solutions found in the [redacted] |

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