IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF OHIO

UNITED STATES OF AMERICA,

Plaintiff,

v.

AUSTIN POWDER COMPANY,

Defendant.

Civil Action No.

CONSENT DECREE

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Plaintiff United States of America, on behalf of the United States Environmental Protection Agency (EPA), has filed a Complaint in this action, concurrently with this Consent Decree, alleging that Austin Powder Company ("Austin Powder" or "Defendant") has violated the Clean Water Act (CWA or "Act"), 33 U.S.C. §§ 1251-1388, at Defendant's McArthur, Ohio facility.

Austin Powder owns and operates an explosives manufacturing facility located at 430 Powder Plant Road in McArthur, Ohio (the "Facility"), at which it produces emulsion explosives, cast boosters, and detonation cords for mining operations. The Complaint against Defendant alleges that Austin Powder has violated CWA Section 309(d), 33 U.S.C. § 1319(d), by failing to comply with the terms and conditions of its National Pollutant Discharge Elimination System permit ("NPDES Permit") at the Facility, including by failing to comply with NPDES Permit wastewater effluent limits and failing to implement and maintain adequately the Storm Water Pollution Prevention Plan for the Facility.

Austin Powder owns and operates seven on-site wastewater treatment plants ("WWTPs") at the Facility that treat sanitary and/or process wastewater associated with explosives production. EPA conducted an investigation of the Facility, which included an inspection during October 24-27, 2016, and found alleged violations of the NPDES Permit. EPA and Austin Powder entered into an Administrative Order on Consent on April 27, 2018, under which Defendant agreed, *inter alia*, to submit to EPA for approval and then implement a plan to bring Austin Powder's WWTPs into compliance with the CWA. The Initial WWTP Compliance Measures document, attached as Appendix A to this Consent Decree, satisfies the requirement of the Administrative Order on Consent that Austin Powder submit such a compliance plan.

Defendant does not admit any liability to the United States arising out of the transactions or occurrences alleged in the Complaint.

The Parties recognize, and the Court by entering this Consent Decree finds, that this Consent Decree has been negotiated by the Parties in good faith and will avoid litigation between the Parties and that this Consent Decree is fair, reasonable, and in the public interest.

NOW, THEREFORE, before the taking of any testimony, without the adjudication or admission of any issue of fact or law except as provided in Section I with the consent of the Parties, IT IS HEREBY ADJUDGED, ORDERED, AND DECREED as follows:

I. JURISDICTION AND VENUE

1. This Court has jurisdiction over the subject matter of this action, pursuant to 28 U.S.C. §§ 1331, 1345, and 1355, and CWA Section 309(d), 33 U.S.C. § 1319(d), and over the Parties. Venue lies in this District pursuant to Section 309(b) of the Act, 33 U.S.C. § 1319(b), and 28 U.S.C. §§ 1391(b) and 1395(a), because the violations alleged in the Complaint are alleged to have occurred in, and Defendant conducts business in, this judicial district. For purposes of this Decree, or any action to enforce this Decree, Defendant consents to the Court's jurisdiction over this Decree and any such action and over Defendant and consents to venue in this judicial district.

2. For purposes of this Consent Decree, Defendant agrees that the Complaint states claims upon which relief may be granted pursuant to CWA Section 309(d), 33 U.S.C. § 1319(d).

II. APPLICABILITY

3. The obligations of this Consent Decree apply to and are binding upon the United States, and upon Defendant and any successors, assigns, or other entities or persons otherwise bound by law.

4. No transfer of ownership or operation of the Facility, whether in compliance with the procedures of this Paragraph or otherwise, shall relieve Defendant of its obligation to ensure that the terms of the Decree are implemented. At least 30 Days prior to such transfer, Defendant shall provide a copy of this Consent Decree to the proposed transferee and shall simultaneously provide written notice of the prospective transfer, together with a copy of the proposed written agreement, to EPA and the United States Department of Justice (DOJ) in accordance with Section XIII (Notices). Any attempt to transfer ownership or operation of the Facility without complying with this Paragraph constitutes a violation of this Consent Decree.

5. Defendant shall provide a copy of this Consent Decree to all officers, employees, and agents whose duties might reasonably include compliance with any provision of this Decree, as well as to any contractor retained to perform work required under this Consent Decree. Defendant shall condition any such contract upon performance of the work in conformity with the terms of this Consent Decree.

6. In any action to enforce this Consent Decree, Defendant shall not raise as a defense the failure by any of its officers, directors, employees, agents, or contractors to take any actions necessary to comply with the provisions of this Consent Decree.

7. Objectives. It is the express purpose of the Parties in entering this Consent Decree to further the objectives of the CWA. All plans, reports, construction, maintenance, and other obligations in this Consent Decree or resulting from the activities required by this Consent

Decree shall have the objective of causing Defendant to come into and/or remain in compliance with the terms of the NPDES Permit and the CWA.

III. DEFINITIONS

8. Terms used in this Consent Decree that are defined in the Act or in regulations promulgated pursuant to the Act have the meanings assigned to them in the CWA or such regulations, unless otherwise provided in this Decree. Whenever the terms set forth below are used in this Consent Decree, the following definitions apply:

"Complaint" means the complaint filed by the United States in this action;

"Consent Decree" or "Decree" means this Decree and all appendices attached hereto (listed in Section XXIII). In the event of a conflict between this Consent Decree and any appendix, the text of this Consent Decree shall control;

"Date of Lodging" means the date that the United States files a "Notice of Lodging" of this Consent Decree with the Clerk of this Court for the purpose of providing notice and comment to the public in accordance with 28 C.F.R. § 50.7;

"Day" means a calendar day unless expressly stated to be a business day. In computing any period of time for a deadline under this Consent Decree, where the last day would fall on a Saturday, Sunday, or federal holiday, the period runs until the close of business of the next business day;

"Defendant" means Austin Powder Company;

"Discharge" shall have the meaning assigned in CWA Section 502(16), 33 U.S.C. § 1362(16);

"DOJ" means the United States Department of Justice and any of its successor departments or agencies;

"EPA" means the United States Environmental Protection Agency and any of its successor departments or agencies;

"Effective Date" means the definition provided in Section XIV (Effective Date);

"Facility" means Defendant's explosives manufacturing facility, also known as the "Red Diamond Plant," located at 430 Powder Plant Road in McArthur, Ohio;

"Initial WWTP Compliance Measures" means the interim steps set forth in Appendix A that were taken by Austin Powder prior to and during the course of negotiations regarding the Consent Decree, which were designed to help Austin Powder come into and remain in compliance with the Clean Water Act and the NPDES Permit;

"Interest" means the rate specified by 28 U.S.C. § 1961;

"NPDES" means the National Pollutant Discharge Elimination System permit program described in CWA Section 402, 33 U.S.C. § 1342, and in other provisions of the CWA;

"NPDES Permit" means NPDES Permit No. OH0006173 issued by Ohio EPA on behalf of the State of Ohio with an effective date of March 1, 2020, and an expiration date of February 28, 2025, and any subsequent NPDES permit issued by the State of Ohio to Defendant for the Facility;

"Ohio EPA" means the Ohio Environmental Protection Agency and any successor departments, agencies, or instrumentalities of the State of Ohio;

"Outfall" means a type of "point source," as that term is defined in CWA Section 502(14), 33 U.S.C. § 1362(14), that serves as a discharge point from the Facility. "Outfall" followed by an arabic numeral means the Outfall assigned that number in the NPDES Permit;

"Paragraph" means a portion of this Decree identified by an arabic numeral;

"Parties" means the United States and Defendant;

"Permit-to-Install" or "PTI" means the permit issued by Ohio EPA prior to the construction or modification of a wastewater collection system, a wastewater storage basin, or a wastewater treatment plant, such as the Outfall 010 and 011 WWTPs at the Facility;

"Point Source" shall have same meaning as defined in CWA Section 502(14), 33 U.S.C. § 1362(14);

"Section" means a portion of this Decree identified by a roman numeral;

"State" means the State of Ohio.

"United States" means the United States of America, acting on behalf of EPA; and

"WWTP" or "Wastewater Treatment Plant" means the facilities and associated components that provide treatment to sanitary and process wastewater at the Facility, in order to comply with the requirements of the NPDES Permit and the CWA.

IV. CIVIL PENALTY

9. Within 30 Days after the Effective Date, Defendant shall pay the sum of $2.3 million as a civil penalty, together with interest accruing from the Date of Lodging, at the rate specified in 28 U.S.C. § 1961 as of the Date of Lodging.

10. Defendant shall pay the civil penalty due by FedWire Electronic Funds Transfer (EFT) to the DOJ account, in accordance with instructions provided to Defendant by the Financial Litigation Unit (FLU) of the United States Attorney's Office for the Southern District of Ohio after the Effective Date. The payment instructions provided by the FLU will include a Consolidated Debt Collection System (CDCS) number, which Defendant shall use to identify all payments required to be made in accordance with this Consent Decree. The FLU will provide the payment instructions to:

Constantine Toscidis
Associate General Counsel
Austin Powder Company
25800 Science Park Drive
Cleveland, Ohio 44122
(216) 839-5468
con.toscidis@austinpowder.com

on behalf of Defendant. Defendant may change the individual to receive payment instructions on its behalf by providing written notice of such change to DOJ and EPA in accordance with Section XIII (Notices).

11. At the time of payment, Defendant shall send notice that payment has been made to: (i) EPA via email at cinwd_acctsreceivable@epa.gov or via regular mail at EPA Cincinnati Finance Office, 26 W. Martin Luther King Drive, Cincinnati, Ohio 45268; (ii) DOJ via email or regular mail in accordance with Section XIII (Notices); and (iii) EPA in accordance with Section XIII (Notices). Such notice shall state that the payment is for the civil penalty owed pursuant to the Consent Decree in *United States v. Austin Powder Corp.* and shall reference the civil action number, CDCS Number, and DOJ case number 90-5-1-1-12117.

12. Defendant shall not deduct any penalties paid under this Decree pursuant to this Section IV or Section VII (Stipulated Penalties) in calculating its federal income tax.

V. COMPLIANCE REQUIREMENTS

13. Austin Powder shall operate and maintain the WWTPs at the Facility in accordance with the terms and conditions of the NPDES Permit and CWA Section 309(d), 33 U.S.C. § 1319(d).

14. Initial WWTP Compliance Measures. Prior to and during the course of negotiations on the Consent Decree, Defendant has implemented the interim measures set forth in Appendix A ("Initial WWTP Compliance Measures"). The Initial WWTP Compliance

Measures consisted of remedial measures designed to help Austin Powder come into and remain in compliance with the NPDES Permit and the CWA at its WWTPs.

15. WWTP Compliance Plan and Remedial Measures. On January 27, 2021, Defendant submitted a proposed WWTP Compliance Plan ("WWTP Compliance Plan") to EPA. The purpose of the WWTP Compliance Plan was to identify and develop additional remedial measures to cause Austin Powder to come into and maintain compliance with all NPDES Permit requirements, including achieving compliance at the Outfall 001 and Outfall 010 WWTPs by April 1, 2022, or within 90-days of issuance of the PTI related to the remedial measures identified in the Outfall 010 Compliance Plan by Ohio EPA, whichever is earlier. Austin Powder shall implement remedial measures at the Outfall 001 and Outfall 010 WWTPs in accordance with the requirements and schedule set forth in Appendix B.

16. Outfall 011 WWTP Treatability Study. On July 9, 2021, Defendant completed an Outfall 011 WWTP Treatability Study ("Treatability Study") in accordance with the requirements set forth in the WWTP Compliance Plan. The purpose of the Treatability Study was to study the effectiveness of the remedial measures proposed in the WWTP Compliance Plan relating to the Outfall 011 WWTP.

17. Outfall 011 Compliance Plan. On August 23, 2021, Defendant submitted an Outfall 011 Compliance Plan to EPA for approval pursuant to Paragraph 27. The purpose of the Outfall 011 Compliance Plan is to use the results of the Outfall 011 WWTP Treatability Study to identify and develop additional remedial measures to cause Austin Powder to come into and maintain compliance with all NPDES Permit requirements related to the Outfall 11 WWTP.

a. The Outfall 011 Compliance Plan shall include:

(1) An update regarding the status of all measures required by the Initial WWTP Compliance Measures in Appendix A and an evaluation of the anticipated benefits resulting from implementing these remedial measures;

(2) A copy of the Treatability Study required by Paragraph 16, including a detailed discussion of the investigation, testing, and associated results;

(3) All additional alternative remedial measures considered by Austin Powder to come into and remain in compliance with the NPDES Permit and CWA at Outfall 011;

(4) The remedial measures(s) recommended by Austin Powder, including an explanation as to how Defendant's recommended remedial measure(s) will address all of the alleged NPDES Permit violations at the Outfall 011 WWTP that have occurred since October 1, 2016;

(5) As to any remedial measure considered by Austin Powder but not recommended pursuant to subparagraph a.(4) above, an explanation as to why Austin Powder does not recommend implementing such measure; and

(6) A proposed schedule for achieving compliance with the NPDES Permit and CWA at Outfall 011, which shall not extend beyond the dates set forth below. The schedule shall identify, for each remedial measure, the deadline for starting construction on the

remedial measures and the deadline by which the remedial measure must be fully operational.

b. Until the date of issuance of the PTIs for the Outfall 010 Compliance Plan and the Outfall 011 Compliance Plan, Defendant shall provide EPA with a written monthly status update regarding the PTIs, including any ongoing discussions with Ohio EPA related to the PTIs. Upon request by EPA, Defendant shall provide copies of correspondence with Ohio EPA related to the PTIs. Defendant shall provide notice to EPA pursuant to Section XIII (Notices) within five Days after it receives the final PTI from Ohio EPA related to the Outfall 010 Compliance Plan and the Outfall 011 Compliance Plan, as applicable, and provide a copy of the PTI. In this notice, Defendant shall identify the relevant compliance deadline, determined pursuant to Paragraph 15 or Paragraph 17, as applicable.

c. Defendant shall implement the Outfall 011 Compliance Plan in accordance with the following schedule:

(1) On or before June 30, 2022, if the PTI for the implementation of the Outfall 011 Compliance Plan is issued by Ohio EPA on or before December 31, 2021;

(2) On or before September 30, 2022, if the PTI for the implementation 011 Compliance Plan is issued by Ohio EPA between January 1, 2022 and March 31, 2022; or

(3) On or before December 31, 2022, if the PTI for the implementation of the Outfall 011 Compliance Plan is issued by Ohio EPA on or after April 1, 2022.

(4) The Outfall 011 Compliance Plan contains interim compliance dates associated with a final compliance date of June 30, 2022. In the event that the final compliance date is extended beyond that date pursuant to subparagraph 17.b(2) or (3) above, Austin Powder shall submit for approval pursuant to Paragraph 27 an updated schedule with interim compliance dates for the Outfall 011 Compliance Plan within 10 days of the receipt of the PTI from Ohio EPA.

18. Minor changes to the approved Outfall 011 Compliance Plan or Appendix B, including extensions of time to complete compliance measures that do not exceed 60 Days, will not be considered modifications to the Consent Decree under Section XVI (Modification), provided that (i) the change will not adversely impact the effectiveness of the remedial measure(s) at issue; and (ii) the final compliance dates set forth in Paragraph 15 and 17.c remain unchanged. Any such change or extension of time must be approved by EPA in writing and EPA's approval or disapproval of a proposed change to either the approved Outfall 011 Compliance Plan or Appendix B shall not be subject to dispute resolution. When proposing such a change to the approved Outfall 011 Compliance Plan or Appendix B, Austin Powder shall explain in writing why the change is a minor change, why the proposed change will not adversely impact Austin Powder's ability to achieve compliance with the NPDES Permit, and describe how the proposed change meets the criteria set forth in (i) and (ii) above.

19. Minor changes to Appendix C also will not be considered modifications to the Consent Decree under Section XVI (Modification), such as changes to reflect modifications to Appendix B made under Paragraph 18 or other minor changes in operation at the Outfall 010 WWTP, provided that such changes will not adversely impact Austin Powder's ability to achieve compliance with the NPDES Permit. Austin Powder shall submit any such proposed change(s) to Appendix C to EPA in writing, and shall explain why the change is a minor change, and why the proposed change will not adversely impact Austin Powder's ability to achieve compliance with the NPDES Permit. Austin Powder may implement such changes to Appendix C immediately, but such changes nonetheless shall be subject to approval under Paragraph 27 of this Consent Decree.

20. Austin Powder may implement temporary alternative treatment measures to meet the requirements of the NPDES Permit prior to completion of implementation of the requirements of Section V (Compliance Requirements) of the Consent Decree, provided that: (a) Austin Powder provides EPA with advance written notice of its intent to use alternative treatment measures in accordance with Section XIII (Notices), including the anticipated duration of all such measures; (b) the notice describes the proposed alternative measures in detail and includes a description of how the proposed alternative measures will address the noncompliance issue; (c) the notice is provided at least 60 Days in advance of the implementation of such measures, and EPA does not object to such measures within 30 Days of receipt of such notice; and (d) use of such alternative measures is needed to (i) address a temporary upset at the Facility that could lead to potential noncompliance with the NPDES Permit or (ii) Austin Powder determines that it will not be in compliance with its NPDES Permit by the dates set forth in Paragraph 15 and Paragraph 17, as applicable, without implementing such alternative measures.

Implementation by Austin Powder of any alternative measures in accordance with this Paragraph 20 does not constitute an approval by EPA of the alternative measures proposed by Austin Powder. Austin Powder remains responsible for complying with all requirements of this Section V (Compliance Requirements) and the NPDES Permit.

21. WWTP Monitoring. Defendant shall begin monitoring the performance of its NPDES-permitted outfalls, excluding Outfall 011, on May 1, 2022, or on the first day of the first full month after the completion and full operation of the remedial measures required by Item # 1 and Item # 2 in Appendix B, if these remedial measures are in full operation on or before March 1, 2022. Defendant shall begin monitoring Outfall 011 on July 1, 2022, or on the first day of the first full month after the completion of the remedial measures required in the approved Outfall 011 Compliance Plan. Defendant shall continue monitoring all of its NPDES permitted outfalls until June 30, 2023, or until at least one continuous year of monitoring of all of Defendant's NPDES permitted outfalls has been completed. This monitoring timeframe shall be referred to as the WWTP Monitoring Period.

22. WWTP Monitoring Report. Within 60 Days after the completion of the WWTP Monitoring Period, Defendant shall submit a WWTP Monitoring Report to EPA for approval pursuant to Paragraph 27. The WWTP Monitoring Report shall include the following:

a. A list of all NPDES permit effluent limit exceedances that occurred during the monitoring period, including dates and total days of violations at each outfall;

b. The cause(s) of NPDES permit effluent limit exceedances, if any;

c. All the DMRs reported to the Ohio EPA during the monitoring period;

d. Any projects implemented during the monitoring period to address and/or mitigate any of the NPDES permit effluent limit exceedances;

e. Any upsets/bypasses of Defendant's WWTPs that occurred during the monitoring period and the corrective actions taken by Defendant to address the upsets/bypasses;

f. Any updates to the Sampling and Analytical Plan, the WWTP Troubleshooting Guidelines, the monthly bioassessments of activated sludge conducted in the WWTPs, Updated WWTP Standard Operating Procedures (SOPs), and the WWTP Operations Plan;

g. Any operation and maintenance issues at the WWTPs;

h. All biomonitoring assessments conducted at the WWTPs;

i. The number of times the Outfall 010 WWTP Ultraviolet (UV) disinfection system was cleaned; and

j. The number of times waste activated sludge was removed from Defendant's WWTPs.

23. Supplemental WWTP Remedial Measures Plan. If, after reviewing the WWTP Monitoring Plan Report, EPA determines that Defendant has not come into compliance with the NPDES Permit, EPA will inform Defendant of this determination in writing. Within 90 Days of receiving this determination, Defendant shall submit to EPA, for approval pursuant to Paragraph 27, a Supplemental WWTP Remedial Measures Plan that proposes additional measures that Defendant shall undertake to address noncompliance with the NPDES Permit and a schedule for completing those additional measures. Upon written approval by EPA, Defendant shall implement the approved Supplemental WWTP Remedial Measures Plan.

24. Monitoring Following Completion of the Supplemental WWTP Remedial Measures Plan. Following completion of the Supplemental WWTP Remedial Measures Plan, Defendant shall conduct monitoring relating to the supplemental remedial measures in accordance with Paragraphs 21 (WWTP Monitoring) and 22 (WWTP Monitoring Report) for one continuous year. Following completion of such monitoring, Defendant shall submit for EPA's approval, pursuant to Paragraph 27, a supplemental monitoring report that addresses the elements of Paragraph 22 ("Supplemental WWTP Monitoring Report"). If, after reviewing the Supplemental WWTP Monitoring Report, EPA determines that Defendant has not come into compliance with the NPDES Permit, EPA will inform Defendant of this determination in writing. Defendant shall continue to implement remedial measures until it has demonstrated, to EPA's satisfaction, that it has come into compliance with the NPDES permit.

25. Outfall 010 WWTP Operations Plan. Within 30 days after completion of the remedial measures required by Paragraph 15 and Appendix B, Defendant shall implement the Outfall 010 WWTP Operations Plan (Appendix C to this Consent Decree).

26. Outfall 011 WWTP Operations Plan. Within 60 Days after EPA approval of the Outfall 011 Compliance Plan, Defendant shall submit to EPA for approval, pursuant to Paragraph 27, an Outfall 011 WWTP Operations Plan. The Outfall 011 WWTP Operations Plan shall identify tasks and procedures relating to the operations of the Outfall 011 WWTP and be substantially similar to the Outfall 010 WWTP Operations Plan in format and level of detail. The Outfall 011 WWTP Operations Plan shall include the following components, at a minimum:

a. Outfall 011 Training Protocols, which shall describe the employee training program related to the operation of the Outfall 011 WWTP;

b. Outfall 011 Sampling Plans, which shall describe all sampling, consisting of compliance sampling and internal process sampling, that will occur at the Outfall 011 WWTP, as part of the WWTP Operations Plan;

c. WWTP Bioassessment Testing Procedures, which shall describe the internal process evaluations of activated sludge used in order to gauge biomass health at the Outfall 011 WWTP, and shall include corrective actions to be taken to remediate issues based upon test results;

d. Sampling and Analytical Plan, which shall describe how Defendant will monitor influent waste streams, WWTP operational parameters, and WWTP treatment performance process controls at all active WWTPs at the Facility;

e. WWTP Troubleshooting Guidelines, which describes the WWTP operational and problem-solving guidance that will be given to Austin Powder employees;

f. WWTP Data Monitoring Tracking System, which shall mean the data tracking system Defendant shall use to aid in the management of its WWTPs, including any ongoing WWTP issues, and the applicable responses. A description of the WWTP Data Monitoring Tracking System shall be included in Defendant's WWTP Operations Plan; and

g. Updated WWTP Standard Operating Procedures, which shall describe the procedures developed by Austin Powder to update onsite laboratory analyses, sampling methods, and laboratory quality assurance/quality controls.

27. Approval of Deliverables. After review of any plan, report, or other item that is required to be submitted pursuant to this Consent Decree, EPA will in writing: (a) approve the submission; (b) approve the submission upon specified conditions; (c) approve part of the submission and disapprove the remainder; or (d) disapprove the submission. If EPA fails to act on a submittal within 90 Days, any subsequent milestone date dependent upon such action by EPA shall be extended by the number of Days beyond the 90-Day period that EPA uses to act on the submittal, provided that: (i) Defendant notifies EPA in writing, at the time of its submittal, of the end date of the 90-Day review period; and (ii) if EPA fails to act within 90 Days, Defendant notifies EPA within seven Days following expiration of the 90-Day review period of any specific milestone dates that Defendant believes would be extended. EPA has agreed to the 90-day review period in this Paragraph based upon the particular submissions to be reviewed under this Consent Decree, and in recognition of the work already done by Austin Powder in developing the WWTP Compliance Plan and WWTP Operations Plan.

28. If the submission is approved pursuant to Paragraph 27, Defendant shall take all actions required by the plan, report, or other document, in accordance with the schedules and requirements of the plan, report, or other document, as approved. If the submission is conditionally approved or approved only in part pursuant to Paragraph 27(b) or (c), Defendant shall, upon written direction from EPA, take all actions required by the approved plan, report, or other item that EPA determines are technically severable from any disapproved portions, subject to Defendant's right to dispute only the specified conditions or the disapproved portions under Section IX (Dispute Resolution). If EPA conditions approval pursuant to Paragraph 27(b) upon resubmission of the plan, report, or other item, Defendant shall resubmit the plan, report, or other item in accordance with the conditions of EPA's approval.

29. If the submission is disapproved in whole or in part pursuant to Paragraph 27(c) or (d), Defendant shall, within 45 Days or such other time as the Parties agree to in writing, correct all deficiencies and resubmit the plan, report, or other item, or disapproved portion thereof, for approval, in accordance with the preceding Paragraphs. If the resubmission is approved in whole or in part, Defendant shall proceed in accordance with the preceding Paragraph.

30. If a resubmitted plan, report, or other item, or portion thereof, is disapproved in whole or in part, EPA may again require Defendant to correct any deficiencies, in accordance with the preceding Paragraphs, or may itself correct any deficiencies subject to Defendant's right to invoke Dispute Resolution and the right of EPA to seek stipulated penalties as provided in the preceding Paragraphs.

31. If Defendant elects to invoke Dispute Resolution as set forth in Paragraphs 28 or 30, Defendant shall do so by sending a Notice of Dispute in accordance with Paragraph 58 within 30 Days (or such other time as the Parties agree to in writing) after receipt of the applicable decision. Any stipulated penalties applicable to the original submission, as provided in Section VII, accrue during the 45-Day period or other specified period, but shall not be payable unless the resubmission is untimely or is disapproved in whole or in part; provided that, if the original submission was so deficient as to constitute a material breach of Defendant's obligations under this Decree, the stipulated penalties applicable to the original submission shall be due and payable notwithstanding any subsequent resubmission.

32. Permits. Where any compliance obligation under this Section requires Defendant to obtain a federal, state, or local permit or approval, Defendant shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals, allowing

for all legally required processing and review including requests for additional information by the permitting or approval authority. Defendant may seek relief under the provisions of Section VIII (Force Majeure) for any delay in the performance of any such obligation resulting from a failure to obtain, or a delay in obtaining, any permit or approval required to fulfill such obligation, if Defendant has submitted timely and complete applications and has taken all other actions necessary to obtain all such permits or approvals. The inability of Defendant to obtain a permit in adequate time to allow compliance with the deadlines stated in this Consent Decree shall be considered a Force Majeure event only if Defendant demonstrates that it exercised best efforts to fulfill its permitting obligations in a timely manner.

VI. REPORTING REQUIREMENTS

33. Defendant shall submit the following reports to EPA and DOJ at the addresses set forth Section XIII (Notices):

a. By January 31st, April 30th, July 31st, and October 31st of each year after the lodging of this Consent Decree, until termination of this Decree pursuant to Section XVII, Defendant shall submit electronically a quarterly report for the preceding three months that includes the following:

(1) the status of any construction or compliance measures;

(2) completion of milestones;

(3) problems encountered or anticipated, together with implemented or proposed solutions;

(4) status of permit applications; and

(5) operations and maintenance activities.

b. The report shall also include a description of any noncompliance and anticipated noncompliance, including anticipated delays in achieving compliance, with the requirements of this Consent Decree and an explanation of the violation's likely cause and of the remedial steps taken, or to be taken, to prevent or minimize such violation or delay. If Defendant violates, or has reason to believe that it may violate, any requirement of this Consent Decree, Defendant shall notify DOJ and EPA of such violation or anticipated delay, as applicable, and its likely duration, in writing, within 14 Days of the Day Defendant first becomes aware of the violation or delay, with an explanation of the violation's or delay's likely cause and of the remedial steps taken, or to be taken, to prevent or minimize such violation or delay. If the cause of a violation or anticipated delay cannot be fully explained at the time the report is due, Defendant shall so state in the report. Defendant shall investigate the cause of the violation or anticipated delay, as applicable, and shall then submit an amendment to the report, including a full explanation of the cause of the violation or anticipated delay, within 30 Days of the Day Defendant becomes aware of the cause of the violation or delay. Nothing in this Paragraph or the following Paragraph relieves Defendant of its obligation to provide the notice required by Section VIII (Force Majeure).

34. Within 14 Days of Austin Powder's submission of a discharge monitoring report to Ohio EPA, Defendant shall submit copies of such discharge monitoring report to EPA in accordance with Section XIII (Notices). For each discharge monitoring report that reports noncompliance with the NPDES Permit, Defendant shall include a description of the cause(s) of the violation and all corrective actions taken and to be taken to address the violation and prevent future violations.

35. Whenever any violation of this Consent Decree or of the NPDES permit or any other event affecting Defendant's performance under this Decree, or the performance of its Facility, may pose an immediate threat to the public health or welfare or the environment, Defendant shall notify EPA by telephone at 312-886-6465 (Keith Middleton) and by email to the addresses listed in Section XIII (Notices) as soon as possible, but no later than 24 hours after Defendant first knew of the violation or event. This procedure is in addition to the requirements set forth in the preceding Paragraphs.

36. Each report submitted by Defendant under this Section shall be signed by an authorized official of the submitting party and include the following certification:

> I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based upon my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

37. This certification requirement does not apply to emergency or similar notifications where compliance would be impractical.

38. The reporting requirements of this Consent Decree do not relieve Defendant of any reporting obligations required by the CWA or implementing regulations, or by any other federal, state, or local law, regulation, permit, or other requirement.

39. Any information provided pursuant to this Consent Decree may be used by the United States in any proceeding to enforce the provisions of this Consent Decree and as otherwise permitted by law.

VII. STIPULATED PENALTIES

40. Defendant shall be liable for stipulated penalties to the United States for violations of this Consent Decree as specified below, unless excused under Section VIII (Force Majeure). A violation includes failing to perform any obligation required by the terms of this Decree, including any work plan or schedule approved under this Decree, according to all applicable requirements of this Decree and within the specified time schedules established by or approved under this Decree.

41. Late Payment of Civil Penalty. If Defendant fails to pay the civil penalty required to be paid under Section IV (Civil Penalty) when due, Defendant shall pay a stipulated penalty of $1,250 per Day for each Day that the payment is late.

42. Defendant shall be liable to the United States as specified in Tables 1 through 4 below:

<table>
<tr><th colspan="3">Table 1 – <i>NPDES Permit</i></th></tr>
<tr><th>Violation</th><th colspan="2">Stipulated Penalty</th></tr>
<tr><td rowspan="4">Each failure to comply with any daily maximum concentration or mass limit effluent limitation in the NPDES Permit at Outfall 001 or Outfall 010</td><td>Degree of Exceedance</td><td>Penalty Per Violation Per Day On or After the Deadlines Set Forth in Paragraph 15</td></tr>
<tr><td>1-20%</td><td>$2,000</td></tr>
<tr><td>21-50%</td><td>$3,500</td></tr>
<tr><td>50% or more</td><td>$6,000</td></tr>
<tr><td rowspan="4">Each failure to comply with any monthly or weekly average concentration or mass limit effluent limitation in the NPDES Permit at Outfall 001 or Outfall 010</td><td>Degree of Exceedance</td><td>Penalty Per Violation Per Day On or After April 1, 2022</td></tr>
<tr><td>1-20%</td><td>$2,000</td></tr>
<tr><td>21-50%</td><td>$3,500</td></tr>
<tr><td>50% or more</td><td>$6,000</td></tr>
</table>

Each failure to comply with any daily maximum concentration or mass limit effluent limitation in the NPDES Permit at Outfall 011	Degree of Exceedance — Penalty Per Violation Per Day On or After the Deadlines Set Forth in Paragraph 17 1-20%..........$2,000 21-50%..........$3,500 50% or more..........$6,000
Each failure to comply with any monthly or weekly average concentration or mass limit effluent limitation in the NPDES Permit at Outfall 011	Degree of Exceedance — Penalty Per Violation Per Day On or After the Deadlines Set Forth in Paragraph 17 1-20%..........$2,000 21-50%..........$3,500 50% or more..........$6,000

Table 2 – *Compliance Milestones*

Violation	Stipulated Penalty
Each failure to comply with any requirement or deadline set forth in Table 1 or Paragraph 15, Outfall 011 Compliance Plan, Supplemental WWTP Remedial Measures Plan, Outfall 010 WWTP Operations Plan, or the Outfall 011WWTP Operations Plan	Period of Noncompliance — Penalty Per Violation Per Day 1st through 30th Day — $1,000 31st through 60th Day — $1,500 61st Day and beyond — $2,500

Table 3 – *Reporting Obligations*

Violation	**Stipulated Penalty**	
	Period of Noncompliance	Penalty Per Violation Per Day
Each failure to comply with any recordkeeping, submission, or reporting requirement in Section V (Compliance Requirements) or Section VI (Reporting Requirements)	1st through 30th Day	$500
	31st through 60th Day	$1,000
	61st Day and beyond	$1,500

Table 4 – *Other Consent Decree Obligations*

Violation	**Stipulated Penalty**
Each failure to comply with any other requirement of this Consent Decree for which no Stipulated Penalty is specified	$1,000 Per Violation Per Day

43. Stipulated penalties under this Section shall begin to accrue on the Day after performance is due or on the Day a violation occurs, whichever is applicable, and shall continue to accrue until performance is satisfactorily completed or until the violation ceases. Stipulated penalties shall accrue simultaneously for separate violations of this Consent Decree.

44. Defendant shall pay any stipulated penalty within 30 Days of receiving the United States' written demand.

45. The United States may in the unreviewable exercise of its discretion, reduce or waive stipulated penalties otherwise due it under this Consent Decree.

46. Stipulated penalties shall continue to accrue as provided in Paragraph 43, during any Dispute Resolution, but need not be paid until the following:

a. If the dispute is resolved by agreement of the Parties or by a decision of EPA that is not appealed to the Court, Defendant shall pay accrued penalties determined to be owing, together with interest, to the United States within 30 Days of the effective date of the agreement or the receipt of EPA's decision or order.

b. If the dispute is appealed to the Court and the United States prevails in whole or in part, Defendant shall pay all accrued penalties determined by the Court to be owing, together with interest, within 60 Days of receiving the Court's decision or order, except as provided in subparagraph c, below.

c. If any Party appeals the District Court's decision, Defendant shall pay all accrued penalties determined to be owing, together with interest, within 15 Days of receiving the final appellate court decision.

47. Obligations Prior to the Effective Date. Upon the Effective Date, the stipulated penalty provisions of this Decree shall be retroactively enforceable only with regard to the requirements of Paragraphs16, 17, and 21 that have occurred prior to the Effective Date, provided that stipulated penalties that may have accrued prior to the Effective Date may not be collected unless and until this Consent Decree is entered by the Court.

48. Defendant shall pay stipulated penalties owing to the United States in the manner set forth in and with the confirmation notices required by Paragraph 10, except that the transmittal letter shall state that the payment is for stipulated penalties and shall state for which violation(s) the penalties are being paid.

49. If Defendant fails to pay stipulated penalties according to the terms of this Consent Decree, Defendant shall be liable for interest on such penalties, as provided for in 28 U.S.C. § 1961, accruing as of the date payment became due. Nothing in this Paragraph shall be construed to limit the United States from seeking any remedy otherwise provided by law for Defendant's failure to pay any stipulated penalties.

50. The payment of penalties and interest, if any, shall not alter in any way Defendant's obligation to complete the performance of the requirements of this Consent Decree.

51. Non-Exclusivity of Remedy. Stipulated penalties are not the United States' exclusive remedy for violations of this Consent Decree. Subject to the provisions of Section XI (Effect of Settlement/Reservation of Rights), the United States expressly reserves the right to seek any other relief it deems appropriate for Defendant's violation of this Decree or applicable law, including but not limited to an action against Defendant for statutory penalties, additional injunctive relief, mitigation or offset measures, and/or contempt. However, the amount of any statutory penalty assessed for a violation of this Consent Decree shall be reduced by an amount equal to the amount of any stipulated penalty assessed and paid pursuant to this Consent Decree.

VIII. FORCE MAJEURE

52. "Force majeure," for purposes of this Consent Decree, is defined as any event arising from causes beyond the control of Defendant, of any entity controlled by Defendant, or of Defendant's contractors, that delays or prevents the performance of any obligation under this Consent Decree despite Defendant's best efforts to fulfill the obligation. The requirement that Defendant exercise "best efforts to fulfill the obligation" includes using best efforts to anticipate any potential force majeure event and best efforts to address the effects of any potential force majeure event (a) as it is occurring and (b) following the potential force majeure, such that the

delay and any adverse effects of the delay are minimized. "Force Majeure" does not include Defendant's financial inability to perform any obligation under this Consent Decree. Application for construction grants, State Revolving Loan Funds, or any other grants or loans, or other delays caused by inadequate facility planning or plans and specifications on the part of Defendant shall not be cause for extension of any required compliance date in this Consent Decree.

53. If any event occurs or has occurred that may delay the performance of any obligation under this Consent Decree, whether or not caused by a force majeure event, Defendant shall provide notice by telephone to Keith Middleton at 312-886-6465, or by email, pursuant to email addresses listed in Section XIII (Notices), within 72 hours of when Defendant first knew that the event might cause a delay. Within seven Days thereafter, Defendant shall provide in writing to EPA an explanation and description of: the reasons for the delay; the anticipated duration of the delay; all actions taken or to be taken to prevent or minimize the delay; a schedule for implementation of any measures to be taken to prevent or mitigate the delay or the effect of the delay; Defendant's rationale for attributing such delay to a force majeure event if it intends to assert such a claim; and a statement as to whether, in the opinion of Defendant, such event may cause or contribute to an endangerment to public health, welfare or the environment. Defendant shall include with any notice all available documentation supporting the claim that the delay was attributable to a force majeure. Failure to comply with the above requirements shall preclude Defendant from asserting any claim of force majeure for that event for the period of time of such failure to comply, and for any additional delay caused by such failure. Defendant shall be deemed to know of any circumstance of which Defendant, any entity controlled by Defendant, or Defendant's contractors knew or should have known.

54. If EPA agrees that the delay or anticipated delay is attributable to a force majeure event, the time for performance of the obligations under this Consent Decree that are affected by the force majeure event will be extended by EPA for such time as is necessary to complete those obligations. An extension of the time for performance of the obligations affected by the force majeure event shall not, of itself, extend the time for performance of any other obligation. EPA will notify Defendant in writing of the length of the extension, if any, for performance of the obligations affected by the force majeure event.

55. If EPA does not agree that the delay or anticipated delay has been or will be caused by a force majeure event, EPA will notify Defendant in writing of its decision.

56. If Defendant elects to invoke the dispute resolution procedures set forth in Section IX (Dispute Resolution), it shall do so no later than 15 Days after receipt of EPA's notice. In any such proceeding, Defendant shall have the burden of demonstrating by a preponderance of the evidence that the delay or anticipated delay has been or will be caused by a force majeure event, that the duration of the delay or the extension sought was or will be warranted under the circumstances, that best efforts were exercised to avoid and mitigate the effects of the delay, and that Defendant complied with the requirements of Paragraphs 52 and 53. If Defendant carries this burden, the delay at issue shall be deemed not to be a violation by Defendant of the affected obligation of this Consent Decree identified to EPA and the Court.

IX. DISPUTE RESOLUTION

57. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. Defendant's failure to seek resolution of a dispute

under this Section shall preclude Defendant from raising any such issue as a defense to an action by the United States to enforce any obligation of Defendant arising under this Decree.

58. Informal Dispute Resolution. Any dispute subject to Dispute Resolution under this Consent Decree shall first be the subject of informal negotiations. The dispute shall be considered to have arisen when Defendant sends DOJ and EPA a written Notice of Dispute. Such Notice of Dispute shall state clearly the matter in dispute. The period of informal negotiations shall not exceed 21 Days from the date the dispute arises, unless that period is modified by written agreement. If the Parties cannot resolve a dispute by informal negotiations, then the position advanced by the United States shall be considered binding unless, within 45 Days after the conclusion of the informal negotiation period, Defendant invokes formal dispute resolution procedures as set forth below.

59. Formal Dispute Resolution. Defendant shall invoke formal dispute resolution procedures, within the time period provided in the preceding Paragraph, by sending DOJ and EPA a written Statement of Position regarding the matter in dispute. The Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting Defendant's position and any supporting documentation relied upon by Defendant.

60. The United States shall send Defendant its Statement of Position within 45 Days of receipt of Defendant's Statement of Position. The United States' Statement of Position shall include, but need not be limited to, any factual data, analysis, or opinion supporting that position and any supporting documentation relied upon by the United States. The United States' Statement of Position shall be binding on Defendant, unless Defendant files a motion for judicial review of the dispute in accordance with the following Paragraph.

61. Defendant may seek judicial review of the dispute by filing with the Court and serving on the United States, in accordance with Section XIII (Notices), a motion requesting judicial resolution of the dispute. The motion must be filed within ten Days of receipt of the United States' Statement of Position pursuant to the preceding Paragraph. The motion shall contain a written statement of Defendant's position on the matter in dispute, including any supporting factual data, analysis, opinion, or documentation, and shall set forth the relief requested and any schedule within which the dispute must be resolved for orderly implementation of the Consent Decree.

62. The United States shall respond to Defendant's motion within the time period allowed by the Local Rules of this Court. Defendant may file a reply memorandum, to the extent permitted by the Local Rules.

63. Standard of Review

a. Disputes Concerning Matters Accorded Record Review. Except as otherwise provided in this Consent Decree, in any dispute brought under Paragraph 58 pertaining to the adequacy or appropriateness of plans, procedures to implement plans, schedules or any other items requiring approval by EPA under this Consent Decree; the adequacy of the performance of work undertaken pursuant to this Consent Decree; and all other disputes that are accorded review on the administrative record under applicable principles of administrative law, Defendant shall bear the burden of proof provided by applicable law.

b. Other Disputes. Except as otherwise provided in this Consent Decree, in any other dispute brought under Paragraph 58, Defendant shall bear the burden of demonstrating that its position complies with this Consent Decree and better furthers the Objectives of the Consent Decree.

64. The invocation of dispute resolution procedures under this Section shall not, by itself, extend, postpone, or affect in any way any obligation of Defendant under this Consent Decree, unless and until final resolution of the dispute so provides. Stipulated penalties with respect to the disputed matter shall continue to accrue from the first Day of noncompliance, but payment shall be stayed pending resolution of the dispute as provided in Paragraph 46. If Defendant does not prevail on the disputed issue, stipulated penalties shall be assessed and paid as provided in Section VII (Stipulated Penalties).

X. INFORMATION COLLECTION AND RETENTION

65. The United States and its representatives, including attorneys, contractors, and consultants, shall have the right of entry into any facility covered by this Consent Decree at all reasonable times, upon presentation of credentials, to:

a. monitor the progress of activities required under this Consent Decree;

b. verify any data or information submitted to the United States in accordance with the terms of this Consent Decree;

c. obtain samples and, upon request, splits of any samples taken by Defendant or its representatives, contractors, or consultants;

d. obtain documentary evidence, including photographs and similar data; and

e. assess Defendant's compliance with this Consent Decree.

66. Upon request, Defendant shall provide EPA or its authorized representatives splits of any samples taken by Defendant. Upon request, EPA shall provide Defendant splits of any samples taken by EPA.

67. Until five years after the termination of this Consent Decree, Defendant shall retain, and shall instruct its contractors and agents to preserve, all non-identical copies of all documents, records, or other information (including documents, records, or other information in electronic form) in its or its contractors' or agents' possession or control, or that come into its or its contractors' or agents' possession or control, and that relate in any manner to Defendant's performance of its obligations under this Consent Decree. This information-retention requirement shall apply regardless of any contrary corporate or institutional policies or procedures. At any time during this information-retention period, upon request by the United States, Defendant shall provide copies of any documents, records, or other information required to be maintained under this Paragraph.

68. At the conclusion of the information-retention period provided in the preceding Paragraph, Defendant shall notify the United States at least 90 Days prior to the destruction of any documents, records, or other information subject to the requirements of the preceding Paragraph and, upon request by the United States, Defendant shall deliver any such documents, records, or other information to EPA. Defendant may assert that certain documents, records, or other information is privileged under the attorney-client privilege or any other privilege recognized by federal law. If Defendant asserts such a privilege, it shall provide the following: (a) the title of the document, record, or information; (b) the date of the document, record, or information; (c) the name and title of each author of the document, record, or information; (d) the name and title of each addressee and recipient; (e) a description of the subject of the document, record, or information; and (f) the privilege asserted by Defendant. However, no documents, records, or other information created or generated pursuant to the requirements of this Consent Decree shall be withheld on grounds of privilege.

69. Defendant may also assert that information required to be provided under this Section is protected as Confidential Business Information (CBI) under 40 C.F.R. Part 2. As to any information that Defendant seeks to protect as CBI, Defendant shall follow the procedures set forth in 40 C.F.R. Part 2.

70. This Consent Decree in no way limits or affects any right of entry and inspection, or any right to obtain information, held by the United States pursuant to applicable federal laws, regulations, or permits, nor does it limit or affect any duty or obligation of Defendant to maintain documents, records, or other information imposed by applicable federal or state laws, regulations, or permits.

XI. EFFECT OF SETTLEMENT/RESERVATION OF RIGHTS

71. This Consent Decree resolves the civil claims of the United States for the violations alleged in the Complaint filed in this action through the date of lodging.

72. The United States reserves all legal and equitable remedies available to enforce the provisions of this Consent Decree. This Consent Decree shall not be construed to limit the rights of the United States to obtain penalties or injunctive relief under the Act or implementing regulations, or under other federal laws, regulations, or permit conditions, except as expressly specified in Paragraph 71. The United States further reserves all legal and equitable remedies to address any imminent and substantial endangerment to the public health or welfare or the environment arising at, or posed by, Defendant's Facility.

73. In any subsequent administrative or judicial proceeding initiated by the United States for injunctive relief, civil penalties, other appropriate relief relating to the Facility or Defendant's violations, Defendant shall not assert, and may not maintain, any defense or claim based upon the principles of waiver, res judicata, collateral estoppel, issue preclusion, claim

preclusion, claim-splitting, or other defenses based upon any contention that the claims raised by the United States in the subsequent proceeding were or should have been brought in the instant case, except with respect to claims that have been specifically resolved pursuant to Paragraph 71.

74. This Consent Decree is not a permit, or a modification of any permit, under any federal, State, or local laws or regulations. Defendant is responsible for achieving and maintaining complete compliance with all applicable federal, State, and local laws, regulations, and permits; and Defendant's compliance with this Consent Decree shall be no defense to any action commenced pursuant to any such laws, regulations, or permits, except as set forth herein. The United States does not, by its consent to the entry of this Consent Decree, warrant or aver in any manner that Defendant's compliance with any aspect of this Consent Decree will result in compliance with provisions of the Act, 33 U.S.C. § 1251 *et seq.*, or with any other provisions of federal, State, or local laws, regulations, or permits.

75. This Consent Decree does not limit or affect the rights of Defendant or of the United States against any third parties, not party to this Consent Decree, nor does it limit the rights of third parties, not party to this Consent Decree, against Defendant, except as otherwise provided by law.

76. This Consent Decree shall not be construed to create rights in, or grant any cause of action to, any third party not party to this Consent Decree.

XII. COSTS

77. The Parties shall bear their own costs of this action, including attorneys' fees, except that the United States shall be entitled to collect the costs (including attorneys' fees) incurred in any action necessary to collect any portion of the civil penalty or any stipulated penalties due but not paid by Defendant.

XIII. NOTICES

78. Unless otherwise specified in this Decree, whenever notifications, submissions, or communications are required by this Consent Decree, they shall be made in writing and sent by mail or email, with a preference for email, addressed as follows:

As to DOJ by email:
eescdcopy.enrd@usdoj.gov
Re: DJ # 90-5-1-1-12117

As to DOJ by mail:
EES Case Management Unit
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044-7611
Re: DJ # 90-5-1-1-12117

As to EPA by email:
middleton.keith@epa.gov
and r5weca@epa.gov

As to EPA by mail:
Chief
Water Enforcement and Compliance Assurance Branch
Enforcement and Compliance Assurance Division
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard (ECW-15J)
Chicago, IL 60604

As to Defendant:
Constantine Toscidis
Associate General Counsel
Austin Powder Company
25800 Science Park Drive
Cleveland, Ohio 44122
con.toscidis@austinpowder.com

With a copy to:
Erica M. Spitzig
Partner
Taft Stettinius & Hollister LLP
425 Walnut Street, Suite 1800
Cincinnati, Ohio 45202
espitzig@taftlaw.com

For technical communications with Defendant:	Lauren Biggs Safety, Health, and Environmental Leader Austin Powder Company 32000 Powder Plant Road McArthur, Ohio 45651 lauren.biggs@austinpowder.com

79. Either Party may, by written notice to the other Party, change its designated notice recipient or notice address provided above.

80. All electronic submittals made to EPA must be in Portable Document Format (pdf) or similar format that is text searchable. If data are submitted in electronic spreadsheet form, Defendant shall provide the data and corresponding information in editable Excel format and not in image format. If Excel format is not available, then the electronic format should allow for data to be used in calculations by a standard spreadsheet program similar to Excel. The subject of the email correspondence must include Defendant's name, the name of the deliverable, and the Court's case number. If Defendant is unable to submit notifications, submissions, or communications to EPA by email, Defendant shall provide the notifications, submissions, or communications required by this Consent Decree to the mailing addresses listed above in Paragraph 78 and include electronic format of the notifications, submissions, or communications on physical media such as compact disk, flash drive, or a similar storage device.

81. Notices submitted pursuant to this Section shall be deemed submitted upon mailing or transmission by email, unless otherwise provided in this Consent Decree or by mutual agreement of the Parties in writing.

XIV. EFFECTIVE DATE

82. The Effective Date of this Consent Decree shall be the date upon which this Consent Decree is entered by the Court or a motion to enter the Consent Decree is granted, whichever occurs first, as recorded on the Court's docket.

XV. RETENTION OF JURISDICTION

83. The Court shall retain jurisdiction over this case until termination of this Consent Decree, for the purpose of resolving disputes arising under this Decree or entering orders modifying this Decree, pursuant to Sections IX (Dispute Resolution) and XVI (Modification), or effectuating or enforcing compliance with the terms of this Decree; provided, however, that Defendant hereby agrees that it shall be bound to perform duties scheduled to occur prior to the Effective Date. In the event the United States withdraws or withholds consent to this Consent Decree before entry, or the Court declines to enter the Consent Decree, then the preceding requirement to perform duties scheduled to occur before the Effective Date shall terminate.

XVI. MODIFICATION

84. Except as otherwise set forth in Paragraphs 18 and 19, the terms of this Consent Decree, including any attached appendices, may be modified only by a subsequent written agreement signed by all the Parties. Where the modification constitutes a material change to this Decree, it shall be effective only upon approval by the Court.

85. Any disputes concerning modification of this Decree shall be resolved pursuant to Section IX (Dispute Resolution), provided, however, that, instead of the burden of proof provided by Paragraph 63, the Party seeking the modification bears the burden of demonstrating that it is entitled to the requested modification in accordance with Federal Rule of Civil Procedure 60(b).

XVII. TERMINATION

86. After Defendant has completed the requirements of Section V (Compliance Requirements), including those relating to the WWTP Initial Compliance Measures and WWTP Compliance Plan, has thereafter maintained continuous satisfactory compliance with this

Consent Decree and the NPDES Permit for a period of one year, has complied with all other requirements of this Consent Decree, EPA has approved the WWTP Compliance Plan Monitoring Report and the Supplemental WWTP Remedial Measures Monitoring Report, if applicable, and Defendant and has paid the civil penalty and any accrued stipulated penalties as required by this Consent Decree, Defendant may serve upon the United States a Request for Termination, stating that Defendant has satisfied those requirements, together with all necessary supporting documentation.

87. Following receipt by the United States of Defendant's Request for Termination, the Parties shall confer informally concerning the Request and any disagreement that the Parties may have as to whether Defendant has satisfactorily complied with the requirements for termination of this Consent Decree. If the United States agrees that the Decree may be terminated, the Parties shall submit, for the Court's approval, a joint stipulation terminating the Decree.

88. If the United States does not agree that the Decree may be terminated, Defendant may invoke Dispute Resolution under Section IX. However, Defendant shall not seek Dispute Resolution of any dispute regarding termination until 60 Days after service of its Request for Termination.

89. Regardless of whether Defendant has requested termination of the Consent Decree pursuant to Paragraph 86, the United States may seek the Court's approval to terminate this Consent Decree based upon the United States' determination that Defendant has met the requirements for termination in accordance with this Section.

XVIII. PUBLIC PARTICIPATION

90. This Consent Decree shall be lodged with the Court for a period of not less than 30 Days for public notice and comment in accordance with 28 C.F.R. § 50.7. The United States reserves the right to withdraw or withhold its consent if the comments regarding the Consent Decree disclose facts or considerations indicating that the Consent Decree is inappropriate, improper, or inadequate. Defendant consents to entry of this Consent Decree without further notice and agrees not to withdraw from or oppose entry of this Consent Decree by the Court or to challenge any provision of the Decree, unless the United States has notified Defendant in writing that it no longer supports entry of the Decree.

XIX. SIGNATORIES/SERVICE

91. Each undersigned representative of Defendant and the Assistant Attorney General for the Environment and Natural Resources Division of the Department of Justice or his designee certifies that he or she is fully authorized to enter into the terms and conditions of this Consent Decree and to execute and legally bind the Party he or she represents to this document.

92. This Consent Decree may be signed in counterparts, and its validity shall not be challenged on that basis. Defendant agrees to accept service of process by mail with respect to all matters arising under or relating to this Consent Decree and to waive the formal service requirements set forth in Rules 4 and 5 of the Federal Rules of Civil Procedure and any applicable Local Rules of this Court including, but not limited to, service of a summons. Defendant need not file an answer to the Complaint in this action unless or until the Court expressly declines to enter this Consent Decree.

XX. INTEGRATION

93. This Consent Decree constitutes the final, complete, and exclusive agreement and understanding among the Parties with respect to the settlement embodied in the Decree and supersedes all prior agreements and understandings, whether oral or written, concerning the settlement embodied herein. Other than deliverables that are subsequently submitted and approved pursuant to this Decree, the Parties acknowledge that there are no representations, agreements, or understandings relating to the settlement other than those expressly contained in this Consent Decree.

XXI. FINAL JUDGMENT

94. Upon approval and entry of this Consent Decree by the Court, this Consent Decree shall constitute a final judgment of the Court as to the United States and Defendant.

XXII. 26 U.S.C. § 162(f)(2)(A)(ii) IDENTIFICATION

95. For purposes of the identification requirement of Section 162(f)(2)(A)(ii) of the Internal Revenue Code, 26 U.S.C. § 162(f)(2)(A)(ii), performance of Section II (Applicability), Paragraph 5; Section V (Compliance Requirements), Paragraphs 13-26, 28, and 32, and related Appendices B and C; Section VI (Reporting), Paragraphs 33, 34, and 36; and Section XVI (Information Collection and Retention), Paragraphs 65-68, is restitution or required to come into compliance with law.

XXIII. APPENDICES

96. The following Appendices are attached to and part of this Consent Decree:

"Appendix A" is the "Initial WWTP Compliance Measures."

"Appendix B" is the "Outfall 001 and 010 Remaining Measures"

"Appendix C" is the "Outfall 010 WWTP Operations Plan."

Dated and entered this __ day of __________, 2022.

____

UNITED STATES DISTRICT JUDGE

Signature page for Consent Decree in *United States v. Austin Powder Co.* (S.D. Ohio)

FOR THE UNITED STATES OF AMERICA:

TODD KIM
Assistant Attorney General
Environment and Natural Resources Division
U.S. Department of Justice

JEFFREY A. SPECTOR
Senior Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
Washington, DC 20044-7611

KENNETH L. PARKER
United States Attorney
Southern District of Ohio
MATTHEW HORWITZ
Civil Chief
Southern District of Ohio
221 E. Fourth Street, Suite 400
Cincinnati, OH 45202
(513) 684-6823

Signature page for Consent Decree in *United States v. Austin Powder Co.* (S.D. Ohio)

FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY:

ROBERT KAPLAN Digitally signed by ROBERT KAPLAN Date: 2022.01.18 18:03:30 -06'00'

ROBERT A. KAPLAN
Regional Counsel
U.S. Environmental Protection Agency, Region 5

SUSAN PROUT Digitally signed by SUSAN PROUT Date: 2022.01.11 08:39:45 -06'00'

SUSAN PROUT
Associate Regional Counsel
U.S. Environmental Protection Agency, Region 5
Office of Regional Counsel

FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY:

LAWRENCE STARFIELD
Digitally signed by LAWRENCE STARFIELD
Date: 2022.03.11 08:40:34 -05'00'

Dated: ________________

LAWRENCE E. STARFIELD
Acting Assistant Administrator
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency

ROSEMARIE KELLEY
Director
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency

JOSEPH G. THEIS
Acting Director
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency

GRACIELA GARCIA PENDLETON
Attorney-Adviser
Water Enforcement Division
Office of Civil Enforcement
Office of Enforcement and Compliance Assurance
U.S. Environmental Protection Agency
1200 Pennsylvania Ave., N.W.
Washington, D.C. 20460
Pendleton.Gracie@epa.gov

Signature page for Consent Decree in *United States v. Austin Powder Co.* (S.D. Ohio)

FOR AUSTIN POWDER COMPANY:

11/23/21
Date

JASON RAWLINGS
PRESIDENT- Austin Powder Company

Appendix A

Initial WWTP Compliance Measures

Item #	Outfall(s)	Action Completed	Completion Date(s)
1	001	Initiate compliance sampling at internal Outfall 601.	Sampling initiated March 2017.
2	001	Installed UV disinfection system.	New UV disinfection system was installed and operational December 2020.
3	001	Installed on-line/telemetry instrumentation to measure pH, DO, temperature, and flow.	System installed and operational December 2020.
4	003	Outfall pipes combined to single discharge.	Combination completed and discharge from second outfall pipe eliminated July 2018.
5	003	Mechanical upgrades – flow riser, dosing chamber pumps, electronic controls, effluent flowmeter.	Upgrades completed June 2019.
6	003	Decommissioned Outfall 003 and installed septic treatment system.	• Outfall 003 septic system installed and operational in November 2020. • Outfall 003 removed from NPDES permit March 2021.
7	004	Outfall 004 decommissioned.	Completed May 2018.
8	005	Outfall 005 decommissioned.	Completed August 2018.
9	006	Installed new effluent flowmeter at Outfall 006.	Completed September 2019.
10	006	Decommissioned Outfall 006 and installed septic treatment system.	• Outfall 006 septic system installed and operational December 2020. • Outfall 006 removed from NPDES permit March 2021.
11	007	Retrained employees on handling of removed sediment.	Training completed August 2018.
12	007	Installed new flowmeter at Outfall 007 to replace the current flow estimation procedure.	Flowmeter installed and commissioned in September 2020.
13a	010	Developed and implemented updated UV Disinfection System Cleaning Procedures at the Outfall 010 WWTP.	• New UV disinfection system was installed June 2020 and became operational July 2020. • Updated UV cleaning procedures completed in December 2020.
13b	010	Installed new UV disinfection system for Outfall 010.	New UV system installed June 2020.

Item #	Outfall(s)	Action Completed	Completion Date(s)
14	010	Installed electric heaters and temperature controls to provide influent heating and maintain aeration basin temperature above 60 °F during winter.	System installed and operational February 2021.
15	010	Installed on-line instrumentation to measure pH, DO, temperature, and turbidity, with capability for future telemetry.	System installed and operational February 2021.
16	010	Updated facility WWTP Operations Plan for Outfall 010 to reflect process changes and incorporate new guidance documents: • Training protocol; • Sampling and analytical plan; • Bioassessment testing; • Source survey results • Standard operating procedures • Key Process Indicators; • Troubleshooting guides; and, • Data monitoring system instructions.	• Revision 0 completed December 2020. • Revision 1 completed March 2021.
17	Outfalls 001, 010, and 011	Developed and implemented WWTP Bioassessment Testing Procedures with monthly microscopic bioassessments. Bioassessment reports utilized to assist in WWTP operations evaluation.	• Monthly biomass assessments have occurred since February 2021 and will continue for the foreseeable future. • The WWTP Operations Manual includes a bioassessment interpretation guide to assist with troubleshooting based on bioassessment reports
18	010 and 011	Conducted wastewater source survey to develop flow/load balance for all WWTP influent streams.	• Source survey with water balance diagrams completed 3/27/2020. • Supplemental characterization conducted in April 2020 to identify critical parameter loading, completed and reported 5/15/2020. • Supplemental characterization for PETN plant completed in October 2020.
19	010, 011	Developed and implemented Sampling & Analytical Plan for WWTP process monitoring and control. Purchased additional equipment and instrumentation required for analytical monitoring.	• Sampling/Analytical Plans for WWTPs submitted with source survey on 3/27/2020. • Laboratory equipment purchased and installed as of 8/14/2020. • SOPs for laboratory analytical procedures prepared and implemented September 2020.

Item #	Outfall(s)	Action Completed	Completion Date(s)
			• Updated sampling plan is being followed to collect/analyze process samples.
20	010, 011	Conducted site-specific wastewater operations training for facility personnel associated with process wastewater generation and any wastewater treatment.	• Initial training (general wastewater principles) delivered 7/28/2020. • Second training session (analytical procedures and troubleshooting) delivered 9/11/2020.
21	010	Updated facility SOPs to cover necessary operation, maintenance, and process monitoring/control activities for effective wastewater treatment. Procedures developed for operations activities at Outfall 010 and analysis of process control samples at both Outfall 010 and 011.	• Analytical SOPs completed and implemented August 2020. • Outfall 010 operational SOPs completed and implemented December 2020.
22	010, 011	Prepared WWTP Troubleshooting Guidance tables, including Key Process Indicators troubleshooting guidelines, to assist in identifying and correcting abnormal operating conditions at Outfall 010/011 WWTPs.	KPI/Troubleshooting Guides for both Outfalls 010 and 011 WWTPs completed on 5/26/2020.
23	010, 011	Developed and implemented WWTP Data Monitoring Tracking System, including process monitoring data tracking system (spreadsheets, trending charts, control points), for Outfall 010 WWTP.	• Data Management System and instruction guide for Outfall 010 completed in December 2020. • Preliminary data management spreadsheet for Outfall 011 implemented as of August 2020, with final Data Management System and instruction guide to be developed as part of Outfall 011 Compliance Plan.
24	011	Sampling Contingency Plan meeting 40 CFR 136 developed and implemented.	Completed December 4, 2018.
25	011	Technology vendor (Entex) engaged for mechanical review and troubleshooting support.	Initiated June 2019.
26	011	Diverted waste stream for recycling, reducing COD by approximately 80%.	Stream diverted in September 2020.
27	011	Hired a State of Ohio certified wastewater operator, with a minimum of Class A certification, to be in responsible charge of the Outfall 011 WWTP.	• Class III operator hired and began employment May 2020. • Second class III operator hired May 2021.

Item #	Outfall(s)	Action Completed	Completion Date(s)
28	011	Completed the following mechanical upgrades to the Outfall 011 WWTP in advance of final remedy development: 1. New process sampling ports, 2. Aeration grid for Anoxic Bioreactor #1 (enhanced BOD/NH_3-N removal), 3. Upgraded control valves for bioreactor aeration system, 4. New downcomer in secondary clarifier to enhance sludge settling, 5. Installation of coagulant addition system, 6. Installation of defoamer addition system, and 7. Installation of MBBR media in Anoxic Bioreactor #1.	Mechanical upgrades completed as follows: 1. Sampling ports installed August 2020, 2. Anoxic Bioreactor #1 aeration grid installed July 2020, 3. Aeration control valves installed December 2020, 4. Clarifier downcomer installed July 2020, 5. Coagulant addition installed February 2021, 6. Defoamer addition installed February 2021, and 7. MBBR media installed February 2021.

Appendix B
Outfall 001 and 010 Remaining Measures

Item Number	Outfall Location	Project/Task	Achievement of Full Operation Date
1.	Outfall 001	Installation of a septic system to handle sanitary wastewater from Outfall 001, and elimination of discharges from Outfall 001	December 31, 2021
2.	Outfall 010	Onsite hauling of Outfall 001 process wastewater influent to the Outfall 010 WWTP for treatment and associated 010 WWTP upgrades, including: • Installation of new equalization tank with a minimum design storage capacity of 6,000 gallons; • Aeration Basin Feed Pump with minimum design capacity of 5 gallons per minute; and • Associated equalization tank and feed pump sewerage; and supplemental carbon feed system	April 1, 2022, or within 90 days of issuance of necessary permits by Ohio EPA, whichever is earlier.
3.	Outfall 001	Petition Ohio EPA to remove Outfall 001 from NPDES Permit and submit a copy of the NPDES permit modification request to EPA, pursuant to Section XIII (Notices)	January 31, 2022, or within 30 days after issuance of an NPDES Permit modification reflecting the final remedy at Outfall 011 (if required), whichever is later

Appendix C
[Outfall 010 WWTP Operations Plan]

AUSTIN POWDER COMPANY

Operations Manual – Outfall 010 WWTP

Prepared for:

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

December 2021

Operations Manual – Outfall 010 WWTP

Prepared for:
Austin Powder Company
Red Diamond Facility
McArthur, Ohio

This document has been prepared by SLR International Corporation (SLR). The material and data in this report were prepared under the supervision and direction of the undersigned.

Don Taylor

Don Taylor
Principal

A. Todd Lusk

A. Todd Lusk, P.E.
Senior Engineer

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ACRONYMS AND ABBREVIATIONS

APC	Austin Powder Company
BOD$_5$	Biochemical Oxygen Demand, 5-day
COD	Chemical Oxygen Demand
DNA	Deoxyribonucleic Acid
DO	Dissolved Oxygen
EPA	Environmental Protection Agency
EPS	Exocellular Polymeric Substances
EQ	Equalization
F/M	Food-to-Microorganism Ratio
g/mL	grams per milliliter
gpd	gallons per day
gpd/ft	gallons per day per foot
gpd/ft^2	gallons per day per square foot
gpm	gallons per minute
KPI	Key Process Indicator
mg/L	milligrams per liter
mJ/cm^2	millijoules per square centimeter
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
MOP	Manual of Practice
NH$_3$-N	Ammonia Nitrogen
NO$_2$-N	Nitrite Nitrogen
NO$_3$-N	Nitrate Nitrogen
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OFR	Overflow Rate
o-PO$_4$-P	Orthophosphate Phosphorus
PPE	Personal Protection Equipment
psig	Pounds per square inch, gauge
QA/QC	Quality Assurance/Quality Control
RAS	Return Activated Sludge
scfm	Standard cubic feet per minute
SDS	Safety Data Sheet
SOP	Standard Operating Procedure
SRT	Solids Retention Time
SSV$_{30}$	30-Minute Settled Sludge Volume
s.u.	Standard pH Units
SVI	Sludge Volume Index
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TNT	Trinitrotoluene
TP	Total Phosphorus
TSS	Total Suspended Solids
UV	Ultraviolet
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
WPCF	Water Pollution Control Federation
WWTP	Wastewater Treatment Plant

INTRODUCTION

The purpose of this manual is to summarize the basic operation and control of the wastewater treatment plant serving Outfall 010 at the Austin Powder Company Red Diamond facility. All major unit operations and processes are discussed in the manual. The manual presents a description of the treatment processes and provides operating guidelines for each unit operation. This manual is limited to describing normal operations and predictable departures from the normal mode of operation. It cannot provide in-depth analysis of every possible operating mode and does not present detailed repair and maintenance procedures. This document should be considered dynamic in nature and will be reviewed on an annual basis to identify required updates and modifications based on long-term operational experience.

In addition to the description of the unit operations, general process information regarding the major unit processes of the plant is provided for reference and used for educating operators on their functions. The user is expected to be familiar with basic wastewater treatment concepts that have been presented during the operator training program. Operators responsible for wastewater operations will receive bi-annual refresher training and supplemental training on any updated procedures as the updates are implemented. Basic theory and operating principles are presented while complicated mathematical expressions and highly specialized concepts are excluded.

A hard copy of this manual should remain in the Environmental Engineer’s office for operator reference. An electronic copy of the manual is also available on the APC internal server at \\RDN-SERVER\EnvirLab\Environmental\Red Diamond\Water\Waste Water Treatment Plants\Outfall 010 WWTP\Operating Procedures.

1. PROCESS DESCRIPTION

1.1 PROCESS FLOW DIAGRAM

The process flow diagram for the Outfall 010 WWTP is provided in Appendix A. Sections 1.2 and 1.3 below describe the expected influent characteristics and permitted effluent discharge limits for the WWTP, respectively. Section 1.4 identifies the core unit processes and general flow path of wastewater through the WWTP.

1.2 INFLUENT WASTEWATER CHARACTERISTICS

Wastewater characteristics for influent to the Outfall 010 WWTP are shown in Table 1-1. These values have been derived from a combination of characterization data collected on various source streams and WWTP operating data. Source characterization data are provided in Appendix B. The wastewater treatment plant has the capacity to treat the maximum flow and loading conditions.

Table 1-1. Outfall 010 WWTP Influent Characteristics

Parameter	Units	Average Value[1]	Max. Value
Process Wastewater (Booster Buildings)			
Flow	gpd	1,650	3,600
Chemical Oxygen Demand (COD)	mg/L	75	160
Trinitrotoluene (TNT)	mg/L	29	34
Sanitary Wastewater[2]			
Flow	gpd	300	400
Chemical Oxygen Demand (COD)	mg/L	750	750
Biochemical Oxygen Demand (BOD)	mg/L	350	350
Total Suspended Solids (TSS)	mg/L	400	400
Total Kjeldahl Nitrogen (TKN)	mg/L	60	60
Total Phosphorus (TP)	mg/L	15	15
Combined WWTP Influent			
Flow	gpd	1,950	4,000
Chemical Oxygen Demand (COD)	mg/L	146	193

Notes:
1. Characterization data as of April 2020.
2. Assumed characteristics of typical medium-strength sanitary wastewater.

1.3 TREATED EFFLUENT LIMITS

Effluent limits for the WWTP are established in the facility NPDES permit. Table 1-2 below provides a summary of all regulated discharge parameters at Outfall 010, including parameters that have monitoring requirements but no numerical limits.

Table 1-2. Outfall 010 Effluent Limits

Parameter	Concentration					Loading, kg/day[1]		
	Units	Max.	Min.	Weekly	Monthly	Daily	Weekly	Monthly
Flow	gpd					Monitor Only		
Temperature	°C	Monitor Only						
Dissolved O_2	mg/L		6.0					
COD	mg/L	Monitor Only						
pH	s.u.	9.0	6.5					
TSS	mg/L	18			12	0.273		0.182
Oil & Grease	mg/L	10				0.152		
NH_3-N, Summer	mg/L	1.5			1.0	0.0228		0.0152
NH_3-N, Winter	mg/L	4.5			3.0	0.0682		0.0455
NO_2-N + NO_3-N	mg/L	Monitor Only						
Turbidity Severity	Units	Monitor Only						
E. coli	#/100 mL	362		161				
$CBOD_5$	mg/L	15			10	0.228		0.152

Notes:
1. Loading limits calculated based on design flow of 4,000 gpd.

1.4 WWTP UNIT PROCESSES

In order to achieve compliance with the effluent limits in Table 1-2, the WWTP for Outfall 010 includes the following unit processes, in their order of operation:

- Influent trash trap and feed well;
- Equalization;
- Aerobic biological treatment with supplemental carbon addition;
- Secondary clarification;
- Tertiary media filtration; and,
- Ultraviolet disinfection.

Operation of each of these unit processes is described in subsequent chapters of this manual.

2. TRASH TRAP AND FEED WELL

2.1 PRINCIPLES OF OPERATION

Sanitary wastewater typically contains solid materials that cannot be adequately treated with conventional activated sludge due to their size and complexity of the organic compounds present. The majority of these solids come from toilet flushing and discarded food waste. In order to prevent these solids from accumulating in the biological treatment tank, they are removed upstream of the bioreactor, usually by a combination of screening or sedimentation.

The Outfall 010 WWTP includes a Trash Trap, an in-ground sedimentation chamber where heavier solids are allowed to settle out of the wastewater and be collected. The Trash Trap is periodically cleaned out to remove accumulated solid material. The remaining wastewater overflows from the Trash Trap by gravity to the Feed Well, an additional in-ground concrete basin from which influent wastewater is pumped to downstream units for treatment.

2.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSPOPHY

A gravity sewer conveys sanitary wastewater from the Booster Building Change House to the Trash Trap. Process wastewater is pumped from each Booster Building to the Trash Trap inlet. Hauled industrial wastewater is transferred for treatment at the Outfall 010 wastewater treatment plant from the following sources: the PETN Drying, PETN Sieving, Balloon Manufacturing, and Booster Material Weigh Out Operations . The Trash Trap has a total working volume of 1,000 gallons and operates at a constant level of 4’-6”, and overflows as additional wastewater enters. Accumulated solids from both the 010 Trash Traps are removed manually by an outside contractor (currently Ron Evans Enterprises) every six months and disposed at a municipal treatment works (currently the City of Jackson Wastewater Treatment Plant).

The Feed Well has a working capacity of 1,800 gallons and contains two submersible pumps (P-42-01/P-42-03) operating in lead-lag configuration. Each pump has a 2.0-hp motor and transfers wastewater at a rate of 8 gpm. The pumps are controlled by a submersible pressure bell that measures the water level in the tank. The lead pump is set to activate at a water depth of 2’-2” and deactivate at a water depth of 1’-2”. At a tank level of 6’-6”, the lag pump is activated and a high level alarm notifies operators of the high level condition. Wastewater from the Feed Well is automatically transferred to the Equalization Tank for additional blending, based on the pressure bell located within the Feed Well. Refer to Section 3.2 of the manual for additional information on the Equalization Tank.

2.3 NORMAL OPERATIONS

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the Trash Trap and Feed Well at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations

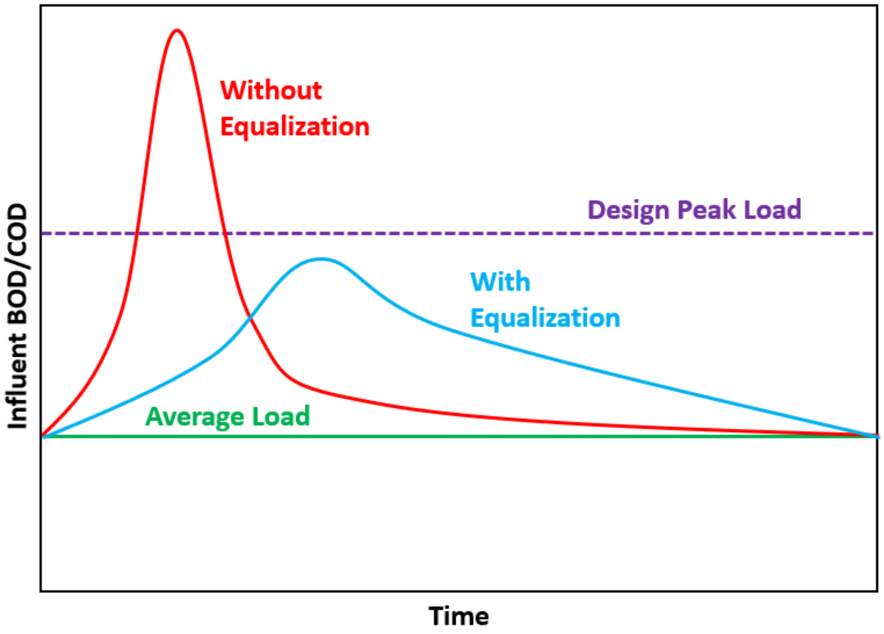
- SOP 010-002: Outfall 010 Sampling and Monitoring

3. EQUALIZATION TANK AND FEED PUMP

3.1 PRINCIPLES OF OPERATION

Equalization is a process for minimizing variability in both hydraulic and organic loading at a wastewater treatment plant. Biological treatment processes operate most efficiently when their operating environment is not subjected to rapid changes. Sudden, rapid changes in flow or concentration of a key treatment parameter (such as COD or BOD), known as slug loads or shock loads, can cause the bioreactor to operate above its maximum design capacity. This condition can potentially result in incomplete treatment or, in severe cases, an upset to the biomass in the reactor. Equalization provides a method to "smooth out" slug loads by spreading them over a longer period of time, as shown in Figure 3-1 below.

Figure 3-1. Equalization of Slug Loads in Wastewater Treatment



Additionally, the normal wastewater flows to the Outfall 010 WWTP occur only five days per week because of the current production schedule at the Booster Buildings. Equalization allows the WWTP operators to accumulate wastewater during the week to provide a steady feed over the weekend when no additional wastewater is generated.

3.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSPOPHY

Equalization Tank T-44-01 has a 7'-10" diameter, 19'-7" in length, and a working volume of 6,000 gallons. Influent to the Equalization Tank is pumped from the Feed Well via pumps P-42-01 and P-42-03 as described in Section 2.2. Contents of the tank are mixed with a centrifugal recirculation pump (P-44-02). The EQ Tank is fitted with multiple level instruments to protect mechanical equipment and notify operators of abnormal conditions. A continuous level transmitter includes audible alarms and notifies operators via SMS text when the EQ Tank level is above its high-level setpoint or below its low-level setpoint. A low-low level alarm on the transmitter deactivates recirculation pump P-44-02 and Aeration Feed Pump P-45-01 to prevent cavitation and damage to the pumps. A separate high-high level switch deactivates the Feed Well pumps to prevent overfilling of the tank.

Aeration Feed Pump P-45-01 is a progressive cavity-type pump and transfers water from the EQ Tank to the Aeration Basin at a rate of up to 5 gpm, with typical flows ranging between 1.5 and 2.5 gpm. The flow rate through P-45-01 is controlled by adjusting the variable-frequency drive on the pump motor. Equalization Tank effluent flow is monitored and recorded with an in-line flowmeter and transmitter. A low-flow alarm or high discharge pressure alarm will deactivate the pump, as these alarms indicate a potential blockage that could lead to pump damage.

The general philosophy for managing flow out of the Equalization Tank is to make adjustments only when necessary to prevent overflow of the tank or to prevent overloading of the bioreactor. During weekends, when little to no influent flow is expected, the level of the Equalization Tank is brought down by continued flow through the Aeration Feed Pump to maintain a stable loading rate to the Aeration Basin.

3.3 NORMAL OPERATIONS

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the Equalization Tank and Feed Pump at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations
- SOP 010-002: Outfall 010 Sampling and Monitoring

4. BIOLOGICAL TREATMENT

4.1 PRINCIPLES OF BIOLOGICAL TREATMENT

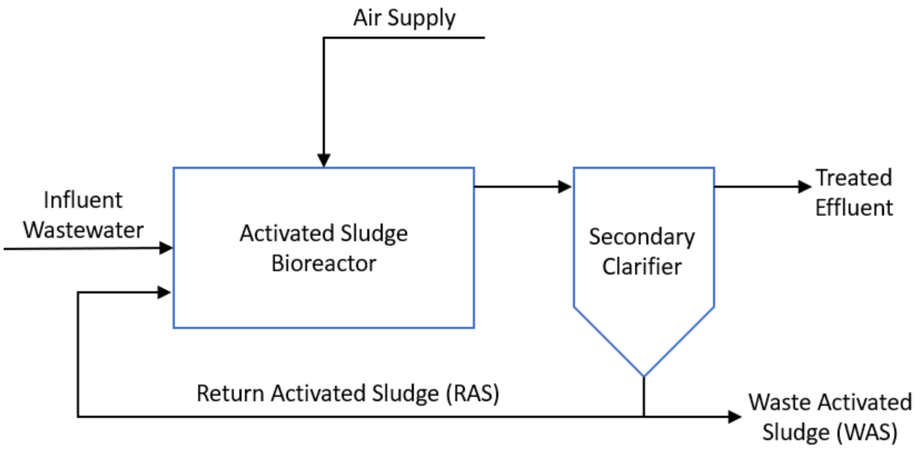
A biological treatment system is a controlled environment in which naturally occurring bacterial microorganisms (activated sludge, also referred to as biomass) consume and/or convert organic matter in the wastewater to carbon dioxide, water, and less harmful constituents. Ammonia and organic nitrogen can also be converted to nitrates through aerobic oxidation and the nitrogen gas through anoxic denitrification. This section describes the process involved during the biological treatment of organic and inorganic compounds in wastewater.

The conventional activated sludge treatment process consists of the following unit operations:

- Aeration/Mixing
- Clarification
- Sludge Recycle/Wasting

These three unit operations are always present in some form in an activated sludge treatment process. A schematic of the conventional activated sludge treatment process is presented in Figure 4-1 below.

Figure 4-1. Conventional Activated Sludge Treatment Process



Water and biomass are transferred between the two process tanks by a variety of methods. Influent from the Feed Well is pumped mechanically into the Aeration Basin, and the wastewater/biomass mixture flows by gravity into the Clarifier. Settled biomass is recycled to the Aeration Basin using an airlift pumping system, and biologically treated effluent flows by gravity downstream to the Dosing Chamber for further treatment.

The Aeration Basin provides the environment (oxygen, pH/alkalinity, temperature, nutrients, etc.) suitable for biological microorganisms to degrade the wastewater constituents of concern, as well as to live and reproduce. The Clarifier separates the biomass from the treated wastewater by gravity sedimentation and retains the microorganisms in the treatment system.

As with any living organism, microorganisms must perform certain tasks to maintain and regulate the complex systems required for sustaining life. The bacterial cells absorb food, nutrients, and oxygen from solution and convert them into a usable form of energy, which, in turn, is used by the bacteria to grow and carry out reproductive processes.

The following four essential components must be present to sustain a biological treatment system:

1. Living microorganisms;
2. Food (i.e., substrate) and nutrients;
3. Growth and reproduction; and,
4. Suitable operating environment.

4.1.1 MICROORGANISMS

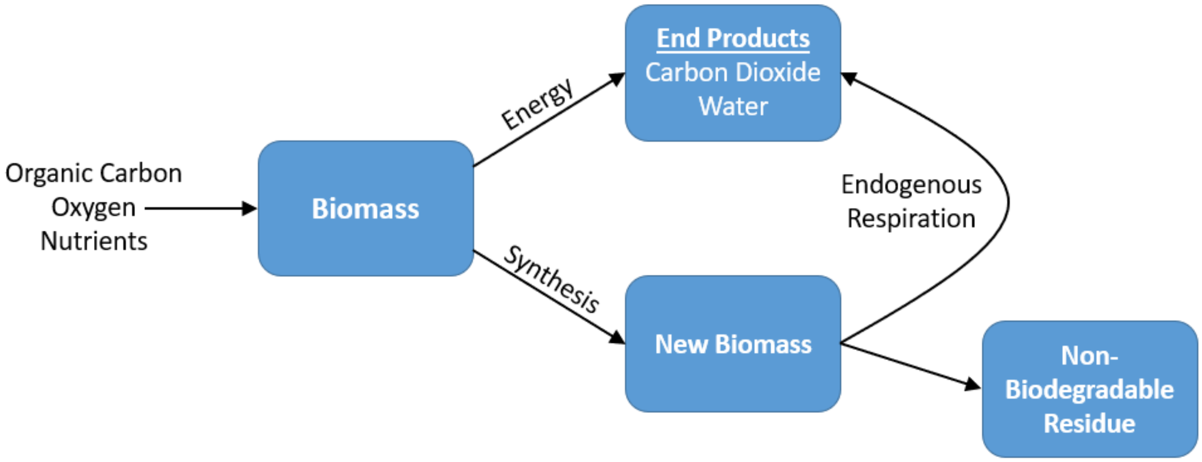
Bacteria are the basic common microorganism of any biological treatment system because they play a fundamental role in the removal of organic and inorganic compounds in water. Bacteria are usually classified as either heterotrophic or autotrophic. Heterotrophic bacteria utilize organic matter as a source of both energy and carbon. Autotrophic bacteria are less common and consume inorganic matter as an energy source and utilize inorganic carbon as their carbon source. The microorganisms in the Outfall 010 are primarily heterotrophic, because the wastewater contains organic matter (COD) as the primary food. Many species of heterotrophic bacteria are present in the biomass that together degrades the organic matter (COD) present in the influent to the treatment plant. Additionally, certain species of autotrophic bacteria are present that convert ammonia nitrogen to nitrate nitrogen and utilize inorganic carbon (in the form of carbonate and bicarbonate ions) as their carbon source.

Bacteria are also commonly classified into one of two respiration groups, aerobic (presence of dissolved oxygen) or anaerobic (complete absence of oxygen). Most microorganisms used in wastewater treatment, including those found in the Outfall 010 WWTP, are aerobic.

4.1.1.1 Aerobic Microorganisms

Aerobic respiration occurs in the presence of free dissolved oxygen. Bacteria in this classification, called aerobes, utilize free dissolved oxygen to perform the chemical reactions involved in releasing energy from organic or inorganic compounds. Energy, water, carbon dioxide, and new biomass are the end products resulting from the breakdown of organic compounds during aerobic respiration. This form of respiration is the most common, as well as the most efficient in terms of converting organic matter to energy. Figure 4-2 below provides an illustration of the aerobic biological oxidation of organic compounds (heterotrophic oxidation).

Figure 4-2. Biological Oxidation of Organic Compounds



4.1.1.2 Heterotrophic Microorganisms

Heterotrophic bacteria compose the majority of the biomass in the Outfall 010 WWTP Aeration Basin. The biomass includes a large number of different bacterial species, each able to degrade certain organic compounds based on its available enzymes and metabolic pathways. However, the net result of organic bio-oxidation will always produce carbon dioxide and water as end products. The chemical equation below shows an example of bio-oxidation of the simple sugar glucose.

$$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$$

Just as in human bodies, these chemical reactions release energy that the bacteria can use for movement and reproduction.

4.1.1.3 Autotrophic Microorganisms

Due to the influent concentrations of ammonia nitrogen and the low effluent discharge limits at Outfall 010, the WWTP Aeration Basin is designed to perform biological nitrification, where ammonia is converted to nitrate by specialized autotrophic bacteria. Nitrification is a two-stage process involving different species of bacteria. The first bacteria, *Nitrosomonas*, utilizes free oxygen and inorganic carbon to convert ammonia to nitrite nitrogen via the reaction below:

$$2NH_4^+ + 3O_2 + 4HCO_3^- \rightarrow 2NO_2^- + 4CO_2 + 6H_2O$$

A second bacteria, *Nitrobacter*, further oxidizes nitrite to nitrate:

$$2NO_2^- + O_2 \rightarrow 2NO_3^-$$

Nitrifiers are classified as pure aerobes and need a readily accessible supply of free dissolved oxygen during nitrification. These reactions also generate acidity (in the form of dissolved carbon dioxide) that can lower the pH of the Aeration Basin.

4.1.2 SUBSTRATE AND NUTRIENTS

When heterotrophic bacteria come into contact with organic matter (as measured by BOD_5, COD, etc.), they transfer the organics into their cells as a food source. To ensure efficient transfer, the process requires sufficient mixing and time. The quantity of organics, which are biodegraded, also depends upon the concentration of biomass maintained in the system. The biochemical functions performed by a microorganism to convert the organic material to energy are referred to as the microorganism's metabolism. In a mature biological treatment system, the metabolic process reaches a state of equilibrium.

In order to metabolize the organic (COD) food source at the Outfall 010 WWTP, the bacteria hydrolyze them into soluble sugar units, amino acids, and fatty acids. Reduced soluble organic compounds are eventually oxidized to end products of carbon dioxide and water. Sanitary wastewater contains more complex organic compounds (e.g., human waste products, food waste, etc.) while the process wastewater contains smaller, less complex molecules such as acetone and trinitrotoluene (TNT).

4.1.2.1 Loading Rate (F/M Ratio)

The basic control parameters in a typical activated sludge system are process wastewater influent flow rate, influent organic (COD) concentration, and the microorganism concentration in the Aeration Basin. The microorganism concentration in the Aeration Basin is not measured directly. An indirect microorganism concentration measurement is obtained from the total suspended solids (TSS) and volatile suspended solids (VSS) analyses performed on Aeration Basin samples. The tank contents are referred to as mixed liquor. Thus, the Aeration Basin TSS and VSS are referred to as the mixed liquor suspended solids (MLSS) and mixed liquor volatile suspended solids (MLVSS), respectively. The MLVSS is generally used as a surrogate parameter to represent the microorganism concentration. The mixed liquor suspended solids (MLSS) concentration is not used because the analysis includes both biological and inert non-biological suspended materials in the water.

In the Outfall 010 WWTP, the influent organic loading rate will be used as one of the control parameters. The process wastewater flow from the Feed Well and organic (BOD or COD) concentration determine the loading rate to the biological system known as the Food-to-Microorganism ratio (F/M). The F/M ratio for the Aeration Basin is calculated on a BOD or COD basis, and can be expressed by the equation below:

$$F/M_{COD} = \frac{COD\ Loading\ (\frac{lbs}{day})}{MLVSS\ Inventory\ (lbs)}$$

The ratio is expressed as the mass of organics supplied per unit mass of biological solids in the Aeration Basin per day. The target F/M ratio for the Outfall 010 WWTP on a COD basis (F/M_{COD}) is 0.2 lb COD/lb

MLVSS-day, with an acceptable range of 0.15 to 0.25 lb COD/lb MLVSS-day. The MLVSS concentration can fluctuate in the plant, increasing as new bacteria are grown and decreasing when they are wasted out of the treatment plant. and is based on the phase of operation. Table 4-1 shows the required COD load at various operating MLSS and MLVSS concentrations for the Aeration Basin. These values are based on a fixed biological volume and on a steady F/M ratio of 0.2 lb COD/lb MLVSS-day.

Table 4-1. Aeration Basin COD Loading Capacity at F/M = 0.20

Operating MLSS (mg/L)	Operating MLVSS (mg/L)	Biomass Inventory (lb)	COD Load (lb/day)
2,000	1,500	58.7	11.7
2,500	1,875	73.4	14.7
3,000	2,250	88.0	17.6
3,500	2,625	103	20.5
4,000	3,000	117	23.5

At typical influent flow rates and COD concentrations, the WWTP may not receive the target loading of COD from influent alone. For this reason, supplemental carbon feed is available to provide sufficient organics to maintain biomass health. Operations personnel have little control over the influent COD concentrations and flow; however, these must be measured to determine the amount of influent loading so that the supplemental carbon feed can be adjusted appropriately. Supplemental carbon addition is discussed in more detail in Chapter 8.

The mass of microorganisms in the biological treatment system can also be controlled by operations through a process called sludge wasting. This process involves removing sludge from the Aeration Basin for disposal. Therefore, at the Outfall 010 WWTP, the operators can control both the “food” and the “microorganism” variables in the F/M ratio. Operations can best achieve the desired operating F/M by maintaining a steady biomass concentration (MLVSS) and only varying the COD loading when required.

4.1.2.2 Sludge Age

Another parameter used to control activated sludge systems is the solids retention time (SRT) or sludge age. Although the bacterial population in a system is dynamic due to sludge growth, die-off, sludge wastage, and clarifier effluent TSS, the sludge age can be quantified in the following simple expression:

$$Sludge\ Age\ (days) = \frac{Total\ Solids\ Inventory\ (lbs)}{Solids\ Discharged\ in\ Effluent\ and\ Wasting\ (\frac{lbs}{day})}$$

The mass of solids in the system includes those solids in the Aeration Basin and Clarifier. The mass wasted includes the sludge wastage and effluent TSS in the Dosing Chamber. Sludge age may be thought of as inversely related to F/M loading rate. Systems with high sludge ages generally have low F/M loading rates. Under low loading condition, the estimated SRT for the Aeration Basin is greater than 100 days. Control of the F/M through load management and supplemental carbon addition helps to moderate the SRT based on projected biomass growth rates at higher organic loading. Under normal operating conditions, the sludge age for the Outfall 010 WWTP should be approximately 30 days.

4.1.2.3 Sludge Wasting

Sludge wasting is performed to maintain the desired solids (MLSS) concentration in the Aeration Basin. Wasting of activated sludge maintains the proper relationship between the microorganisms and the food (COD) in the Aeration Basin (i.e. F/M). The microorganisms use the food to grow and multiply which results in an increase in the amount of MLSS in the basin. Routine wasting is therefore required to maintain the desired MLSS concentration for treatment. The design MLSS concentration for the Outfall 010 WWTP is between 2,000 and 4,000 mg/L. Higher MLSS concentrations are desired during cold weather operation since the biomass metabolism rate slows down at lower temperature. As a consequence of this, the operating F/M ratio during the winter should be lower than during the summer.

The performance of the activated sludge treatment system and the characteristics of the sludge itself are related to the system F/M loading and to the sludge age. Very high loaded (short sludge ages) systems are likely to experience dispersed bacterial growth, and very low loaded (long sludge age) systems can experience heavily degraded floc or excessive filamentous bacteria growth. Both of these conditions produce a biomass which has poor settling properties due to its buoyancy. If this condition persists, the settling rate of the sludge can slow enough to cause the sludge to build up and overflow the clarifier weirs, thus increasing the final effluent suspended solids. Filamentous bacteria can be identified by microscopic examination.

Sludge wasting should be conducted on a weekly basis in order to maintain the MLSS concentration in the Aeration Basin within the target range. The WWTP does not have a dedicated waste sludge pumping or dewatering system; therefore, sludge removal is achieved using a contract hauling service to vacuum out the required quantity of sludge to be wasted. The weekly volume of sludge to remove from the Aeration Basin is calculated by the equation below:

$$Waste\ Volume\ (gal) = Basin\ Volume\ (gal) \times \frac{Current\ MLSS\ \left(\frac{mg}{L}\right) - Target\ MLSS(\frac{mg}{L})}{Current\ MLSS\ (\frac{mg}{L})}$$

The volume of the Aeration Basin for this equation is 4,700 gallons.

4.1.2.4 Nutrient Requirements

Nutrients play a vital role in the successful operation of a biological treatment system. As bacterial cells consume organic and inorganic substrate as food, they form building blocks of carbon used for the creation of new cellular material, a process called synthesis. When enough cell building blocks and energy accumulate, the cell reproduces. This process cannot continue unless the bacteria are supplied with a relatively steady diet of both organic compounds and nutrients. The objectives of a nutrient management program are to provide nutrients in proportion to the organic load and to optimize nutrient feed rates through nutrient residual monitoring.

Biological cells are made up of five basic elements, including carbon, hydrogen, oxygen, nitrogen, and phosphorus. These elements must be present within the biological treatment system to maintain the desired biomass population. Nutrient requirements for typical biological treatment system are provided in Table 4-2 below.

Table 4-2. Nutrient Requirements for Activated Sludge

Macronutrients	Micronutrients
Carbon (BOD)	Manganese
Oxygen	Copper
Nitrogen	Zinc
Phosphorus	Molybdenum
	Selenium
	Magnesium
	Cobalt
	Calcium
	Potassium
	Sodium
	Iron

A general rule of thumb used for nutrient management of an industrial wastewater influent is a BOD:Nitrogen:Phosphorous ratio of approximately 100:5:1 on a mass basis. It is critical to the process that these elements be supplied in the proper amounts on a steady basis, or shifts in biological species may occur, resulting in poor settling sludge or high effluent suspended solids. It is essential that adequate nutrient levels be maintained during high organic loadings or undesirable filamentous microorganisms may proliferate.

The Outfall 010 WWTP biosystem has ample supply of both macronutrients and micronutrients in the influent, primarily supplied from the sanitary wastewater component. The influent has an excess supply of nitrogen, which is why nitrification is required to meet the effluent discharge limits for ammonia.

4.1.2.5 Transient Loads

An important consideration in the performance of a treatment plant is the ability of microorganisms to cope with sudden or rapid changes in the influent loading. Such changes are termed transient or shock loads. Effects of transient loads may vary from a slight change in the settling velocity of the sludge to major upsets, which cause solids to carry over the clarifier weir. Severe transients can cause a complete halt of metabolic activity.

Transient loadings to biological treatment systems may occur in one of several forms. The most common type is a quantitative transient, which involves a change in the biodegradable organic or ammonia concentration of the waste and, consequently, in the F/M loading to the system. This change may be a decrease or increase, either of which can lead to a negative system response. Another common type of transient is caused by inhibitory or toxic compounds, such as free cyanide, free sulfides, or excess free ammonia. A "toxic" shock results from materials damaging or inhibiting the biological processes taking place in the system. Equalization at the Outfall 010 WWTP is provided to minimize the impact of any transient loads that occur.

The ability of a process to recover from a transient loading depends on the operating strategy and the elapsed time between successive transients. Maintaining more microorganisms in the system than necessary for COD removal can provide a cushion against transients. Also, high sludge age systems generally respond better to transients than low sludge age systems.

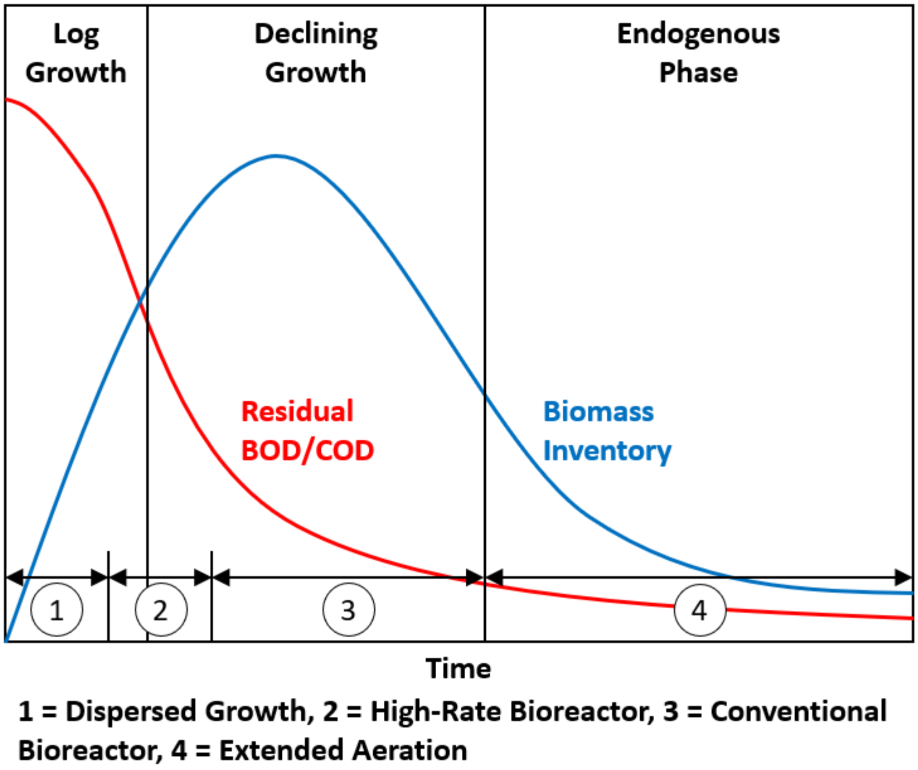
4.1.3 GROWTH AND REPRODUCTION

Bacterial microorganisms grow to a maximum size and then reproduce by a process called binary fission. This involves one cell splitting into two new individual cells. These two new cells will grow and eventually divide again in the same manner. The entire process of one cell growing and splitting into two new cells can occur in as little as twenty to thirty minutes, depending on the bacterial species and the availability of substrate (i.e., organic carbon).

4.1.3.1 Phases of Growth

Bacterial microorganisms experience several stages or phases of growth depending on the ratio of substrate (food/organics) to the concentration of biomass. The curve in Figure 4-3 below establishes three distinct phases of growth, which include the logarithmic growth phase, the declining growth phase, and the endogenous phase. The conversion of organics to biomass is greatest during the logarithmic growth stage and least during the endogenous phase when the bacteria are living off the food stored in their cells. Most biological treatment plants are operated in the declining growth phase to limit the need for sludge wasting while maintaining a healthy growing biomass.

Figure 4-3. Growth Phases in Activated Sludge Systems



4.1.3.2 Activated Sludge Flocculation

Activated sludge formation occurs after the microorganisms have adsorbed the food and converted it to new biomass. During this adsorption/oxidation process, the bacteria produce a polyelectrolyte on their surfaces (exocellular polymeric substances or EPS) that causes them to be attracted to each other and clump together in biological masses termed activated sludge flocs.

If the microorganisms are in the logarithmic growth phase, caused by an abundance of substrate (food) in comparison to the microorganism concentration, EPS is not produced in sufficient quantities to maintain good flocculation. This situation is not usually desired in an effluent treatment plant because microorganisms in this phase of growth are dispersed and do not settle well in the clarifier, resulting in a highly turbid, high suspended solids effluent. Likewise, with a very low organic loading in relation to the microorganism concentration, the polyelectrolyte starts to be reabsorbed and digested, resulting in a fragmented floc, which also causes poor settling and a turbid effluent.

4.1.4 OPERATING ENVIRONMENT

Eight major criteria are necessary to establish and control a suitable operating environment for a biological treatment system. Operation of an activated sludge system requires control and monitoring of these operational criteria. The eight major criteria must **all** be maintained within an acceptable range, preferably within an optimum or target range, to ensure that the biosystem functions properly. The criteria are as follows:

- MLSS/MLVSS
- Feed Flow Rate
- Nutrients
- DO/Mixing
- pH/Alkalinity
- Temperature
- TDS/Conductivity
- Toxics Control

The acceptable and optimal ranges for the Outfall 010 WWTP are presented in the Key Process Indicator and Troubleshooting Guides located in Appendix H.

4.1.4.1 MLSS/MLVSS

MLVSS is used to represent the concentration of microorganisms present, while MLSS represents the sum of microorganisms plus inert material. The acceptable range of MLSS and MLVSS concentrations must be maintained within the Aeration Basin in order to ensure treatment effectiveness and acceptable effluent quality.

Appropriate MLSS and MLVSS concentrations are maintained in the Aeration Basin primarily through sludge wastage control. Sludge wasting is a means of maintaining the balance between biomass growth and the removal of biomass from the system. If the MLSS or MLVSS concentrations fall outside of an acceptable range, the sludge wasting frequency may have to be adjusted. Sludge age and MLSS/MLVSS levels will be used to control sludge wasting.

4.1.4.2 Feed Flow Rate

APC operators have limited control over the organic loading from influent wastewater. In order to maintain the target F/M_{COD} ratio, organic loading rate to the Aeration Basin is maintained by adjusting the rate of supplemental carbon addition. The operator can best achieve a desired operating F/M_{COD} by maintaining a steady MLVSS concentration and monitoring the COD removal achieved by the Aeration Basin. Monitoring the influent and clarifier effluent COD is a crucial component for evaluating the system performance. Monitoring of select constituents and their removal will inform the operator if the Aeration Basin is operating properly. If either the influent or clarifier effluent concentration falls outside of an acceptable range, the influent flow rate may have to be adjusted.

4.1.4.3 Nutrients

As noted in Section 4.1.2.4, the influent to the Outfall 010 WWTP is expected to contain a sufficient supply of nutrients (nitrogen and phosphorus) to maintain biomass health. The influent contains excess nitrogen that is treated via nitrification. However, operators should perform periodic analyses of biologically treated effluent to confirm that nitrification is successfully treating the influent nitrogen and that sufficient residual phosphorus is present.

4.1.4.4 Dissolved Oxygen/Mixing

Dissolved Oxygen (DO) is provided in the aerobic zones by mechanical blowers and a subsurface diffused aeration system that has two fundamental objectives. First, the aeration system must impart sufficient agitation to ensure that microorganisms and wastewater are completely mixed. Second, the aeration system must deliver sufficient dissolved oxygen throughout the aerobic zones so they are fully aerobic, and a residual DO greater than 2.0 mg/L is maintained. The overall objective for mixing and dissolved oxygen control is to provide the oxygen needed for ammonia and COD removal while using as little energy as possible.

The total dissolved oxygen requirement in an aerobic biological system is based on the following:

1. Oxygen needed for biodegradation of organics and production of new biomass. This is estimated at 0.8 to 1.0 lb O_2 per lb COD removed.
2. Oxygen used for normal metabolic maintenance of organisms, referred to as “endogenous respiration.” This is generally within the range of 0.01 to 0.1 lb O_2/day per lb MLVSS in system.
3. Oxygen used to convert ammonia to nitrate via nitrification. This is estimated at 4.6 lb O_2 per lb ammonia-nitrogen (NH_3-N) nitrified.
4. Oxygen required to satisfy an immediate chemical oxygen demand, such as sulfites, etc. This demand is a function of the concentration of the chemical present.

Therefore, the total oxygen requirements are:

- O_2 for COD removal;
- + O_2 for endogenous respiration;
- + O_2 for nitrification; and,
- + O_2 for chemical demand.

Residual DO is the amount of oxygen remaining in solution after all the biological and chemical needs for oxygen has been satisfied. A residual DO of above 2.0 mg/L assures the operations personnel that sufficient oxygen is being transferred into the water and that the system is fully aerobic. If the residual DO falls below 1.0 mg/L for extended periods, the entire system can become stressed due to oxygen deficiency, which can lead to the formation of filamentous and slime producing bacteria. Higher DO concentrations (i.e., > 5.0 mg/L) are not harmful to the biomass but will increase energy costs and may increase foaming.

4.1.4.5 pH

The pH of the mixed liquor helps define which microbial species will proliferate in the Aeration Tanks and the rate at which the microorganisms reproduce. Most heterotrophic species can tolerate moderate changes within the normal biological treatment pH range of 6.5 to 8.0 s.u. (standard pH units) without a reduction in performance. Nitrifying bacteria are more sensitive to pH and perform most effectively within a pH range of 6.8 to 7.5 s.u.

Furthermore, microorganisms can alter the pH of their environment through various metabolic activities. Nitrification generates carbonic acid as a reaction product and can lower the pH of the wastewater. The influent pH is slightly basic, and the Aeration Basin is expected to operate within the desired range at near-neutral pH without external adjustment. The pH is monitored in the Aeration Basin with an immersed probe.

The Aeration Basin pH is monitored continuously, as shown on the Process Flow Diagram in Appendix A. If the Aeration Basin pH falls outside of an acceptable range, adjusting the influent pH may be required.

4.1.4.6 Temperature

Temperature is an important variable for system performance. Generally, biological performance declines when the Aeration Basin temperature rises above 95 °F or drops below 60 °F. During cold weather months, the temperature in the Aeration Basin can potentially drop below 60 °F. Additionally, sudden changes in tank temperature of 6 to 10 °F within 24-48 hours can severely shock an aerobic system. Such shocks can cause poor organics removal and may require extended recovery periods. The heaters at the Feed Well regulate the influent temperature to maintain temperature in the Aeration Basin within the desired range. Temperature is continuously monitored in the Aeration Basin.

4.1.4.7 TDS/Conductivity

Most activated sludge treatment systems operate with a Total Dissolved Solids (TDS) concentration of less than 10,000 mg/L, indicating a freshwater environment. Rapidly increasing or decreasing TDS levels can cause system upsets, as the changing salt levels affect the microorganisms' cellular osmotic pressure. This most commonly leads to higher effluent suspended solids and reduced organics and ammonia removals. Another indicator more commonly used to determine the concentration of dissolved solids is the electrical conductivity of the water. The TDS and conductivity (C) of a given water stream or sample are directly related. As a general rule, the TDS can generally be expressed as a function of the conductivity by multiplying the conductivity by 0.7 (i.e., TDS = 0.7 x C).

The influent to the Outfall 010 WWTP contains between 500 and 1,500 mg/L of TDS, and normal changes in conductivity within this range are not expected to impact the biological treatment process. Conductivity is measured three times per week at the Aeration Basin using a handheld meter.

4.1.4.8 Toxicity Control

The influent wastewater can contain toxic constituents that are not identified through routine chemical analyses. Build-up of toxic constituents in the Aeration Basin can inhibit biological activity resulting in a decline in treatment performance. Toxicity build-ups that are not promptly corrected can lead to a biological treatment upset. Routine monitoring of effluent quality (COD, NH_3-N) will assist operators in evaluating the condition of the biomass. Corrective actions for management of toxicity are provided in the Troubleshooting Guides in Appendix H.

4.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSOPHY

The Aeration Basin at the Outfall 010 WWTP is an in-ground rectangular concrete tank with a working volume of approximately 4,700 gallons. Influent is supplied from Feed Pumps P-42-01 and P-42-03 via Splitter Box 42-06. Supplemental carbon is also added to the Splitter Box.

The Aeration Basin will operate within an F/M_{COD} range of 0.15-0.25 lb COD/lb MLVSS-d under normal conditions. This loading rate corresponds to an MLVSS concentration of 1,500 mg/L and a COD between 9 and 15 lb/day.

A coarse bubble, diffused air system at the bottom of the Aeration Basin distributes the blower-supplied air for oxygen and mixing.

4.2.1 MLSS/MLVSS LEVELS

Under normal operating conditions, the MLSS concentration in the Aeration Basin should be between 2,000 and 4,000 mg/L. Higher MLSS concentrations will likely be required in the winter to ensure adequate bioactivity for BOD and ammonia removal. The MLVSS is expected to range between 75 and 85 percent of the MLSS.

4.2.2 TEMPERATURE CONTROL

Temperature in the Aeration Basin is monitored via instrument TIT-42-07. Temperature control is provided by electric heaters (42-07/08/09) at the Feed Well to raise the temperature of the influent. The target minimum temperature in the Aeration Basin is 60 °F.

4.2.3 AERATION SYSTEM

Aeration is provided using two Roots URAI-24 positive displacement blowers (one operating, one standby) with 1.5 hp motors. Each blower is rated for a capacity of 12.1 scfm at a discharge pressure of 4.0 psig. Air is introduced near the bottom of the Aeration Basin through a series of diffusers to provide even distribution and ensure effective mixing.

4.2.4 SUPPLEMENTAL CARBON ADDITION

Supplemental carbon (MicroC® 4200) is provided to the Aeration Basin from a 55-gallon supply drum with chemical metering pump P-46-06. The feed rate is adjusted using local controls at the pump in order to maintain the target F/M_{COD} in the tank. Supplemental carbon feed is expected to range from 0.5 to 2.0 gpd. Additional information on operation of the carbon addition system is provided in Section 8.

4.3 OPERATING MODES

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the Aeration Basin at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations
- SOP 010-002: Outfall 010 Sampling and Monitoring

5. SECONDARY CLARIFIER

5.1 PRINCIPLES OF OPERATION

The Secondary Clarifier at the WWTP serves as the solids separation unit following biological treatment. A mixture of activated sludge and treated wastewater flows by gravity out of the Aeration Basin into the Secondary Clarifier, providing a quiescent zone where solids are collected at the bottom of the tank and recycled back to the Aeration Basin for reuse. Clarified effluent wastewater flows over a series of V-notch weir plates and on to the Dosing Chamber for additional treatment.

Because floc particles of activated sludge are slightly more dense than water, they will slowly settle in an unmixed tank. The rate of settling depends on multiple conditions in the clarifier, including:

- Particle size;
- Difference in density between the solids and water; and,
- Viscosity of the water.

The typical density of activated sludge is approximately 1.04-1.05 g/mL, meaning the density difference between the sludge and water is typically low. The viscosity of water is higher at colder temperatures, and settling velocity increases with increased particle size; therefore, the optimum operating conditions for clarification are higher wastewater temperatures and larger floc particles.

Additionally, two opposing forces exist within the clarifier. As gravity is pulling the solids down, hydrostatic pressure is forcing the water column up so that it can overflow the clarifier via the weir plates. This upward flow of water is often calculated as a hydraulic overflow rate (OFR) and can be expressed either based on the total surface area of the clarifier (gpd/ft^2) or on the total length of the overflow weir plates (gpd/ft). If the overflow rate is higher than the corresponding settling velocity of the solids in the clarifier, solids cannot effectively settle and will not be collected.

Effective clarifier operation requires that the sludge be able to coalesce into a uniform layer (also called a "blanket") during settling. The sludge blanket helps to collect smaller floc particles and aid them in settling. At MLSS concentrations below approximately 2,000 mg/L, the biomass often cannot produce a coherent blanket and will instead perform discrete settling, resulting in higher loss of solids over the clarifier weirs and potential problems with downstream filtration.

Additionally, the activated sludge must compact efficiently when it settles to the bottom of the clarifier. This parameter is measured by the Sludge Volume Index (SVI) as part of routine settling tests on biomass from the Aeration Basin. A sample of biomass is placed in a cylinder or cone and allowed to settle for 30 minutes to simulate the operation of the clarifier, producing a value known as the 30-minute Settled Sludge Volume (SSV_{30}). The formula for calculating the SVI, using the SSV_{30} result and MLSS of the biomass, is as follows:

$$SVI(\frac{mL}{g}) = \frac{SSV_{30}\ (\frac{mL}{L}) \times 1{,}000}{MLSS\ (\frac{mg}{L})}$$

If the biomass is healthy and operating in its preferred environment, the SVI of the WWTP should be 100 mL/g or lower. Increases in SVI can indicate a condition known as bulking, where the sludge does not compact effectively. Bulking most commonly occurs due to growth of undesirable filamentous bacteria or due to production of excessive EPS when the biomass does not receive enough nutrients for growth.

Some solids will naturally tend to float in the Secondary Clarifier. Very small particles (< 50 microns in diameter) have a settling velocity that is too low. Other particles will float due to buoyancy, caused either by low-density oil & grease accumulating in the floc or due to formation of gas bubbles within the particles.

The most common cause of gas bubbles in nitrifying biological systems is incidental denitrification. Nitrification produces dissolved nitrate ions. In the absence of dissolved oxygen, certain heterotrophic bacteria can use the oxygen in these nitrates to oxidize residual BOD. This reaction generates various gaseous by-products, most commonly nitrogen (N_2) gas. Without mixing to agitate these bubbles out of the floc particles, they cause the solids to float to the surface.

To address situations where floating solids are an ongoing concern, many secondary clarifiers include a scum collection system. This may be present as a rotating arm that pushes scum into a collection trough, or a slotted drum that can be aligned to collect scum from the clarifier surface. Collected scum is then either recycled back to the biological treatment tank or wasted out of the system.

5.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSPOPHY

The Secondary Clarifier at the Outfall 010 WWTP is an in-ground rectangular concrete basin with a 60° sloped pyramidal hopper at the bottom to facilitate sludge collection. The clarifier has approximately 25 ft^2 of active settling area and two 7’-0” long weir plates, corresponding to overflow rates of approximately 160 gpd/ft^2 and 285 gpd/ft, respectively, at the design flow of 4,000 gpd. The effluent weirs are located at the south end of the Clarifier.

Settled sludge is recycled to the Aeration Basin through a 3” airlift pump that draws from the bottom of the pyramidal hopper. Air supply for this airlift pump is provided from the aeration blowers.

An underflow baffle separates the weir plates from the main surface of the Clarifier to prevent discharge of any scum or floating solids. An open pipe is located on the main surface of the Secondary Clarifier to collect any scum that accumulates. Scum is then recycled back to the Aeration Basin with a dedicated 2” airlift pump. This pump also receives supply air from the aeration blowers.

5.3 NORMAL OPERATIONS

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the Secondary Clarifier at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations
- SOP 010-002: Outfall 010 Sampling and Monitoring

6. DOSING CHAMBER AND SAND FILTERS

6.1 PRINCIPLES OF OPERATION

Tertiary filtration is provided at the Outfall 010 WWTP to ensure that the effluent remains in compliance with discharge limits for TSS. Clarification removes the majority of solids from the wastewater but is not efficient for removing smaller particles. Filtration is effective when the TSS concentration of the wastewater is already low (e.g., 30-50 mg/L) but must be lower to meet effluent limits.

6.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSPOPHY

After clarification, wastewater collects in the Dosing Chamber at the Outfall 010 WWTP. This sump serves as a secondary effluent holding tank and internal monitoring point to collect process samples for analysis to evaluate WWTP performance. The Dosing Chamber contains two submersible pumps (P-43-01, P-43-03) that feed the Sand Filters. Operation of the pumps is controlled by a float-type level switch in the Dosing Chamber. A turbidity monitor in the Dosing Chamber (AIT-43-06) also provides continuous monitoring at the Dosing chamber. Turbidity serves as a surrogate parameter for TSS and measures the “cloudiness” of the wastewater. High turbidity measurements at the Dosing Chamber may indicate a potential problem with biological treatment or clarification and may also indicate potential issues with operation of the Sand Filters.

The two Sand Filters provide final filtration of the wastewater to remove residual TSS that remains after treatment in the Secondary Clarifier. Each filter has surface dimensions of 19’-7” by 8’-7”, providing a total filtration area of 168 ft^2 per filter cell. Only one cell is operated at a time. The Sand Filters operate on gravity flow, with wastewater fed at the top of the filter beds and then percolating through the filter media. A splash pad and rip rap prevent erosion of the sand layer below the discharge pipe feeding the filter bed. Each filter contains 18” of sand as the filtration media, placed above progressively coarser layers of support gravel. A perforated pipe at the bottom of the filter beds collects the filtered wastewater and drains it to the Effluent Well.

As filtered solids accumulate in the sand media, the amount of pressure required to push water through the media increases, resulting in slower flow rates and buildup of water level in the filter bed. When one filter cell can no longer keep up with the WWTP feed rate, the other filter cell is placed in service. The fouled media and accumulated solids are removed from the dirty cell and replaced with fresh filter sand. Operators manually select which filter cell is in operation. Fouled media is disposed at a local solid waste landfill (currently the Rumpke landfill in Wellston, Ohio).

6.3 NORMAL OPERATIONS

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the Dosing Chamber and Sand Filters at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations

- SOP 010-002: Outfall 010 Sampling and Monitoring

7. ULTRAVIOLET DISINFECTION

7.1 PRINCIPLES OF OPERATION

Because the Outfall 010 WWTP treats sanitary waste, the wastewater contains pathogenic organisms such as viruses and *E. coli* bacteria. Pathogens are not removed through biological treatment and under certain cases can thrive in the activated sludge. *E. coli*, for example, is a type of heterotrophic bacteria that breaks down organic material in the human gut and will continue to do so in the Aeration Basin.

In order to protect human health in the receiving stream from these pathogens, the wastewater must be disinfected prior to discharge. The discharge permit for the Outfall 010 WWTP includes seasonal limits on *E. coli* during the summer, when the receiving stream may be used for recreation. Ultraviolet (UV) disinfection is provided at the Outfall 010 WWTP. UV disinfection works by damaging the DNA of the organisms, making them unable to reproduce and cause infection. In order for the UV disinfection process to be effective, the wastewater must receive a sufficient dose of UV radiation to damage the bacteria and viruses present. Dosage is dependent on the following parameters:

- Intensity of the UV lamp;
- Contact time with the UV lamp;
- Distance (i.e. path length) from the UV lamp; and,
- Transmittance of the wastewater.

Transmittance depends on the color and turbidity of the wastewater. A more highly colored or more turbid wastewater will absorb most of the UV light very close to the lamp, preventing sufficient dosing at the outer surface of the lamp chamber. The UV lamp is housed inside a quartz sheath that can become fouled with organic material or scale, which also lowers the dose of radiation that reaches the wastewater. In order to ensure that the wastewater receives a sufficient dose of UV light, the turbidity of the water must be low and the lamp must be periodically inspected and cleaned. Troubleshooting guides in Appendix H provide information on how to evaluate the transmittance of the UV system and determine if cleaning is required.

7.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSPOPHY

Filtered wastewater from the Sand Filter underdrains flows by gravity into an effluent wet well. Online instruments in the wet well record the pH (AE-44-03) and dissolved oxygen (AE-44-04) as required by the discharge permit. As the level in the wet well rises, float switches activate pumps P-44-01 (normal flow) and P-44-02 (high flow) to pump water through the UV disinfection chamber.

The UV disinfection system is rated for a flow of up to 8 gpm and provides an applied UV dosage of 40 mJ/cm^2 at this flow rate, which is sufficient to provide disinfection for the Outfall 010 wastewater. A transmittance monitor is included on the UV unit to confirm that sufficient UV radiation is being transferred throughout the water. After disinfection, the effluent passes through a flowmeter (FIT-44-05) with totalizer (FQI-44-05) and temperature indicator (TI-44-05) to monitor daily flow and effluent temperature as required by the discharge permit. Treated wastewater is then discharged via Outfall 010. Effluent monitoring instruments are checked and calibrated by the site Electrical and Instrumentation group according to the manufacturer's recommendations.

7.3 NORMAL OPERATIONS

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the UV Disinfection System at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations
- SOP 010-002: Outfall 010 Sampling and Monitoring
- SOP 010-003: Outfall 010 UV System Cleaning

8. SUPPLEMENTAL CARBON ADDITION

8.1 PRINCIPLES OF OPERATION

As discussed in Section 4.2.1, the activated sludge in the Aeration Basin must be fed at a consistent loading rate for optimum biomass health, as measured by the F/M ratio. The target range for the Outfall 010 WWTP is 0.15-0.25 lb COD/lb MLVSS-d. However, the MLSS concentration in the Aeration Basin must remain at or above 2,000 mg/L for effective settling the Clarifier as described in Section 5.1. Under these constraints, the Aeration Basin should receive a minimum of 12 lbs/d of COD to maintain biomass health. Depending on the flow rate, the COD concentration of the influent wastewater, and the MLVSS in the Aeration Basin, the WWTP may require supplementation of organic carbon in order to meet this minimum loading rate.

Supplemental carbon can be supplied using a variety of organic sources, typically those that are relatively safe to handle, highly soluble, and readily biodegradable. Examples of some common supplemental carbon sources include:

- Alcohols (methanol or ethanol);
- Carbohydrates (sugars, molasses, etc.);
- Ethylene glycol; or,
- Glycerol (glycerin).

The product supplied for the Outfall 010 WWTP is MicroC® 4200, a glycerol-based commercial carbon source. MicroC® 4200 is highly concentrated, containing approximately 9.0 lbs of COD per gallon. This allows operators to supplement the WWTP feed when necessary while using a minimum volume of chemical.

8.2 PROCESS FLOW DESCRIPTION AND OPERATING PHILOSPOPHY

MicroC® Feed Pump P-46-01 is a positive-displacement chemical metering pump that draws MicroC® solution from a 55-gallon drum to feed to the Aeration Basin. Both the pump and the drum are located within a containment shed for spill control and weather protection. The flow rate from the pump is adjusted on the local control panel and can be verified using the supplied calibration column. MicroC® is added to the splitter box upstream of the Aeration Basin, where it mixes with wastewater from the EQ Tank.

In order to provide the appropriate feed rate of MicroC®, the operators must calculate the supplemental carbon requirement according to the following general procedure:

- Calculate the biomass inventory (M) in the Aeration Basin, where
  - M (lbs) = MLVSS (mg/L) x 0.0047 x 8.345
- Calculate the required COD load (F) to achieve an F/M_{COD} of 0.20, where
  - F (lbs/d) = M x 0.20

- Calculate the influent feed rate of COD (F_i) from the EQ Tank, where
    - F_i (lbs/d) = Feed flow (gpm) x Feed COD (mg/L) x 0.012
- Calculate the supplemental COD load (F_s) from MicroC®, where
    - F_s (lbs/d) = F (lbs/d) – F_i (lbs/d)
- Calculate the pump feed rate (Q) in mL/min, where
    - Q (mL/min) = F_s (lbs/d) x 0.292

More detailed instructions regarding calculation of the MicroC® Feed Pump flow rate are provided in SOP 010-004 in Appendix C.

8.3 NORMAL OPERATIONS

Operators should refer to the following Standard Operating Procedures in Appendix C for information on operation of the Supplemental Carbon Addition System at the Outfall 010 WWTP:

- SOP 010-001: Outfall 010 Operations
- SOP 010-002: Outfall 010 Sampling and Monitoring
- SOP 010-004: Outfall 010 MicroC Feed Pump Drawdown and Calibration

9. OPERATOR DUTIES

9.1 OPERATIONAL MONITORING

Effective operation of the Outfall 010 WWTP requires that the performance of the system be closely monitored. The information needed to evaluate the effectiveness of the treatment system and to determine necessary control adjustments is supplied by the readouts of online instruments and the results obtained from sample analyses.

9.2 PROCESS INSTRUMENTATION

The WWTP includes a series of meters, probes and instruments that allow the operators to quickly gather information about the current condition of the WWTP treatment process. Installed instruments at the Outfall 010 WWTP are listed in Table 9-1 below.

Table 9-1. Outfall 010 WWTP Process Instrumentation

Instrument Number	Location	Parameter Measured
LIT-44-03	Equalization Tank	Tank Level
PIT-45-05	Aeration Feed Pump Discharge	Pump Discharge Pressure
FIT-45-07	Aeration Feed Pump Discharge	Pump Discharge Flow
TIT-42-07	Aeration Tank	Tank Temperature
AIT-42-08	Aeration Tank	Tank pH
AIT-42-09	Aeration Tank	Tank Dissolved Oxygen
AIT-43-06	Dosing Chamber	Turbidity
AIT-45-01	UV Disinfection System	UV Transmittance

9.3 PROCESS SAMPLING

9.3.1 PRINCIPLES

Process monitoring samples are collected on a regular basis according to a sampling schedule. Correlations and trends for certain parameters should be developed in order to establish routine control strategies. Proper use of this data allows the operator to initiate preventative measures to avoid upsets and implement corrective actions should an upset occur.

Appendix D provides the routine Sampling and Analysis Plan for the Outfall 010 WWTP.

9.3.2 SAMPLE COLLECTION AND HANDLING

Representative sampling along with timely analysis is essential for an effective monitoring program. Each sample analyzed must accurately reflect its source in order to establish satisfactory operational control of the WWTP. Sample data will also assist with developing process trends and troubleshooting diagnosis.

The wastewater treatment operational decisions depend on the accuracy and validity of results obtained from instruments and/or wastewater samples. If a sampling program is not properly implemented, these decisions may be based on incorrect information. A good sampling program should:

- Be developed with an awareness of health and safety concerns associated with sample collection, i.e. using proper personal protection equipment (PPE) during sampling;
- Ensure that the sample taken is representative of the source;
- Use proper sampling techniques; and,
- Properly protect and preserve the samples until they are analyzed.

Sampling instructions for the Outfall 010 WWTP process samples are located in SOP 010-002 in Appendix C.

9.3.3 SAMPLE TYPES AND TECHNIQUES

9.3.3.1 Grab Samples

Grab samples (taken instantly at one location and time) are taken manually. Each sample provides a “snapshot” of the characteristics at the time the sample is collected. All of the samples collected by the APC operators will be grab samples. Due to the residence times in most of the tanks, a grab sample is representative of the day when the operator is on shift. The remaining operating parameters are monitored by instruments (e.g., temperature, pH, etc.).

The instructions below provide general guidelines for taking a representative grab sample. Further instructions are provided in SOP 010-002.

1. The sample should be collected from the designated sampling location, using an appropriate sample dipping device or collection bottle. When using a sample-dipping device, the mouth of the collecting container should be placed a few inches below the water surface for grab samples in order to avoid collecting an excess of floating materials.
2. The required volume of a grab sample should be approximately one to two liters in order to provide sufficient quantities for all required analyses including repeating analyses with suspect results.
3. The sample container(s) and sampling device must be clean and uncontaminated from previous sampling events. Before a sample is collected, the container should be rinsed several times with distilled water, and then rinsed several times with the sample source water itself. If the sample is being collected through a pipe or sample port, the pipe/port must be thoroughly flushed prior to collecting the sample.

4. Each sample container(s) must be clearly identified and labeled as to the sample location and should also include sample date, time, and type of analyses to be performed if samples are to be stored. This is especially important when collecting multiple samples at various WWTP locations.

In general, operators must conduct analyses of selected parameters immediately after collection. However, if for some reason it is not feasible to perform the sample analyses immediately, proper sample preservation must be used to prevent altering the sample characteristics. Refrigeration and possibly some type of sample preservation chemical will be required.

9.3.3.2 Composite Samples

Composite samples are generally collected to account for flow variations and changes in waste constituents over time. Therefore, a composite sample is a composite (blend) of a series of “grab” samples, which are collected over a period of time, usually 24 hours. Greater accuracy is obtained if the amount of sample in the composite is taken in proportion to the wastewater flow rate. The greater the frequency of samples taken for the composite, the more accurate and representative it will be. As with grab samples composite samples may be collected manually but may also be collected automatically. Composite sampling is not required for any effluent compliance parameters at Outfall 010 and is not expected to occur during normal WWTP operations.

9.4 LABORATORY ANALYSES

A complete list of routine process samples to be analyzed at the Outfall 010 WWTP, including readings from online instruments, is provided in Appendix D. Table 9-1 below provides the purpose for each analysis and a reference to the Standard Operating Procedure in Appendix C that provides instructions for performing the analysis.

Table 9-2. Sampling Program for Outfall 010 WWTP

Location	Parameter	Purpose of Analysis	SOP for Analysis
EQ Tank/Feed Well	COD	Monitor/control organic loading	100-003
	NH_3-N	Monitor nitrogen loading	100-002
Aeration Basin	pH[1]	Monitor/control bioreactor environment	100-009
	DO[1]	Monitor/control bioreactor environment	100-010
	Temperature[1]	Monitor/control bioreactor environment	N/A
	Conductivity	Monitor/control bioreactor environment	100-011
	MLSS	Monitor/control biomass inventory	100-008
	MLVSS	Monitor/control biomass inventory	100-008
	SSV_{30}	Monitor biomass settling/secondary clarifier loading	100-007
	SVI	Monitor biomass settling/secondary clarifier loading	100-007
Dosing Chamber	Turbidity[1]	Monitor secondary clarifier performance/filter feed quality	100-012

Location	Parameter	Purpose of Analysis	SOP for Analysis
	NH_3-N	Monitor nitrification performance/nutrient availability	100-002
	NO_3-N	Monitor nitrification performance/nutrient availability	100-004
	o-PO_4-P	Monitor nutrient availability	100-006
	TSS	Monitor secondary clarifier performance/filter feed quality	100-008
	COD	Monitor bioreactor treatment performance	100-003

Notes:
1. Parameter is normally measured by online instrument. SOP reference is for laboratory analysis if required.

In addition to onsite analyses, samples of activated sludge from the Aeration Basin should be sent out monthly for microscopic evaluation, or whenever the WWTP is in an upset condition. This evaluation provides information on the composition of the biomass and can identify features that lead to process upset. Information on how to interpret and apply findings from these microscopic bioassessments is located in Appendix E.

9.5 DATA QUALITY

Because the WWTP operators must rely on monitoring data to make decisions on process adjustments, it is critical that the data be reliable. Online probes and instruments should be calibrated routinely according to manufacturer recommendations. When conducting laboratory analyses, operators should calibrate handheld probes before each use. Glassware must be clean and free from contaminants that could skew results. When the expected concentration of a parameter is above the maximum range of the analytical method, operators should perform dilutions. Finally, operators must perform quality analysis and quality control (QA/QC) checks, including standard and duplicate samples for wet chemistry procedures. Standard solutions confirm that the analytical instrument is clean and functioning properly, and duplicate analyses confirm that the analytical method is being followed consistently and that results are reproducible. The following SOPs, located in Appendix C, provide instructions for calibrating instruments and performing standard/duplicate analyses:

- 100-009: pH Calibration and Measurement
- 100-010: DO Calibration and Measurement
- 100-011: Conductivity Calibration and Measurement
- 200-001: Dilutions
- 200-002: Glassware Cleaning
- 200-003: QA/QC Procedures

9.6 TRAINING AND CERTIFICATIONS

APC operators have received onsite training regarding the basic functions of WWTP unit process, laboratory analyses, and troubleshooting strategies. The training materials and associated review quizzes are located in Appendix F. These materials should be presented to any new personnel responsible for WWTP operations and reviewed annually by current operators.

Additionally, Ohio Environmental Protection Agency (OEPA) regulations require that the person in responsible charge for WWTP operations hold, at a minimum, a Class A wastewater treatment certificate. Any operator holding a state certification should stay familiar with OEPA requirements for continuing education to ensure that his/her license remains active.

10. PROCESS MONITORING AND TROUBLESHOOTING

One goal of operating any biological treatment plant is to prevent upsets. However, in the event of an upset, it is very important to identify the potential causes so that corrective measures can be taken to resume normal operations in the shortest possible time. The longer the upset is allowed to continue, the more difficult it is to resume normal operations. This chapter presents a list of conditions and/or parameters that can indicate upset conditions and provides troubleshooting guidelines to help recover from an upset.

10.1 DATA ENTRY AND TRACKING

In order for the monitoring data to be useful to operators in maintaining control of treatment at the WWTP, they must be tabulated and reviewed to identify any abnormalities or trends that could point towards a potential upset condition. The data management spreadsheets and operational trending charts available to APC operators allow them to conduct a review of recent treatment performance and will notify them if any analyses fall outside their expected ranges. Instructions for use of the data management file are provided in Appendix G.

10.2 KEY PROCESS INDICATORS

Each parameter monitored at the WWTP has an associated target value or range to ensure effective operation and treatment. These operational targets are known as Key Process Indicators (KPIs) since they can also be used to assist the operators in identifying abnormal operating conditions or potential treatment upsets. KPIs for the Outfall 010 WWTP are located with the troubleshooting guides in Appendix H.

KPI target values are set with the objective of providing operators adequate time to identify and correct abnormal operating conditions before effluent quality deteriorates to a point where exceedances could occur. However, if an exceedance were to occur, the KPI target and ranges should be reviewed, and internal sampling frequency should increase on a temporary basis until the abnormal situation is resolved.

Example: *The KPI range for the pH of the Aeration Basin is 6.8 to 7.5 s.u. This range is the ideal operating environment for nitrifying bacteria to perform their desired biochemical reactions (i.e., conversion of ammonia to nitrate). If the Aeration Basin pH rises too far above this range, the equilibrium of ammonia in the wastewater shifts away from the ionized form (NH_4^+) to the free form (dissolved NH_3 gas). Free ammonia is actually toxic to nitrifying bacteria and can disrupt the nitrification process. If the pH drops too low, the intermediate nitrite product (NO_2^-) formed during nitrification will begin to convert to free nitrous acid (HNO_2), which is also toxic/inhibitory to the nitrifying bacteria.*

10.3 TROUBLESHOOTING GUIDELINES

The troubleshooting guidelines for the Outfall 010 WWTP, located in Appendix H, have been organized to simplify the operator's analysis of a problem and are based on available information regarding expected operation of the treatment system. Every wastewater treatment system exhibits somewhat different upset symptoms and responds somewhat differently to the same operational modification. Thus, the system should be monitored closely and the troubleshooting techniques presented herein should be updated as needed based on operating experience. The troubleshooting guidelines primarily address biological treatment process upsets. Biological treatment systems are subject to upsets that stem from an unhealthy biomass that may develop for a variety of reasons. To diagnose and correct problems with specific pieces of equipment or instruments, operators should refer to the vendor-supplied manuals.

The troubleshooting guidelines are divided into four steps:

1. Symptoms (problem identification/description);
2. Potential consequences of not resolving the problem;
3. Possible root cause(s) for the symptoms observed; and,
4. Recommended investigative actions (steps to take to investigate and/or verify the cause of the problem) or corrective actions (to respond to the problem or improve the situation).

The "symptoms" listed reflect the potential system conditions that could arise and how the operators would realize a problem exists. The possible cause section indicates the reason(s) a particular symptom may be observed. Possible causes may be either biological or mechanical in nature. The "diagnosis" list contains a step-by-step method of determining and/or verifying the "cause" of the problem. The intent is to follow the steps until the "cause" of the problem is confirmed and the solution is successful. Before undertaking any of the troubleshooting steps, the operator should verify that the upset condition actually exists by double checking probe or instrument readings and analytical results. For example, if the dissolved oxygen concentration in the aeration basin decreases, the first step should always be to confirm that the probe has not malfunctioned. The troubleshooting guidelines presented herein assume that the upset condition actually exists and that this has been verified.

Listed "corrective actions" provide a list of available steps to remedy the problem. It is assumed that the operator has been instructed as to when the supervisory personnel should be informed. At the onset of an upset condition and while undertaking corrective actions, the treatment plant operation and performance must be monitored very closely to assess the effectiveness of the corrective actions and ensure that another problem is not created. For instance, if the operator is attempting to raise the MLSS concentration due to a high F/M_{COD} condition, the clarifier should be closely monitored to ensure that the higher solids loading does not cause the clarifier effluent quality to deteriorate. Thus, during an upset and during the response, the monitoring frequency of many of the operating and performance parameters needs to be increased.

To continually meet the discharge requirements that apply to the effluent from this treatment system, it is extremely important that each plant upset be thoroughly observed, logged, and discussed with utilities and production personnel. Every detail of each plant upset should be recorded. Supervisory personnel should be consulted if any doubt exists regarding the ability of the plant to meet effluent standards.

11. SAFETY

11.1 INTRODUCTION

This chapter is a general discussion of safety specific to the biological treatment. However, APC is responsible for identifying specific hazards as well as developing their own specific rules. You, the operator, have the responsibility of protecting yourself and other treatment plant personnel or visitors by following safety procedures established for the plant. You must accept the task of maintaining the plant in such a manner as to continually provide a safe place to work. This can only be done if you constantly THINK SAFETY. You should train yourself to analyze jobs, work areas, and procedures from a safety standpoint. Learn to recognize potentially hazardous areas, actions and conditions.

Accidents don’t just happen. – **THEY ARE CAUSED**.

11.2 HOUSEKEEPING

Good housekeeping is an indispensable aid to safety. Keep all structures, walking surfaces, and equipment in good repair and maintained in a neat condition. Pick up tools. Put away loose equipment when not in use. Keep walking surfaces free from grease, oil and scum. In any biological wastewater treatment plant, there is opportunity for walkways to become slippery from the collection of slime in areas where wind whips spray and froth from the bioreactor. Wash any accumulated slime/scum to reduce the potential hazards from slipping. In some instances, sand sprinkled on a slippery walk will provide the needed traction for safe walking.

11.3 POST-INCIDENT RESPONSE

Prominently post incident response information near the WWTP. Such information may include:

1. Telephone number of nearest fire station, hospital, and onsite incident response team.
2. First aid directions for common physical injuries.
3. Location of nearest emergency shower and eyewash locations.
4. Plant horn/siren warning system instructions.

11.4 ELECTRICAL HAZARDS

When working on or around any electrical equipment, lockout and tagout procedures according to APC protocols must be followed. Extra care should be taken when working with equipment that may become wet with water, mist or slime build-up, as discussed above.

11.5 MECHANICAL EQUIPMENT

Mechanical equipment at the WWTP (i.e. blowers, mixers, etc.) should be equipped with guards as required by manufacturer and APC recommendations. Post adequate warning signs near all dangerous machinery, hidden obstacles, or hazardous locations. Generally, all moving parts of machinery require guards. This includes pulleys, gears, and all exposed moving machine parts. If it is necessary to remove the guards before making adjustments on equipment, make sure that they are reinstalled before restarting the equipment.

11.6 NOISE

Loud noises from motors and aeration blowers can cause permanent ear damage. The blowers associated with biological treatment provide the most noise from equipment at the WWTP. Operators and maintenance workers must wear proper ear protection when working in noisy areas in accordance with APC guidelines.

11.7 BACTERIAL INFECTION (HEALTH HAZARDS)

Wastewater and biological treatment represent potential hazards to treatment plant personnel. It is possible for bacterial infections and water-borne diseases such as typhoid fever, paratyphoid fever, dysentery, infectious jaundice, and hepatitis to be transmitted from the treatment of sanitary wastewater. Danger from tetanus at treatment plants exists due to the potential for moist, rusty environments. Any cuts should be immediately treated with an anti-bacterial agent.

Water-borne diseases usually enter the body through the mouth. Most often they are carried to the mouth by the hands or by objects carried in the hands. The best defense against infection from the water-borne diseases is good personal hygiene and careful attention to anything that enters the mouth. Other infections enter through breaks in skin; therefore, a good defense against infection is prompt medical attention to any injury or cut that breaks the skin.

Personal hygiene includes such precautions as a soapy shower and change of clothes after the end of the work shift, as well as washing hands with warm soapy water after bathroom use, before eating or smoking, and upon leaving the laboratory. The hands carry the majority of infectious materials in wastewater work. "Keep your hands below your collar" is good advice to follow while working with pipes, in sewers, tanks, or while handling wastewater or activated sludge. Keep fingers away from nose, mouth, and eyes. Exercise care in smoking. It is practically impossible to avoid contaminating the ends of pipes, cigars, or cigarettes without proper care. Use nitrile gloves to protect the hands from contact with infectious materials while cleaning pumps or handling sludge or wastewater. During the shift, coveralls or dedicated work clothes should be worn. Rubber shoe covers help keep the shoes clean and dry when working around sludge pumps and other operating areas.

Avoid wearing work clothes home because bacteria may be transmitted to your family. If you must take them home, launder them separately from regular family wash. All of these precautions should reduce the possibility of you or your family becoming ill because of your contact with wastewater.

11.8 LABORATORY HAZARDS

Work in the laboratory involves using various glassware, instruments, heaters, etc. The following safety practices are pertinent to analyses conducted in wastewater treatment laboratories:

1. All chipped or cracked glassware should be discarded and placed in a special container for disposal.
2. Ammonia and nitric acid can react violently with some organic materials. Always keep the possibility of fire or explosion in mind when using these chemicals.
3. Do not handle chemicals with bare hands. Concentrated acids and bases require particular care. **Add concentrated acids to water, not water to the acids**. A person splashed with acid requires large volumes of water immediately to prevent serious burns.
4. Clearly label all chemicals. Always check the label to select the proper chemical. Label all poisons with "skull and crossbones" and the proper antidote.
5. Ventilation in laboratories should always be adequate to prevent accumulating fumes and dust.
6. Avoid smoking and eating when working with possibly infectious materials, such as raw sludge. Thoroughly wash your hands before smoking or eating.
7. A carbon dioxide fire extinguisher should be mounted in a readily accessible location in the laboratory.
8. Remove samples from hot plates, ovens, or furnaces with tongs or other suitable tools.
9. Electrical equipment used in the laboratory should be properly grounded.
10. Do not use laboratory glassware for a drinking cup or food dish.
11. Several reagents used in routine analysis contain toxic chemicals that must be discarded as hazardous waste by a licensed disposal company. Dispose of all spent test vials in appropriate containers.

11.9 SAMPLE COLLECTION

Follow APC guidelines for personnel protection when collecting samples. The following provide some additional general guidelines for safe sample collection:

1. Wear safety glasses when collecting samples or handling open sample containers. This will reduce the risk of wastewater accidentally splashing into the eyes.
2. Wear rubber gloves when collecting wastewater or sludge samples. Wash the gloves thoroughly before removing them. Wash hands thoroughly with a disinfectant.
3. Do not collect a sample with your bare hands if you have areas where the skin is broken with cuts or scratches.
4. Use poles, dippers, etc., as necessary to safely collect samples from in-ground tanks.

11.10 CHEMICAL HANDLING

Operators should review the Safety Data Sheet (SDS) on any chemical stored or used at the WWTP. Most chemicals have a potential for injury or health effects if it (1) comes in contact with the eyes, (2) comes in contact with the skin, (3) is breathed, or (4) is swallowed.

1. Eye Hazards:

   Most chemicals pose moderate to severe risk when they come in contact with the eyes. Some chemicals can cause permanent injury even when properly treated. Avoid all eye contact by wearing proper protection. If accidental contact does occur, flush eyes 15 minutes with water and report to a physician.

2. Skin Contact:

   Remove all contaminated clothing. Most acids and bases can produce rapid and serious damage to tissues. In case of skin contact, flush thoroughly with large amounts of water and immediately call a physician.

3. Breathing:

   Fumes or vapor of acids may produce respiratory irritation. Use proper protective equipment when high vapor concentrations are encountered. In case of exposure, remove patient to fresh air; administer artificial respiration if needed. Notify a physician.

4. Swallowing:

   Most chemicals are hazardous if swallowed and may cause permanent injury or death. Wear full-face protection when handling dangerous chemicals such as acids. In case of accidental swallowing, follow emergency instructions provided in the chemical's SDS. Notify a physician immediately.

In case of accidental spillage of any chemical, contact the site SHES Manager. **DO NOT** sewer any chemical without proper instructions. It may be harmful to the wastewater treatment system, or it may cause violation of the effluent discharge limits. Follow the SDS instructions and APC procedures for cleanup.

11.11 SAFETY REFERENCES

The following general references provide additional information regarding safe practices at wastewater treatment plants.

- Water Pollution Control Federation (WPCF) Manual of Practice (MOP) No.1: *Safety in Wastewater Works*
- WPCF MOP No. 11: *Operation of Effluent treatment plants*
- WPCF MOP No. 18: *Simplified Laboratory Procedures for Wastewater Examination*

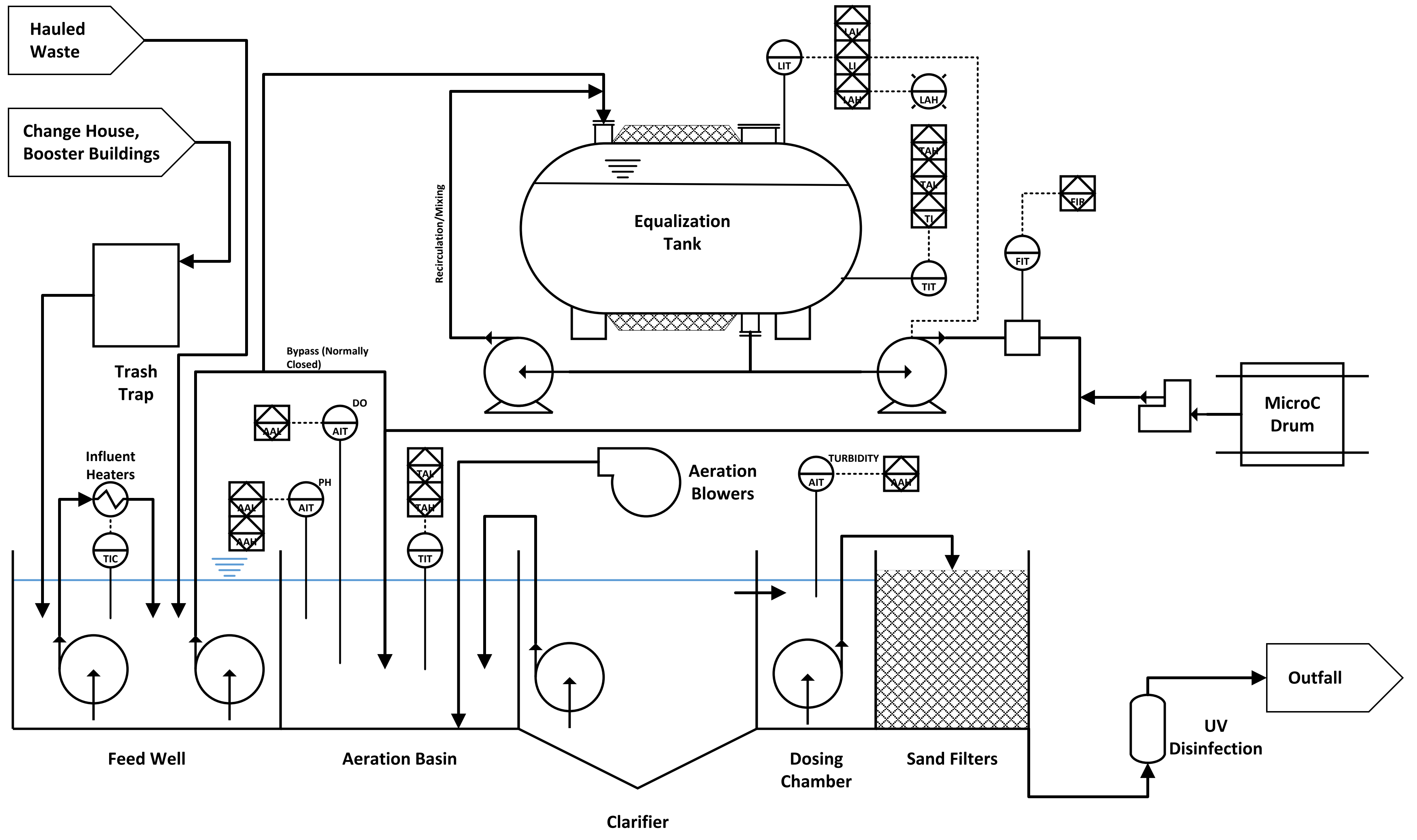
- EPA Technical Bulletin: Safety in the Operation and Maintenance of Wastewater Treatment Works, Contract No. 68-01-0324

APPENDIX A

PROCESS FLOW DIAGRAM

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio



Prepared For:

AUSTIN POWDER CO.
RED DIAMOND PLANT
MCARTHUR, OH

SLR INTERNATIONAL CORP.
FLORENCE, KY

12/29/2021

APPENDIX A.
OUTFALL 010 WWTP
PROCESS FLOW DIAGRAM

APPENDIX B

INFLUENT SOURCE SURVEY AND CHARACTERIZATION

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

APPENDIX B. SOURCE SURVEY CHARACTERIZATION DATA FOR OUTFALL 010 STREAMS

Date	Booster #1 Raw			Booster #1 Finished			Booster #2 Raw			Booster #2 Finished			Booster #3 Raw			Booster #3 Finished			010 Feed Well		010 Dosi	010 Aeration		010 Effluent		
	pH s.u.	COD mg/L	TNT mg/L	pH s.u.	COD mg/L	TNT mg/L	pH s.u.	COD mg/L	TNT mg/L	pH s.u.	COD mg/L	TNT mg/L	pH s.u.	COD mg/L	TNT mg/L	pH s.u.	COD mg/L	TNT mg/L	COD mg/L	TDS mg/L	COD mg/L	Temp. °F	DO mg/L	Turbidity NTU	Color PtCO	UVT %
3/30/2020	8.2	129		7.9	74.4		8.2	269		7.9	61.3		8.4	285		7.8	41.4		163	796	< 100	59.9	5.70			
3/31/2020																						60.1	5.79	2.5	< 5.00	73.6%
4/1/2020	8.4	< 200	57.1	8.1	< 200	29.8	8.3	2,810	56.4	7.9	< 200	18.6	8.4	< 200	67.8	7.8	29.6	25.0	40.5	584	< 200	60.1	4.80	1.6	< 5.00	72.2%
4/2/2020																						59.7	6.14	1.1	< 5.00	72.6%
4/3/2020	8.4	70.7		8.2	68.5		8.2	152		7.9	74.4		8.4	154		8.4	81.2		138	660	76.7	59.2	6.07			
4/6/2020	8.4	127		7.9	99.4		8.3	167		7.7	58.7		8.4	172		7.7	58.7		169	584	74.5	58.6	7.35			
4/7/2020																						60.3	6.18	1.4	< 5.00	72.2%
4/8/2020	8.4	107	75.0	8.1	67.2	48.6	8.3	93.8	64.3	7.6	25.1	18.3	8.4	194	83.0	7.6	38.4	29.0	154	560	47.2	62.2	6.07	1.1	< 5.00	82.9%
4/9/2020		143			69.6			130			41.5			157			63.7		110	656	63.7	63.3	6.25	1.1	< 5.00	84.7%
4/10/2020	8.4			8.1			7.9			7.5			8.5			7.8						64.0	6.16			
4/13/2020	8.4	158		7.9	82.2		8.0	144		7.2	62.9		8.5	154		7.9	52.9		193	1,180	66.6	55.4	6.50			
4/14/2020																						57.9	7.97	3.8	< 5.00	84.2%
4/15/2020	8.3	90.3	68.8	8.2	72.6	44.1	8.3	126	55.9	7.9	61.6	23.6	8.4	173	72.5	7.8	85.6	26.8	164	1,450	55.1	57.2	8.27	1.8	< 5.00	97.8%
4/16/2020																						57.2	8.01	1.7	< 5.00	100%
4/17/2020	8.3	127		8.2	87.1		8.3	144		7.8	93.7		8.4	160		7.8	79.4		183	616	31.2	57.7	8.83			
4/21/2020																										
Count	**9**	**9**	**3**	**9**	**9**	**3**	**9**	**9**	**3**	**9**	**9**	**3**	**9**	**9**	**3**	**9**	**9**	**3**	**9**	**9**	**9**	**15**	**15**	**9**	**9**	**9**
Average	**8.36**	**128**	**67**	**8.07**	**91**	**41**	**8.20**	**448**	**59**	**7.71**	**75**	**20**	**8.42**	**183**	**74**	**7.84**	**59**	**27**	**146**	**787**	**79**	**59.5**	**6.67**	**1.79**	**5.00**	**82.2%**
Minimum	**8.20**	**71**	**57**	**7.90**	**67**	**30**	**7.90**	**94**	**56**	**7.20**	**25**	**18**	**8.40**	**154**	**68**	**7.60**	**30**	**25**	**41**	**560**	**31**	**55.4**	**4.80**	**1.10**	**5.00**	**72.2%**
Maximum	**8.40**	**200**	**75**	**8.20**	**200**	**49**	**8.30**	**2810**	**64**	**7.90**	**200**	**24**	**8.50**	**285**	**83**	**8.40**	**86**	**29**	**193**	**1,450**	**200**	**64.0**	**8.83**	**3.80**	**5.00**	**100.0%**
95th %ile	**8.40**	**183**	**74**	**8.20**	**160**	**48**	**8.30**	**1794**	**64**	**7.90**	**157**	**23**	**8.50**	**251**	**82**	**8.20**	**84**	**29**	**189**	**1,342**	**160**	**63.5**	**8.44**	**3.28**	**5.00**	**99.1%**

APPENDIX C

WWTP STANDARD OPERATING PROCEDURES

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

Wastewater Treatment Plant

Category		Procedure#	Rev.#
Procedure		010-001	A
Subject Outfall 010 WWTP Operations			

SCOPE

This procedure provides checklists for the startup, normal operations, and shutdown procedures for the Outfall 010 WWTP.

RELEVANT DOCUMENTS

Drawing #APS-US-RD-0026-40 – Austin Powder Company Outfall 010 WWTP Modifications Preliminary Layout Plan View, Rev A (SLR, April 2020).

Figure 1 Conceptual Modifications for Outfall 010 Disinfection, Rev A (SLR, April 2020).

As Built 4,000 GPD WWTP Plan View

Austin Powder Company Operations Manual – Outfall 010 WWTP (SLR, December 2020)

Ohio Environmental Protection Agency National (EPA) Pollutant Discharge Elimination System (NPDES) Permit number #OIF00003*GD

Troubleshooting Guides for Outfall 010 WWTP (Outfall 010 WWTP Operations Manual, Appendix H)

Austin Powder Co. Healthy and Safety Plan (HASP)

COMMUNICATIONS

Refer to site HASP

MATERIALS AND EQUIPMENT

The following special materials and equipment are typically required to perform this procedure:

- No special materials required

SAFETY AND HEALTH

This is a Safety and Health Critical Procedure.

PPE: Gloves and safety glasses, and site-appropriate footwear are required at all times. When handling chemicals, chemical-resistant gloves, apron and a face shield are required.

WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals**.**

ENVIRONMENT

This is an Environmentally Critical Procedure. Do not delete this procedure without comparable environmental controls in place.

PROCESS DESCRIPTION

The purpose of the WWTP at Outfall 010 is to provide treatment for the influent wastewater coming from the three Cast Booster production buildings and associated sanitary sources. These wastewater streams contain suspended solids, dissolved organic compounds, pathogens, and ammonia nitrogen. The treatment plant was commissioned in 2009 at a design flow rate of 4,000 gpd.

The Outfall 010 WWTP includes a series of in-ground concrete tanks for collection and treatment of influent streams. Wastewater first flows through a trash trap to gather large solids and is then pumped into an Aeration Tank where wastewater is treated biologically using the extended aeration process. Biological treatment removes organic carbon and ammonia nitrogen. Treated wastewater and biomass then flow into a Clarifier to provide separation of the treated wastewater and biomass, with the biomass recycled to the Aeration Tank. Clarified wastewater is pumped through one of two Sand Filters to provide polishing treatment for suspended solids. After filtration, the wastewater is pumped through an ultraviolet treatment module for pathogen disinfection before discharge via Outfall 010.

Since the WWTP utilizes biological treatment, variations in flow, loading, and pH must be normalized or dampened to provide the bacteria with as consistent as a feed as possible. Failure to do so may result in a biological system upset that can lead to reduced effluent quality.

TABLE 1. Effluent Limitations and Monitoring Requirements

Outfall 010 Effluent Limitations and Frequency									
Parameter	**Discharge Limitation**							**Monitoring Requirements**	
	Concentration Based Limits (mg/L)				**Loading Based Limits (kg/day)**			**Frequency**	**Sample Type**
	Maximum	**Minimum**	**Weekly**	**Monthly**	**Daily**	**Weekly**	**Monthly**		
Water Temperature (°C)	--	--	--	--	--	--	--	1/Day	Grab
Flow (gal/day)	--	--	--	--	--	--	--	1/Day	Total Estimate
Dissolved Oxygen (mg/L)	--	6.0	--	--	--	--	--	1/Day	Grab
Chemical Oxygen Demand, Low Level (mg/L)	--	--	--	--	--	--	--	1/Month	Grab
pH (s.u.)	9.0	6.5	--	--	--	--	--	1/Week	Grab
Total Suspended Solids (mg/L)	18	--	--	12	0.273	--	0.182	1/Week	Grab
Oil and Grease (mg/L)	10	--	--		0.152	--	--	1/Week	Grab
Nitrogen, Ammonia (mg/L), Summer	1.5	--	--	1.0	0.0228	--	0.0152	1/Week	Grab
Nitrogen, Ammonia (mg/L), Winter	4.5	--	--	3.0	0.0682	--	0.0455	1/Week	Grab
Nitrogen, Nitrite plus Nitrate (mg/L)	--	--	--	--	--	--	--	1/Month	Grab
Turbidity (Severity Units)	--	--	--	--	--	--	--	1/Day	Estimate
E. coli (#/100 ml), Summer	362	--	161		--	--	--	1/Week	Grab
Carbonaceous Biochemical Oxygen Demand (CBOD) 5-day, (mg/L)	15	--	--	10	0.228	--	0.152	1/Week	Grab

PROCEDURE

1.0 Don PPE.

WARNING

Failure to wear proper protective equipment can result in personal injury.

Always follow site safety protocol for PPE.

1.1 Wear proper PPE: Gloves, safety glasses, and appropriate footwear.

2.0 Pre-Startup Checklist

NOTE: This section covers the necessary steps for startup of the WWTP after a prolonged system shutdown when the tanks have been emptied.

2.1 Trash Trap (T-41)

2.1.1 Verify Trash Trap (T-41) is free of debris.

2.1.2 Secure manhole lids on top of unit.

2.2 *Feed Well (upstream compartment of T-42)*

2.2.1 Verify Feed Well (T-42) is free of debris.

2.2.2 Verify Feed Well Pumps (42-01 and 42-03) are installed and ready for service.

2.2.3 Energize Level Switch (LS 42-05).

2.2.4 Close 3” valve (42-13) on discharge side of Feed Well Pump (42-01).

2.2.5 Close 3” valve (42-14) on discharge side of Feed Well Pump (42-03).

2.3 Equalization Tank (T-44-01)

2.3.1 Verify Equalization Tank (T-44-01) is free of debris.

2.3.2 Verify 16” manway is bolted and sealed.

2.3.3 Verify 2” spare flanges on side of tank are blinded and sealed.

2.3.4 Open 1” valve (44-06) between Equalization Tank (T-44-01) Aeration Feed Pump (P-45-01).

2.3.5 Energize Level Indicating Transmitter (LIT 44-03).

2.4 Aeration Tank (T-42)

2.4.1 Verify Aeration Tank (T-42) is free of debris.

2.4.2 Verify air diffuser grid is secured and level.

2.4.3 Open the valve between the Aeration Blower and Aeration Tank (T-42).

2.4.4 Energize Equalization Tank Mixer (A-44-02).

2.4.5 Energize Temperature Indicating Transmitter (TIT 42-07).

2.4.6 Energize pH Analytical Indicating Transmitter (AIT 42-08).

2.4.7 Energize Dissolved Oxygen (DO) Analytical Indicating Transmitter (AIT 42-09).

2.4.8 Arrange for a tanker truck of suitable activated sludge to be delivered to be used as seed sludge for startup.

Note: Seed sludge should be from a similar type of wastewater treatment plant, e.g. similar strength wastewater with a healthy biomass population. Wastewater from a municipal wastewater treatment plant is acceptable if seed sludge from an industrial wastewater treatment plant are unavailable.

2.5 Clarifier (42-10)

2.5.1 Verify Clarifier (42-10) is free of debris.

2.5.2 Verify RAS Airlift (42-11) is ready for service.

2.5.3 Verify Skimmer Airlift system (42-12) is installed and ready for service.

2.5.4 Open valve between the Aeration Blower and the RAS Airlift (42-11).

2.5.5 Open valve between the Aeration Blower and the Skimmer Airlift (42-12).

2.6 Dosing Chamber (T-43)

2.6.1 Verify Dosing Chamber (T-43) is free of debris.

2.6.2 Verify Dosing Chamber Pumps (43-01 and 43-03) are installed and ready for service.

2.6.3 Energize Level Switch (LS 43-05).

2.6.4 Energize Turbidity Analytical Indicating Transmitter (AIT 43-06).

2.7 MicroC Feed System

2.7.1 Verify Containment Pallet (T-46-01) is clean and dry.

2.7.2 Verify MicroC Drum is full and is placed on Containment Pallet (T-46-01).

2.7.3 Open ¼” valve (46-02) between MicroC drum and 100 mL Calibration Column on line SST-1/4-CHEM-015.

2.7.4 Close ¼” valve (46-03) on 100 mL Calibration Column.

2.7.5 Close ¼” valve (46-04) on suction side of MicroC Feed Pump (P-46-06).

Note: This valve will be opened during normal operations but must be closed to perform a drawdown measurement during startup.

2.7.6 Open ¼” valve (46-07) on discharge side of MicroC Feed Pump (P-46-06).

2.7.7 Energize speed controller (SIC 46-06).

2.8 Sand Filters

2.8.1 Verify sand filters are level and have fresh media.

2.8.2 Verify concrete splash pads and rip rap are in place.

2.9 UV Disinfection System

2.9.1 Verify Outfall Structure is free of debris

2.9.2 Verify submersible pump is installed and ready for service.

2.9.3 Close Process Sample Valve.

2.9.4 Energize UV Disinfection System at the local breaker box.

2.9.5 Energize effluent Flowmeter/Totalizer at the local breaker box.

3.0 System Startup

NOTE: Task 3.0 presents the steps to begin treating wastewater collected in the Feed Well.

Verify the Pre-Startup Checklist has been completed for the WWTP as presented Section 2.0.

3.1 Feed Well (upstream compartment of T-42)

3.1.1 Energize Feed Well Pump (42-01) by placing the HOA switch at the local breaker box in the AUTO position.

3.1.2 Energize Feed Well Pump (42-03) by placing the HOA switch at the local breaker box in the AUTO position.

3.1.3 Verify Level Switch (LS 42-05) is energized and ready for use.

Note: Trash Trap (T-41) and Feed Well can now accept wastewater from the Booster Buildings and hauled waste from 001 areas, respectively, and will be pumped to Equalization Tank (T-44-01) when Level Switch (LS 42-05) is activated.

3.2 Equalization Tank (T-44-01)

3.2.1 Verify Level Indicating Transmitter (LIT 44-03) is energize and ready for use.

3.2.2 Allow Equalization Tank (T-44-01) to fill over low level alarm (LALL 44-04) level.

3.2.2 Place Equalization Tank Mixer (A-44-02) in the AUTO position using the HOA switch at the at the local breaker box.

Note: Equalization Tank Mixer (A-44-02) will not turn on until low level alarm (LALL 44-04) is cleared.

3.3 Aeration Feed Pump (P-45-01)

3.3.1 Verify Pressure Indicating Transmitter (PIT-45-05) is energized and ready for use.

3.3.2 Verify Flow Indicating Transmitter (FIT-45-07) is energized and ready for use.

3.3.4 Verify Speed Indicating Controller (SIC-45-02) is energized and ready for use.

3.3.5 Place Aeration Feed Pump (P-45-01) in the AUTO position using the HOA Switch (45-02) at the at the local breaker box.

Note: Aeration Feed Pump (P-45-01) will not start until low level alarm (LALL 44-04) is cleared.

3.4 Aeration Tank (T-42)

3.4.1 Place Aeration Blower in the AUTO position using the HOA Switch at the at the local breaker box.

3.4.2 Verify Temperature Indicating Transmitter (TIT 42-07) is energized and ready for use.

3.4.3 Verify Temperature Sensor (TE 42-07) is submerged.

3.4.4 Verify pH Analytical Indicating Transmitter (AIT 42-08) is energized and ready for use.

3.4.5 Calibrate pH sensor (AE 42-08) as per manufacturer's instructions.

3.4.6 Submerge pH Analytical Sensor (AE 42-08) into Aeration Tank (T-42).

3.4.7 Verify Dissolved Oxygen (DO) Analytical Indicating Transmitter (AIT 42-09) is energized and ready for use.

3.4.8 Calibrate DO Analytical Sensor (AE 42-09) as per manufacturer's instructions.

3.4.9 Submerge DO Analytical Sensor (AE 42-09) into Aeration Tank (T-42).

3.4.10 Allow Aeration Tank (T-42) to fill and then overflow into Clarifier (42-10)

3.5 MicroC Feed System

3.5.1 Open ¼" valve (46-03) located at the base of Calibration Column (FI 46-04) to fill the column to the full mark.

3.5.2 Close ¼ valve (46-02).

3.5.3 Adjust feed rate of the MicroC Feed Pump (P-46-06) to 2 gal/day using the local HMI.

Note: Set point will be field-verified after installation.

3.5.4 Using the HMI, start the MicroC Feed Pump (P-46-06) and begin 60 second timer to calibrate and verify Micro C flow rate.

Note: MicroC feed rate should be 5.2 mL/min.

3.5.5 Repeat steps 3.5.1 through 3.5.4 until the MicroC feed rate is at the target value.

Note: Feed rate is adjusted using speed controller (SIC 46-06).

3.5.6 Allow MicroC Feed Pump (P-46-06) to empty Calibration Column (FI-46-04).

3.5.7 Close ¼" valve (46-03) at the base of the Calibration Column (FI 46-04).

3.5.8 Open ¼ valve (46-02) located between Calibration Column (FI 46-04) and the MicroC drum.

3.6 Clarifier (42-10)

3.6.1 Verify RAS Airlift (42-11) and Skimmer Airlift (42-12) are receiving air from the Aeration Blower.

3.6.2 Allow Clarifier (42-10) to fill and then overflow into Dosing Chamber (T-43).

3.7 Dosing Chamber (T-43)

3.7.1 Verify Level Switch (LS 43-05) is energized and ready for use.

3.7.2 Place Dosing Chamber Pump (43-02) in AUTO position at the HOA switch at the local breaker box.

3.7.3 Place Dosing Chamber Pump (43-03) in AUTO position at the HOA switch at the local breaker box.

3.7.4 Verify Turbidity Analytical Indicating Transmitter (AIT 43-06) is energized and ready for use.

3.7.5 Submerge Turbidity Analytical Sensor (AE 43-06) into Dosing Chamber (T-43).

3.8 Sand Filter

3.8.1 Verify Sand Filter is receiving water from Dosing Chamber (T-43).

3.9 UV Disinfection System

3.9.1 Using the local HOA switch, place submersible pump into AUTO position.

3.9.2 Allow Outfall Structure to fill and verify the submersible pump turns on with the float switch and pumps through the UV Disinfection System to Outfall 010.

3.9.3 Verify effluent flowmeter/totalizer is registering flow to Outfall 010.

4.0 Normal Operations

4.1 Trash Trap (T-41)

4.1.1 Inspect the Trash Trap (T-41) for the accumulation of debris on a monthly basis.

Note: Trash Trap (T-41) is regularly cleaned once every six months. If the solids level reaches 4 feet before the scheduled six month cleaning, use a vacuum truck to remove debris.

4.1.3 Verify the entrance to the pipe PVC-6-WW-001 is not plugged or blinded with debris.

4.2 Feed Well (upstream compartment of T-42)

4.2.1 Verify flow from Trash Trap (T-41) to Feed Well.

4.2.2 When Feed Well Pumps (42-01) and (42-03) are operating, verify there are no unusual noises or excessive vibration. Request Maintenance if any unusual noises or vibration are observed.

4.3 Equalization Tank (T-44-01)

4.3.1 Observe the Equalization Mixer (A-44-02) top-mounted mixer and verify it is free of excessive vibration and unusual noises. Request Maintenance if any unusual noises or vibration are observed.

4.3.2 Verify Aeration Feed Pump (P-45-01) is free of unusual noises and excessive vibration. Request Maintenance if any unusual noises or vibration are observed.

Note: Aeration Feed Pump (P-45-01) is installed with the following interlocks:

- Stop pump at Low-Low Level Alarm (LALL-44-04) at Equalization Tank (T-44-01)
- Stop pump at Pressure Alarm High-High (PAHH-45-05) on the discharge side of Aeration Feed Pump (P-45-01).
- Stop pump at Flow Alarm Low-Low (FALL-45-07) at flow meter (FIT-45-07).

4.3.3 Verify flow through for Aeration Feed Pump (P-45-01) using the flow indicating transmitter (FIT-45-07).

Note: Controller logic to be verified prior to installation.

4.3.4 Using a sampling container, take a sample of Equalization Tank (T-44-01) by opening ½" valve 44-07.

Note: Fill and empty the sample container three times in order to ensure line GS-1-WW-006 is flushed prior to sample collection.

4.3.5 Analyze Equalization Tank (T-44-01) sample for pH.

Note: Target range is between 6.5 to 8.5 s.u. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result falls outside this range.

4.3.6 Analyze Equalization Tank (T-44-01) sample for Chemical Oxygen Demand (COD).

Note: Target range is between 100 to 500 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result falls outside this range.

4.3.7 Analyze Equalization Tank sample (T-44-01) for Ammonia Nitrogen (NH_3-H).

Note: Target range is between 10 to 40 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result falls outside this range.

4.4 Aeration Tank (T-42)

4.4.1 Verify Aeration Blower is free of unusual noises and excessive vibration. Request Maintenance if any unusual noises or vibration are observed.

4.4.2 Using a sampling container, take a sample of Aeration Tank (T-42).

Note: Rinse sample jar with Aeration Tank contents three times prior to sample collection.

4.4.3 Verify pH indicator (AIT 42-08) is within the target range of 6.8 to 7.5 s.u.

Note: Refer to Outfall 010 Troubleshooting Guide for corrective action if the result falls outside this range.

4.4.4 Verify DO indicator (AIT 42-09) is above the target value of 2.0 mg/L.

Note: Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is below this value.

4.4.5 Analyze Aeration Tank (T-42) sample for conductivity.

Note: Target value is < 1,000 µS. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.4.6 Analyze Aeration Tank (T-42) sample for Mixed Liquor Suspended Solids (MLSS).

Note: Target range is between 2,000 to 4,000 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result falls outside this range.

4.4.7 Analyze Aeration Tank (T-42) sample for Sludge Volume Index (SVI).

Note: Target value is < 100mL/g. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.4.8 Observe surface foam coverage at the top of Aeration Tank (T-42).

Note: Target value is < 75% coverage. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.5 Clarifier 42-10

4.5.1 Visually inspect RAS Airlift (42-11) operation.

4.5.2 Visually inspect surface of Clarifier 42-10 for excessive floating solids or scum.

Note: This can indicate a biological upset.

4.6 Dosing Chamber (T-43)

4.6.1 Verify Dosing Chamber Pumps (43-01 and 43-03) are free of unusual noises and excessive vibration. Request Maintenance if any unusual noises or vibration are observed.

4.6.2 Verify turbidity indicator (AIT 43-06) is below the target value of 50 NTU.

Note: Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.6.3 Analyze Dosing Chamber (T-43) sample for NH_3-N.

Note: Target value is < 1.0 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.6.4 Analyze Dosing Chamber (T-43) sample for phosphate.

Note: Target value is >1.0 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is below this value.

4.6.5 Analyze Dosing Chamber (T-43) sample for Nitrate + Nitrite (NO_3-N + NO_2-N).

Note: Target range is between 0 to 20 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is outside this range.

4.6.6 Analyze Dosing Chamber (T-43) sample for COD.

Note: Target value is < 100 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.6.7 Analyze Dosing Chamber (T-43) sample for Total Suspended Solids (TSS).

Note: Target value is < 30 mg/L. Refer to Outfall 010 Troubleshooting Guide for corrective action if the result is above this value.

4.7 UV Disinfection

4.7.1 Record reading from the flowmeter/totalizer at the same time each day.

4.7.2 Record the Irradiance (W/m^2) and Transmittance (%) displayed on the UV disinfection monitor.

4.7.3 Verify submersible pump is free of unusual noises and excessive vibration. Request Maintenance if any unusual noises or vibration are observed.

5.0 System Idle / Temporary Shutdown

NOTE: The following tasks are to be used if the WWTP is undergoing a temporary system shutdown and all forward feed flow has stopped. Setting the system to “Idle” will keep the biomass viable for when the system restarts.

5.1 Equalization (T-44-01)

5.1.1 Verify no flow is coming from the following sources:

- Booster Buildings 1, 2, and 3;
- Booster Building Change House; and
- Hauled waste from 001 holding tank.

5.1.2 Using the local Hand Switch (HS-45-02) place Aeration Feed Pump (P-45-02) in the OFF position.

Note: If the temporary system shutdown lasts longer than three days, consider implementing a system feeding plan to provide biomass in Aeration Tank (T-42) with MicroC.

5.2 MicroC

5.2.1 Place the local Hand Switch (HS-46-06) to the OFF position at MicroC Feed Pump (P-46-06).

Note: If a system feed plan has been implemented because of extended temporary shutdown, supplement Aeration Tank (T-42) with MicroC.

5.3 Clarifier (42-10)

5.3.1 Increase rate on RAS Airlift (42-11) by increasing the air flow to draw down the sludge blanket to remove biomass from Clarifier (42-10) and transfer the sludge to Aeration Tank (T-42).

5.3.2 Once sludge blanket has been transferred to Aeration Tank (T-42), close the air valve on the air line between the Aeration Blower and the RAS Airlift (42-11).

5.3.4 Close the air valve on the air line between the Aeration Blower and the Skimmer Airlift (42-12).

5.3.5 To restore system operations, perform the following actions to bring the system back online:

- Place Aeration Feed Pump (P-45-01) back in the AUTO position using the local Hand Switch (HS-45-02);
- Place MicroC Feed Pump (P-46-06) in the ON position using the local Hand Switch (HS-46-06). Calibrate to desired feed rate as in step 3.5;
- Open the air valve on the air line between the Aeration Blower and the RAS Airlift (42-11); and,
- Close the air valve on the air line between the Aeration Blower and the Skimmer Airlift (42-12).

6.0 System Shutdown

NOTE: The following tasks are to be used if the WWTP is undergoing a full system shutdown for maintenance or turnaround activities.

6.1 Trash Trap (T-41)

6.1.1 Schedule the site contractor to provide a vacuum truck to remove liquid and solid waste from Trash Trap (T-41).

6.2 Feed Well (upstream compartment of T-42)

6.2.1 Allow Feed Well Pumps (42-01) and (42-03) to draw down the Feed Well until Level Switch (LS-42-05) turns the pumps off.

6.2.2 Deenergize Feed Well Pumps (42-01) and (42-03) at the local breaker box.

6.2.3 If necessary, use a vacuum truck to remove residual liquids and solids from the Feed Well.

6.3 Equalization Tank (T-44-01)

6.3.1 Allow Aeration Feed Pump (P-45-01) to draw down the Equalization Tank (T-44-01) until Low Level Alarm (LALL-44-04) turns the pump and Equalization Tank Mixer (A-44-02) off.

6.3.2 Close 1“ valve 44-06 at the base of Equalization Tank (T-44-01).

6.3.3 Deenergize Equalization Tank Mixer (A-44-02) using the local breaker box.

6.3.4 Place Aeration Feed Pump (P-45-01) in the OFF position using the local Hand Switch (HS-42-02).

6.3.5 Deenergize Aeration Feed Pump (P-45-01) using the local breaker box.

6.3.6 Place a bucket under ½” valve (44-07) on line GS-1-WW-006 between the Equalization Tank (T-44-01) and Aeration Feed Pump (P-45-01).

6.3.7 Open the ½” valve (44-07) to drain line GS-1-WW-006.

Note: Bucket may need to be emptied more than once during draining. Properly dispose of wastewater in the bucket into the Aeration Tank (T-42).

6.3.8 Place a bucket under ½” valve (45-03) on line GS-1-WW-007 between Aeration Feed Pump (P-45-01) and Aeration Tank (T-42).

6.3.9 Open the ½" valve (45-03) to drain line GS-1-WW-007.

Note: Bucket may need to be emptied more than once during draining. Properly dispose of wastewater in the bucket into the Aeration Tank (T-42).

6.4 MicroC

6.4.1 Close ¼" valve (46-02).

6.4.2 Open ¼ valve (46-03) on Calibration Column (FI-46-04).

6.4.3 Using the Local Speed Controller (SIC 46-06) on the MicroC pump (P-46-06) to maximum speed to drain the line to the Splitter Box (42-06).

Note: Allow pump to run until line SST-1/4-CHEM-016 is empty and MicroC is no longer being fed into the Splitter Box (42-06).

6.4.4 Place the MicroC Feed Pump (P-46-06) in the OFF position using the local Hand Switch (HS-46-06).

6.4.5 Close ¼" valve (46-03).

6.4.6 Close ¼" valve (46-04).

6.4.7 Close ¼" valve (46-07).

6.5 Aeration Tank T-42

6.5.1 Deenergize pH Analytical Indicating Transmitter (AIT 42-08) at the local breaker box.

6.5.2 Deenergize DO Analytical Indicating Transmitter (AIT 42-09) at the local breaker box.

6.5.3 Remove pH Analytical Sensor (AE 42-08) and store per manufacturer's instructions.

6.5.4 Remove DO Analytical Sensor (AE 42-09) and store per manufacturer's instructions.

6.5.5 Switch off the Aeration Blower at the local control panel.

Note: Turning off the blower will turn off the air diffusers in the Aeration Tank T-42, the Skimmer Airlift in the Clarifier 42-10, and RAS Airlift in the Clarifier 42-10.

6.5.6 Use a vacuum truck to remove residual liquids and solids from Aeration Tank T-42.

6.6 Clarifier 42-10

6.6.1 Use a vacuum truck to remove residual liquids and solids from the Clarifier 42-10.

6.7 Dosing Chamber (T-43)

6.7.1 Allow Dosing Chamber Pumps (43-01) and (43-03) to draw down the Dosing Chamber until Level Switch (LS-43-05) turns the pumps off.

6.7.2 Place Dosing Chamber Pump (43-01) in OFF position at the HOA switch at the local breaker box.

6.7.3 Deenergize Dosing Chamber Pump (43-01) at local breaker box.

6.7.4 Place Dosing Chamber Pump (43-03) in OFF position at the HOA switch at the local breaker box.

6.7.5 Deenergize Dosing Chamber Pump (43-03) at local breaker box.

6.7.6 Deenergize Turbidity Analytical Indicating Transmitter (AIT 43-06) at the local panel.

6.7.7 Remove Turbidity Analytical Sensor (AE 43-06) and store per manufacturer's instructions.

6.7.8 If necessary, use a vacuum truck to remove residual liquids and solids from the Dosing Chamber (T-43).

6.8 UV Disinfection

6.8.1 Allow submersible pump to draw down the Outfall Structure until Level Float Switch (LS) turns the pumps off.

6.8.2 Using the local HOA switch, place submersible pump into OFF position.

6.8.3 Deenergize submersible pump at local breaker box.

6.8.4 Turn off UV Disinfection System at the local breaker box.

6.8.5 Deenergize UV Disinfection System at the local breaker box.

6.8.6 Deenergize effluent Flowmeter/Totalizer at the local breaker box.

6.8.7 Place a bucket under Process Sample Valve on the line between the UV Disinfection System and the Flowmeter/Totalizer.

6.8.8 Open the Process Sample Valve to drain the line between the UV Disinfection System and the Flowmeter/Totalizer.

Note: Bucket may need to be emptied more than once during draining. Properly dispose of wastewater in the bucket into the Outfall Structure.

6.8.9 If necessary, use a vacuum truck to remove residue liquids and solids from the Outfall Structure.

Wastewater Treatment Plant

Category		Procedure#	Rev.#
Procedure		010-002	A
Subject Outfall 010 Sampling and Monitoring			

SCOPE

To conduct operational monitoring and collect process control samples to evaluate the performance of the Outfall 010 Wastewater Treatment Plant (WWTP).

These methods standardize operational duties sample collection for the following process control locations:

- Booster Building Finished Water Tank 1;
- Booster Building Finished Water Tank 2;
- Booster Building Finished Water Tank 3;
- Equalization Tank/Feed Well;
- Aeration Tank;
- MicroC Feed System;
- Dosing Chamber;
- UV Feed Well; and,
- UV System.

RELEVANT DOCUMENTS

Wastewater Sampling Operating Procedure. 2017. EPA Region 4 https://www.epa.gov/sites/production/files/2017-07/documents/wastewater_sampling306_af.r4.pdf.

Recommended Routine Sampling and Analytical Program (Outfall 010 Operations Manual, Appendix D)

Troubleshooting Guides for Outfall 010 WWTP (Outfall 010 Operations Manual, Appendix H)

Ohio Environmental Protection Agency National (EPA) Pollutant Discharge Elimination System (NPDES) Permit number #OIF00003*GD.

Austin Powder Co. Healthy and Safety Plan (HASP).

COMMUNICATIONS

Refer to site HASP

MATERIALS AND EQUIPMENT

The following special materials and equipment are typically required to perform this procedure:

- Sampling bottles or containers;
- Sampling dipper apparatus; and,
- PPE.

SAFETY AND HEALTH

This is a Safety and Health Critical Procedure.

PPE: Gloves, safety glasses, and appropriate footwear are required at all times. When handling chemicals, chemical-resistant gloves, apron and a face shield are required.

WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals**.**

ENVIRONMENT

This is an Environmentally Critical Procedure. Do not delete this procedure without comparable environmental controls in place.

Category		Procedure#	Rev.#
Procedure		010-002	A
Subject Outfall 010 Sampling and Monitoring			

Abbreviations

BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
SSV	Minute Settled Sludge Volume
SVI	Sludge Volume Index
TSS	Total Suspended Solids

The following frequency schedule and procedures are for sampling events.

Routine Process Monitoring Summary Table

Location	Parameter	Frequency	Sample Analysis
Booster Building Finished Water Tank 1	COD	1/week	WWTP Laboratory
	TNT	1/week	QA Laboratory
Booster Building Finished Water Tank 2	COD	1/week	WWTP Laboratory
	TNT	1/week	QA Laboratory
Booster Building Finished Water Tank 3	COD	1/week	WWTP Laboratory
	TNT	1/week	QA Laboratory
Equalization Tank/Feed Well	Flow	1/day	Online meter
	COD	1/day	WWTP Laboratory
	Ammonia	3/week	WWTP Laboratory
Aeration Basin	pH	1/day	Handheld meter
	DO	1/day	Handheld meter
	Temperature	1/day	Handheld meter
	Conductivity	3/week	Handheld meter
	MLSS	2/week	WWTP Laboratory
	MLVSS	2/week	WWTP Laboratory
	F/M Ratio	1/day	Calculation
	Surface Foam Coverage	1/day	Observation
	Microscope Evaluation	1/month	Third party
	Zone Settling Velocity	1/week	WWTP Laboratory
	Settled Sludge Volume	1/week	WWTP Laboratory
	Sludge Volume Index	1/week	Calculation
MicroC Pump	Flow rate	1/day	Online meter
	Calibration Check	1/month	Field

Dosing Chamber	Turbidity	1/day	Online meter
	TSS	2/week	WWTP Laboratory
UV Feed Well	Turbidity	1/day	WWTP Laboratory
	Ammonia	3/week	WWTP Laboratory
	Nitrate + Nitrite	3/week	WWTP Laboratory
	Orthophosphate	2/week	WWTP Laboratory
	TSS	2/week	WWTP Laboratory
	COD	1/day	WWTP Laboratory
UV Disinfection System	Transmittance	1/day	Online meter
	Flow	1/day	Online meter

PROCEDURE

1.0 Don PPE.

WARNING

Failure to wear proper protective equipment can result in personal injury.

Always follow site safety protocol for PPE.

1.1 Wear proper PPE: gloves, safety glasses, and appropriate footwear.

2.0 Booster Buildings Finished Water Tanks 1, 2, and 3

NOTE:

This task is for process sampling at Booster Building Finished Water Tank 1, Booster Building Finished Water Tank 2, and Booster Building Finished Water Tank 3. This procedure should be used for each building.

2.1 Parameters and Frequency

2.1.1
- COD – 1/week
- TNT – 1/week

2.2 Sample Equipment

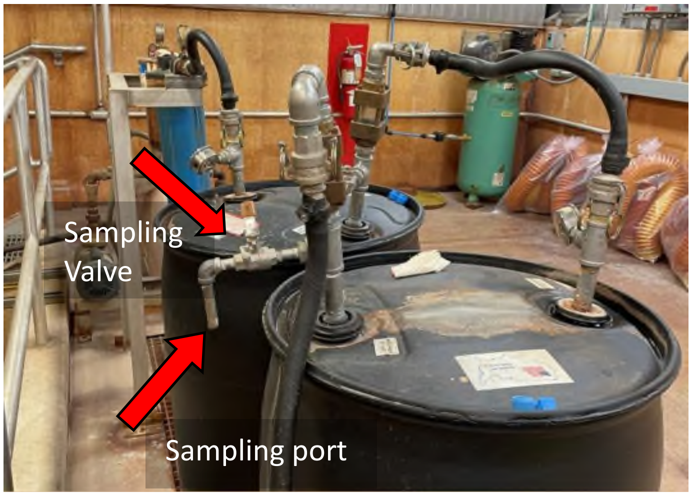
2.2.1
- Nitrile gloves;
- Sampling containers; and,
- 5- gallon bucket.

2.3 Sample Volume

2.3.1 Approximately 1 liter from each building, split between two containers.

2.4 Sample Location

2.4.1 This photo is representative of each building.



2.5 Sample Collection Procedure

2.5.1 Don gloves.

2.5.2 Place bucket under nozzle.

2.5.3 Open sampling valve.

2.5.4 Let flow run for 5 seconds to clear the pipe of stagnant water to obtain a representative sample.

2.5.5 Place bottle sample container under sample valve. Rinse and empty sample container with sample three times dumping the rinse water into the bucket.

2.5.6 Fill sample container.

2.5.7 Pour bucket into trench drain system adjacent to sampling location.

3.0 Feed Well

NOTE:

This task is for process sampling and monitoring of the Equalization Tank. Until the Equalization Tank is installed, samples will be collected from the Feed Well upstream from the Equalization Tank. This procedure will need to be updated when the Equalization Tank has been installed.

3.1 Parameters and Frequency

3.1.1
- Flow – 1/day
- COD – 1/day
- Ammonia—3/week

3.2 Sample Equipment

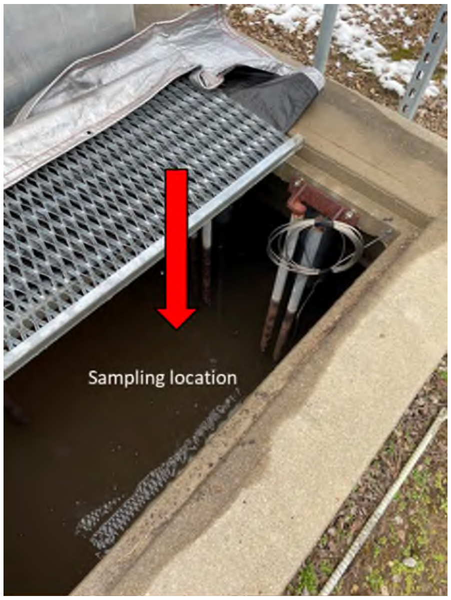
3.2.1
- Nitrile gloves;
- Sampling container; and,
- Sampling dipper apparatus.

3.3 Sample Volume

3.3.1 Approximately 1 liter.

3.4 Sample Locations

3.4.1 The photos below show the sampling locations at the Equalization Tank and the Feed Well.



3.5 Sample Collection Procedure

3.5.1 Don gloves.

3.5.2 Place sampling dipper apparatus in the Feed Well.

3.5.3 Fill sampling dipper apparatus and pour contents back to the Feed Well.

3.5.4 Repeat three times.

3.5.5 Fill sampling dipper apparatus and pour into sample containers

4.0 Aeration Tank

NOTE:

This task is for process sampling and monitoring the Aeration Tank.

4.1 Parameters and Frequency

4.1.1

- pH — 1/day
- DO — 1/day
- Temperature — 1/day
- Conductivity – 3/week
- MLSS – 2/week
- MLVSS—2/week
- Surface foam coverage – 1/day
- Microscope Evaluation – 1/month
- ZSV– 1/week
- SSV-30—1/week

4.2 Sample Equipment

4.2.1

- Nitrile glove;
- Sampling containers;
- Sampling dipper apparatus; and,
- Sample cooler/shipping container.

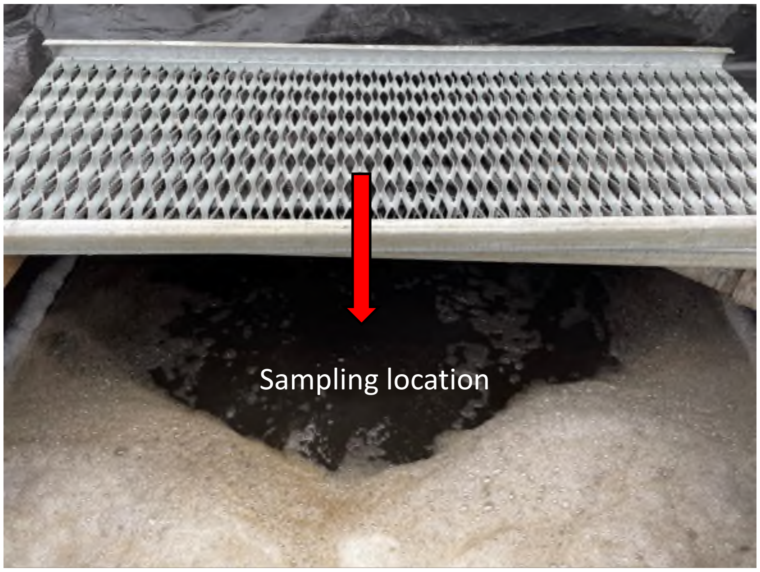
4.3 Sample Volume

4.3.1 Approximately 2 liters, split into 2 containers.

4.3.2 Approximately 250 mL placed in 500 mL container for microscope analysis. This sample is shipped offsite for analysis.

Note: Fill sample container only halfway to ensure samples stay aerobic during transport.

4.4 Sample Location



4.5 Sample Collection Procedure

Note: This Procedure is to used collect wastewater samples for the following analyses at the WWTP laboratory: MLSS, MLVSS, ZSV, and SSV.

4.5.1 Don gloves.

4.5.2 Place sampling dipper apparatus in the Aeration Tank.

4.5.3 Fill sampling dipper apparatus and pour contents back to the Aeration Tank.

4.5.4 Repeat three times.

4.5.5 Fill sampling dipper apparatus and pour into sample containers.

4.6 Microscope Samples

4.6.1 Using the procedure in Section 4.5, fill sampling dipper apparatus and pour into microscope sample container until halfway full.

4.6.2 Package microscope analysis sample in cooler or shipping container.

4.6.3 Submit the microscope analysis sample to a third-party resource.

4.7 Handheld Meter Readings

This Procedure is to monitor temperature, pH, DO, and conductivity.

Note: This section will be updated after instrumentation is purchased and implemented.

4.7.1 Calibrate pH probe per manufacturer's instructions. See SOP 100-009 for calibration procedure.

4.7.2 Submerge probe into Aeration Basin.

4.7.3 Record pH reading using handheld meter.

4.7.4 Record temperature using handheld meter.

4.7.5 Calibrate DO probe per manufacturer's instructions. See SOP 100-010 for calibration procedure.

4.7.6 Submerge probe into Aeration Basin.

4.7.7 Record DO using handheld meter.

4.7.8 Calibrate conductivity meter as per manufacturer's instructions. See SOP 100-001 for calibration procedure.

4.7.9 Submerge probe into Aeration Basin.

4.7.10 Record conductivity using handheld meter.

4.8 Surface Foam Coverage Observation

4.8.1 Looking at the Aeration Tank, estimate the percentage of coverage of foam on the tank surface.

4.8.2 Example of foam is shown in the photo below.

5.0 MicroC Pump

This task is for process monitoring the MicroC Pump. The MicroC Pump has not yet been installed.

5.1 Parameters and Frequency

5.1.1
- Flow rate—1/day
- Calibration check – 1/month

5.2 Equipment

5.2.1
- Nitrile gloves.

5.3 Online Flow Meter Readings

5.3.1 Record flow rate.

Note: This section will be updated after instrumentation is installed.

5.4 Calibration Check

5.4.1 Verify the date of the last calibration check. If the system is due for a calibration check, refer to SOP 010-004 for calibration check instructions.

6.0 Dosing Chamber

NOTE:

This task is for process sampling and monitoring at the Dosing Chamber.

6.1 Parameters and Frequency

6.1.1
- Turbidity
- TSS

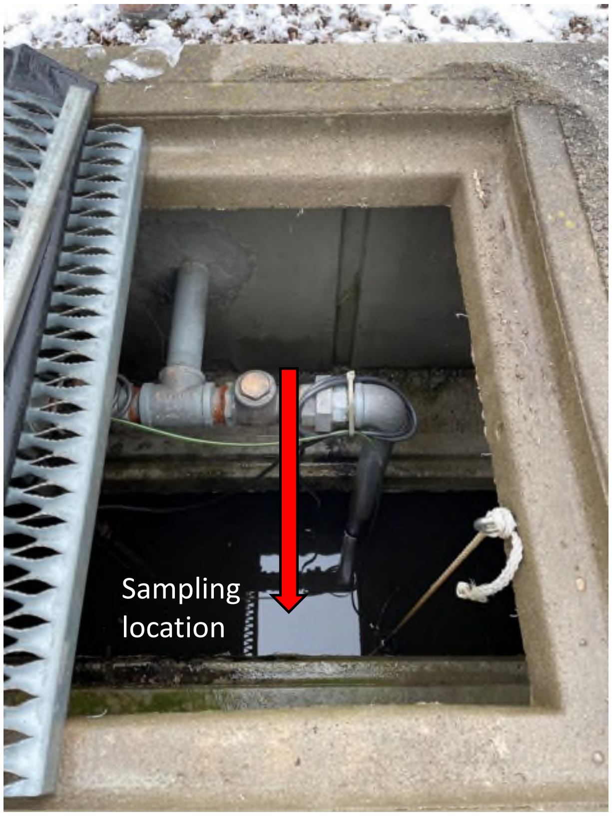
6.2 Sampling Equipment

6.2.1
- Nitrile gloves;
- Sampling containers; and,
- Sampling dipper apparatus.

6.3 Sample Volume

6.3.1 Approximately 1 liter.

6.4 Sample Location



6.5 Sample Collection Procedure

Note: This Procedure is to used collect wastewater samples for the following analyses at the WWTP laboratory: ammonia, nitrate, nitrite, orthophosphate, TSS, and COD.

6.5.1 Don gloves.

6.5.2 Place sampling dipper apparatus in the Dosing Chamber.

6.5.3 Fill sampling dipper apparatus and pour contents back to the Dosing Tank.

6.5.4 Repeat three times.

6.5.5 Fill sampling dipper apparatus and pour into sample containers.

6.5 Online Meter Readings

This Procedure is to monitor turbidity.

Note: This section will be updated after online instrumentation installation.

6.5.1 Record turbidity reading.

7.0 UV Feed Well

NOTE:

This task is for process sampling and monitoring at the UV Feed Well.

7.1 Parameters and Frequency

7.1.1
- NH_3-N
- PO_4-P
- NO_3-N + NO_2-N
- COD
- TSS

7.2 Sampling Equipment

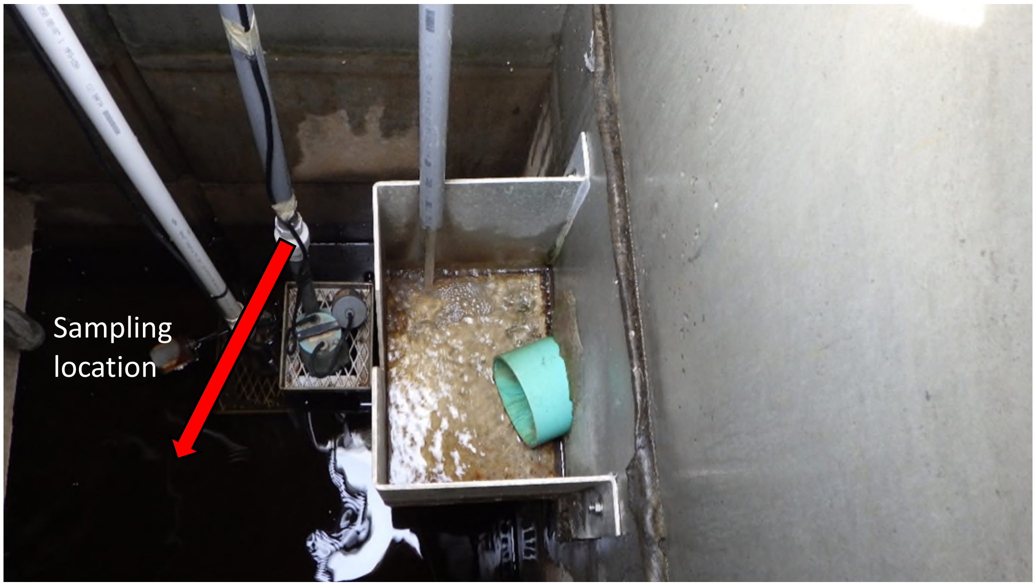
7.2.1
- Nitrile gloves;
- Sampling containers; and,

Sampling dipper apparatus.

7.3 Sample Volume

7.3.1 Approximately 1 liter.

7.4 Sample Location



7.5 Sample Collection Procedure

Note: This Procedure is to used collect wastewater samples for the following analyses at the WWTP laboratory: ammonia, nitrate, nitrite, orthophosphate, TSS, and COD.

7.5.1 Don gloves.

7.5.2 Place sampling dipper apparatus in the Dosing Chamber.

7.5.3 Fill sampling dipper apparatus and pour contents back to the Dosing Tank.

7.5.4 Repeat three times.

7.5.5 Fill sampling dipper apparatus and pour into sample containers.

7.5 Online Meter Readings

This Procedure is to monitor turbidity.

Note: This section will be updated after online instrumentation installation.

7.5.1 Record turbidity reading.

7.5.5 Fill sampling dipper apparatus and pour into sample containers.

8.0 UV Disinfection System

8.1 Parameters and Frequency

8.1.1
- UV Transmittance
- Flow

8.2 Sampling Equipment

8.2.1
- Nitrile gloves.

8.3 Flow Monitoring Location

8.4 Online Flow Meter Readings

8.4.1 At the flow meter located on the discharge side of the UV Disinfection System, record flow meter totalizer reading.

Note: Totalized flow reading is shown as thousands of gallons. Thus, a reading of 1.0000 corresponds to 1,000 gallons.

8.5 UV Disinfection Online System Locations

8.6 UV Transmittance Online Reading

8.6.1 At the UV monitoring panel, record transmittance reading as shown as a percentage.

Wastewater Treatment Plant

Category		Procedure#	Rev.#
Procedure		010-003	A
Subject Outfall 010 UV System Cleaning			

SCOPE	Provide routine inspection, cleaning, and replacement of UV elements for the Outfall 010 WWTP.
RELEVANT DOCUMENTS	Troubleshooting Guides for Outfall 010 WWTP (Outfall 010 Operations Manual, Appendix H) *BA Series Ultraviolet Water Disinfection System Installation, Operation and Maintenance Manual* (UV Superstore) Austin Powder Co. Healthy and Safety Plan (HASP).
COMMUNICATIONS	Refer to site HASP

MATERIALS AND EQUIPMENT

The following special materials and equipment are typically required to perform this procedure:

- Flashlight (if performed at night or under poor lighting conditions)
- Powder-free latex or nitrile Gloves
- Long-cuff gloves
- Lint-free cloths or towels
- Distilled water in spray bottle
- Citric acid-based detergent in spray bottle
- Replacement UV lamp elements (if required)

SAFETY AND HEALTH

This is a Safety and Health Critical Procedure.

PPE: Gloves, safety glasses, and appropriate footwear are required at all times. When handling chemicals, chemical-resistant gloves, apron and a face shield are required.

Damaged bulbs or sheaths can present a cut hazard. Handle any broken components with extreme caution.

Ultraviolet light can damage eyesight – do not look directly at the bulbs when powered on.

ENVIRONMENT

This is an Environmentally Critical Procedure. Do not delete this procedure without comparable environmental controls in place.

Category **Procedure**		Procedure# 010-003	Rev.# A
Subject Outfall 010 UV System Cleaning			

PROCEDURE

1.0 Don PPE.

WARNING

Failure to wear proper protective equipment can result in personal injury.

Always follow site safety protocol for PPE.

1.1 Wear proper PPE: gloves, safety glasses, and appropriate footwear.

2.0 Procedure

NOTE:

Follow facility lock-out/tag-out procedures for isolation of process equipment when performing maintenance.

2.1 Unit Isolation

Note: Refer to photo in Section 3.1 to identify components.

2.1.1 Disconnect power to the UV system and lock out the control panel.

2.1.2 Open the bypass valve.

2.1.3 Close the upstream and downstream isolation valves.

2.1.4 Loosen the threaded connectors on the inlet and outlet to the UV module.

2.1.5 Remove the module from the enclosure.

2.2 Unit Disassembly

Note: Refer to photo in Section 3.2 to identify components.

2.2.1 Loosen the set screw on the compression nut.

2.2.2 Pull apart the compression cap from the compression nut.

2.2.3 Slide the lamp out approximately 2 inches from the compression nut.

2.2.4 Remove the lamp connector from the lamp.

2.2.5 Carefully remove the lamp from the unit and place in a safe location.

2.2.6 Remove the compression nuts from both ends of the unit.

2.2.7 Remove the O-rings on the quartz sleeve.

2.2.8 Carefully remove the quartz sleeve from the unit.

2.3 Inspection and Cleaning

2.3.1 Inspect the sleeve for signs of damage. Replace the sleeve if damage is observed.

2.3.2 Spray the exterior of the sleeve with detergent spray down its entire length.

2.3.3 Wipe down the exterior of the sleeve with a lint-free cloth.

Note: do not use any abrasive materials on the sleeve as this can damage it.

2.3.4 Spray the exterior of the sleeve with distilled water down its entire length.

2.3.5 Wipe down the exterior of the sleeve with a lint-free cloth.

Note: do not use any abrasive materials on the sleeve as this can damage it.

2.3.6 Inspect the sleeve for any residual stains or buildup. If the sleeve still shows signs of buildup, repeat Steps 2.3.2 through 2.3.5 until the sleeve is clean.

2.4 Unit Reassembly

Note: Refer to photo in Section 3.2 to identify components.

2.4.1 Place the sleeve back in the UV housing. The sleeve should be positioned so that it is centered in the housing and the portions visible at either end of the unit are approximately equal.

Note: if the sleeve is not centered in the housing, the O-rings will not seat properly and the sleeve may be damaged when reattaching the compression nuts.

2.4.2 Replace the O-rings at each end of the sleeve.

2.4.3 Replace both compression nuts.

2.4.4 Reattach the lamp to the lamp connector.

2.4.5 Carefully reinsert the lamp into the sleeve at the top of the unit.

2.4.6 Replace the compression cap.

2.4.7 Tighten the set screw on the compression cap.

2.5 System Restart

Note: Refer to photo in Section 3.1 to identify components.

2.5.1 Replace the unit in the enclosure and reattach the threaded union connectors.

2.5.2 Open the upstream and downstream isolation valves.

2.5.3 Close the bypass valve.

2.5.4 Reconnect power to the unit.

2.5.5 Check the operation of the unit at the monitor to verify output and transmittance have returned to normal ranges.

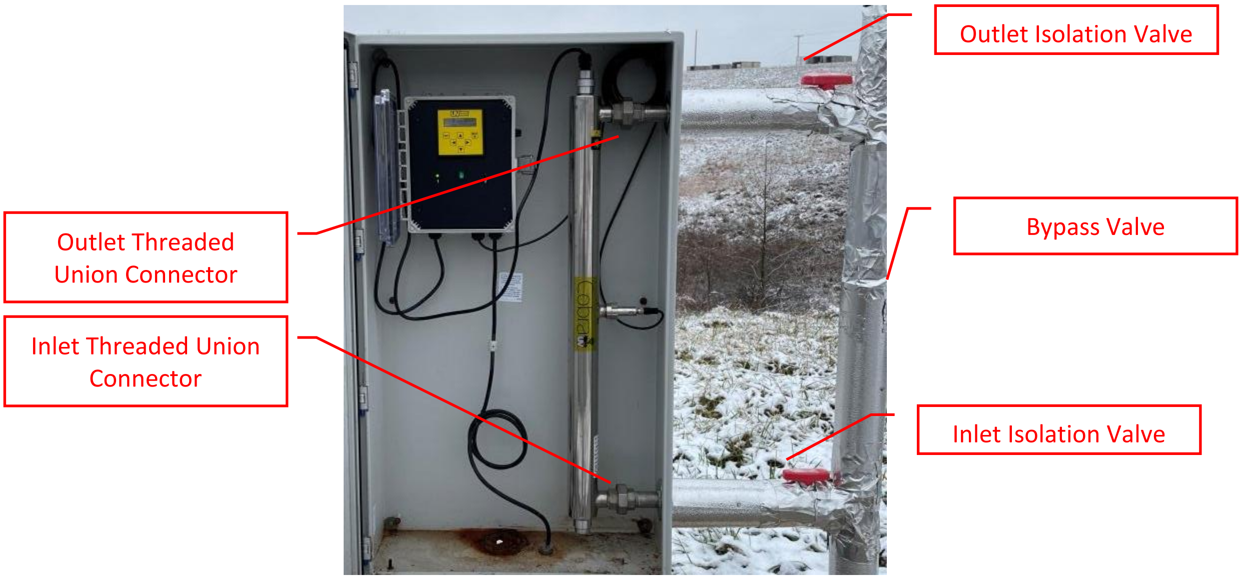
Wastewater Treatment Plant

Category		Procedure#	Rev.#
Procedure		010-003	A

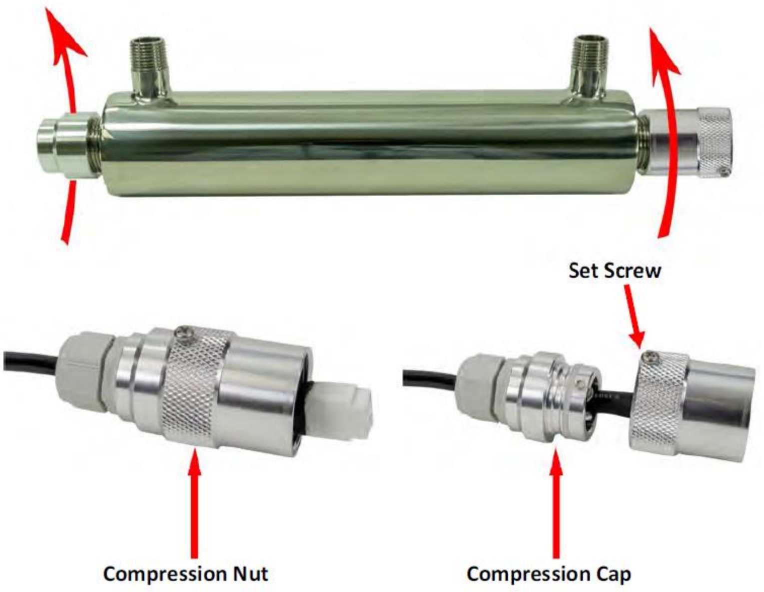
Subject
Outfall 010 UV System Cleaning

3.0 Photos

3.1 UV System Isolation and Restart



3.2 UV System Disassembly and Reassembly



Wastewater Treatment Plant

Category		Procedure#	Rev.#
Procedure		010-004	A
Subject Outfall 010 WWTP MicroC Feed Pump Drawdown and Calibration			

SCOPE

This procedure provides the instructions for performing a drawdown test on the MicroC Feed Pump (P-46-06) to confirm or adjust the chemical addition rate.

RELEVANT DOCUMENTS

Drawing #APS-US-RD-0026-40 – Austin Powder Company Outfall 010 WWTP Modifications Preliminary Layout Plan View, Rev C (SLR, August 2021).

Austin Powder Company Operations Manual – Outfall 010 WWTP (SLR, December 2020)

Pulsafeeder Series MP Pump Manual

Ohio Environmental Protection Agency National (EPA) Pollutant Discharge Elimination System (NPDES) Permit number #OIF00003*GD

Troubleshooting Guides for Outfall 010 WWTP (Outfall 010 WWTP Operations Manual, Appendix H)

Austin Powder Co. Healthy and Safety Plan (HASP)

COMMUNICATIONS

Refer to site HASP

MATERIALS AND EQUIPMENT

The following special materials and equipment are typically required to perform this procedure:

- Stopwatch

Approved	Approval Date	Supersedes	Page
Lauren Biggs	12/9/2021	N/A	1 of 6

SAFETY AND HEALTH

This is a Safety and Health Critical Procedure.

PPE: Gloves and safety glasses, and site-appropriate footwear are required at all times. When handling chemicals, chemical-resistant gloves, apron and a face shield are required.

WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals**.**

ENVIRONMENT

This is an Environmentally Critical Procedure. Do not delete this procedure without comparable environmental controls in place.

PROCESS DESCRIPTION

MicroC is a chemical additive to the Aeration Tank (T-42) to provide a supplemental carbon source for the biomass to optimize treatment efficiencies and pollutant removal. A target feed rate in gallons per hour (gph) is set at the MicroC Feed Pump (P-46-06) by adjusting the stroke length on the pump.

A calibration / drawdown column is installed on the suction side of this chemical feed pump to periodically check the actual chemical feed rate of the MicroC Feed Pump (P-46-06) to ensure the target feed rate is being maintained. If needed, Operators can then adjust the stroke length on the pump accordingly to meet the target feed rate.

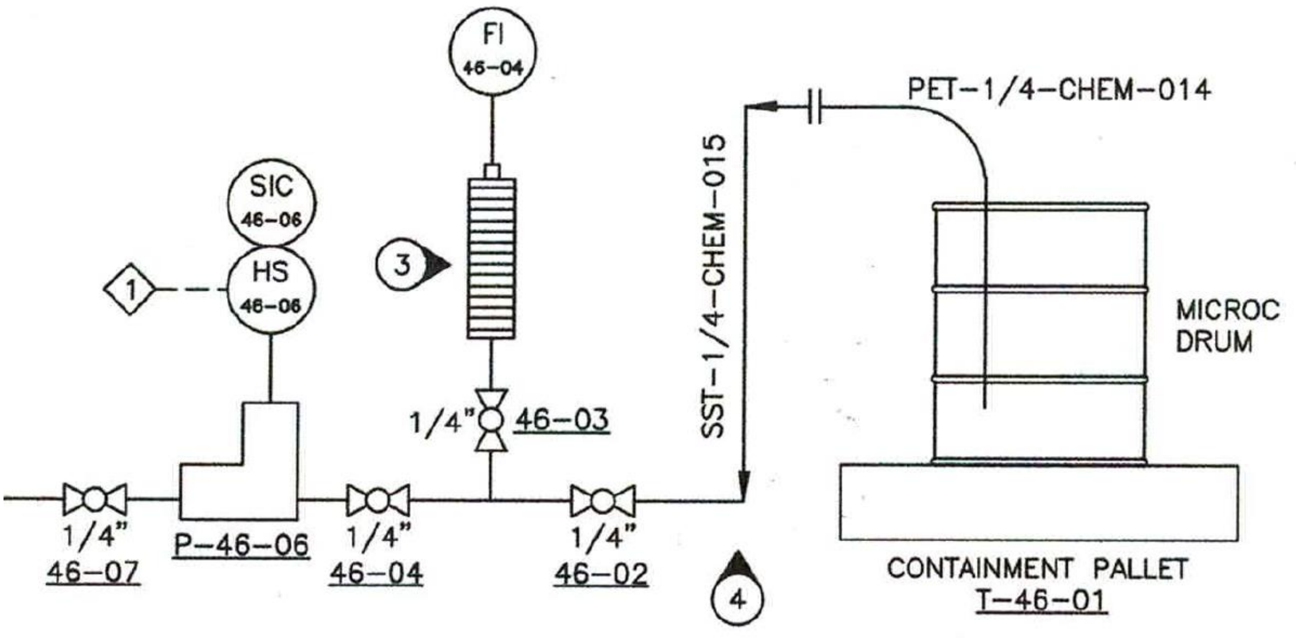


Figure 1. Outfall 010 MicroC Addition System

Wastewater Treatment Plant

Category **Procedure**		Procedure# 010-004	Rev.# A
Subject Outfall 010 WWTP MicroC Feed Pump Drawdown and Calibration			

PROCEDURE

1.0 Don PPE.

WARNING

Failure to wear proper protective equipment can result in personal injury.

Always follow site safety protocol for PPE.

1.1 Wear proper PPE: Gloves, safety glasses, and appropriate footwear.

2.0 Drawdown Test

NOTE: This section covers the necessary steps for performing a drawdown test on MicroC Feed Pump (P-46-06) to determine chemical feed rate. See Figure 1 for reference. A stopwatch is required to perform this procedure.

2.1 Line Up Valves for Drawdown Test

2.1.1 Using the local Hand Switch (HS-46-06), place the MicroC Feed Pump (P-46-06) in the OFF position.

2.1.2 Close ¼” valve 46-04 between Calibration Column (FI-46-04) and MicroC Feed Pump (P-46-06).

2.1.3 Slowly open ¼” valve 46-03 at the base of Calibration Column (FI-46-04).

Note: The Calibration Column (FI-46-04) will begin filling with chemical.

2.1.4 When the MicroC chemical level reaches the “0” mark at the top of the graduations, close ¼” valve 46-03.

2.1.5 Close ¼” valve 46-02 between Calibration Column (FI-06-04) and the MicroC chemical drum.

2.1.6 Fully open ¼” valve 46-03 at the base of the Calibration Column (FI-46-04) to begin the drawdown test.

2.1.7 Open ¼” valve 46-04 between Calibration Column (FI-46-04) and MicroC Feed Pump (P-46-06).

2.2 *Chemical Drawdown Test*

2.2.1 Verify ¼” valve 46-07 between MicroC Feed Pump (P-46-06) and Aeration Tank (T-42) is fully open.

2.2.2 Using the local Hand Switch (HS-46-06), place MicroC Feed Pump (P-46-06) in the ON position.

2.2.3 Immediately start stopwatch.

2.2.4 Verify chemical is being pumped (drawn down) from the Calibration Column (FI-46-04).

2.2.5 Allow chemical to be pumped for exactly **one minute**.

2.2.6 After one minute, use the local Hand Switch (HS-46-06) to place the MicroC Feed Pump (P-46-06) in the OFF position.

2.2.7 Read the chemical level in the Calibration Column (FI-46-04) on the right side to obtain the feed rate in gph.

2.2.8 Once the chemical feed rate has been recorded, use the stroke adjustment dial on MicroC Feed Pump (P-46-06) to increase or decrease the chemical feed rate as necessary.

Note: Repeat Steps 2.1.2 through 2.2.8 as needed to confirm feed rate after any pump adjustments to verify target rate is met.

2.2.9 Once the MicroC feed rate has been confirmed / adjusted, use the local Hand Switch (HS-46-06) to place the MicroC Feed Pump (P-46-06) in the ON position to fully empty the Calibration Column (FI-06-04).

2.2.10 After the Calibration Column (FI-06-04) has been emptied of chemical, place MicroC Feed Pump (P-46-06) back in the OFF position using local Hand Switch (HS-46-06).

2.3 Line Up Valves to Return to Normal Operations

2.3.1 Close ¼” valve 46-03 at the base of the Calibration Column (FI-06-04).

2.3.2 Open ¼” valve 46-02 between Calibration Column (FI-06-04) and the MicroC chemical drum.

2.3.3 Verify ¼” valve 46-04 between Calibration Column (FI-46-04) and MicroC Feed Pump (P-46-06) is fully open.

2.3.4 Verify ¼” valve 46-07 between MicroC Feed Pump (P-46-06) and Aeration Tank (T-42) is fully open.

2.3.5 Using the local Hand Switch (HS-46-06), place MicroC Feed Pump (P-46-06) in the ON position.

Note: This will return the MicroC addition system to normal operational status.

2.3.4 Verify chemical is being delivered, and the system is free of leaks.

Note: If any system leaks develop, they will typically be found at tubing or piping connections and valves.

UNIT STANDARD OPERATING PROCEDURE

TITLE: ALKALINITY ANALYSIS (TITRATION METHOD)

References:	1. *Standard Methods for the Examination of Water and Wastewater*, Method 2320 B, approved 2011.
Purpose:	To determine the amount of alkalinity in process wastewater samples in order to evaluate the performance of the Wastewater Treatment Plant (WWTP) and ensure compliance with NPDES Permit discharge limits.
Scope:	This method determines the concentration of alkalinity in process wastewater as $CaCO_3$ from 0 to 5,000 mg/L.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

DATE	REVIEWED/APPROVED	DATE	QUALITY APPROVED
7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	Date	APC Employee Name	APC Employee Title

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of samples after analysis.

EQUIPMENT AND REAGENTS

1. pH meter (if performing secondary method);
2. Graduated burette and stand;
3. Magnetic stir plate and stir bar;
4. Sample container (200-250 mL beaker);
5. Graduated cylinder, 50mL;
6. Titrant – 0.02 N sulfuric acid (H_2SO_4); and
7. BGMR (Bromocresol green-methyl red) indicator powder pillows.

PROCEDURE

1. Collect samples, reagents, and supplies for analysis.

2. If necessary, add 0.02N H_2SO_4 to the burette so that the meniscus is at the 0 mL mark.

Total Alkalinity (using color indicator) – Primary Method

1. Measure 50 mL of sample into graduated cylinder and transfer to sample container. If diluting, use appropriate amount of sample, then bring to 50mL with DI water. Sample temperature should be 25 ± 5 °C.

2. Place beaker on magnetic stirrer with stir bar in place.

3. Add one powder pillow of Bromocresol Green-Methyl Red Indicator.

4. Stir sample until indicator is dissolved.

5. Titrate (add 0.02N H_2SO_4 from the burette in small increments) to the colorimetric endpoint of purple gray to light pink (pH 4.5 s.u.) As the color begins to change, the rate of acid addition should be decreased.

6. Once the colorimetric endpoint has been reached, record the total volume of acid added. Record to the nearest 0.1 mL marking on the burette, using the bottom of the meniscus as the point of measurement.

Total Alkalinity (using pH probe to measure pH 4.5 endpoint) – Secondary Method

1. Measure 50 mL of sample into graduated cylinder and transfer to sample container. If diluting, use appropriate amount of sample, then bring to 50 mL with DI water. Sample temperature should be 25 ± 5 °C.

2. Place beaker on magnetic stirrer with stir bar in place.

3. While stirring, place pH probe in sample. Do not allow probe to collide with stir bar.

4. Measure pH and record. If the initial pH is < 4.5 s.u., the total alkalinity is recorded as zero.

5. Titrate (add 0.02N H_2SO_4 from the burette in small increments) until the pH of the sample stabilizes at 4.5 s.u.

6. Once the pH has stabilized at 4.5 s.u., record the total volume of acid added. Record to the nearest 0.1 mL marking on the burette, using the bottom of the meniscus as the point of measurement.

INTERFERENCES

1. Soaps, oily materials, suspended solids, or precipitates may coat the pH electrode and cause a delayed reading. Ensure the electrode has time to come to equilibrium between titrant additions.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Reading, Dilution Factor, Result, and Analyst Initials on the WWTP Alkalinity Laboratory Analysis Worksheet.

2. Calculate the Total Alkalinity of the sample using the equation below. For a sample volume of 50 mL and acid strength of 0.02N, the Total Alkalinity will be [20 x Volume Acid Added, mL]:

$$Alkalinity = \frac{50{,}000\ \times Volume\ Acid\ Added, mL\ \times Acid\ Strength, N}{Sample\ Volume, mL}$$

3. Transfer results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – Alkalinity

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

PARAMETER: **TOTAL ALKALINITY**
METHOD: **HACH 8221**

Multiplier = 50,000 x (Acid Strength, N) / (Sample Volume, mL)
Result = (Volume Added, mL) x (Multiplier)

SAMPLE NO.	SAMPLE NAME	DATE	TIME	SAMPLE VOLUME (mL)	ACID STRENGTH (N)	INITIAL VOLUME (mL)	FINAL VOLUME (mL)	VOLUME ADDED (mL)	MULTI-PLIER	RESULT	UNITS	ANALYST INITIALS
1									x		mg/L $CaCO_3$	
2									x		mg/L $CaCO_3$	
3									x		mg/L $CaCO_3$	
4									x		mg/L $CaCO_3$	
5									x		mg/L $CaCO_3$	
6									x		mg/L $CaCO_3$	
7									x		mg/L $CaCO_3$	
8									x		mg/L $CaCO_3$	
9									x		mg/L $CaCO_3$	
10									x		mg/L $CaCO_3$	
11									x		mg/L $CaCO_3$	
12									x		mg/L $CaCO_3$	
13									x		mg/L $CaCO_3$	
14									x		mg/L $CaCO_3$	
15									x		mg/L $CaCO_3$	
16									x		mg/L $CaCO_3$	
17									x		mg/L $CaCO_3$	
18									x		mg/L $CaCO_3$	
19									x		mg/L $CaCO_3$	
20									x		mg/L $CaCO_3$	

UNIT STANDARD OPERATING PROCEDURE

TITLE: AMMONIA NITROGEN ANALYSIS (HACH TNT METHOD)

References:	1. Hach Water Analysis Handbook, DOC316.53.01083 Method 10205 TNTplus 832 2. Hach Water Analysis Handbook, DOC316.53.01081 Method 10205 TNTplus 830
Purpose:	To determine the amount of Ammonia Nitrogen in process wastewater samples in order to evaluate the performance of the Wastewater Treatment Plant (WWTP) and ensure compliance with NPDES Permit discharge limits.
Scope:	This method determines the concentration of Ammonia in process wastewater from 0.015 to 2.00 mg/L (Method 830) or 2 to 47 mg/L (Method 832).
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

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7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	Date	APC Employee Name	APC Employee Title

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of all spent test vials.

EQUIPMENT AND REAGENTS

1. Hach DR3900 Spectrophotometer;
2. Light Shield LZV849 for Hach DR3900;
3. Pipettor, 0.1-1.0 mL with disposable tips;
4. Pipettor, 1.0-10.0 mL with disposable tips;
5. Ammonia standard solution, 10 mg/L;
6. Ammonia Nitrogen TNTplus ULR reagent set (Method 830);
7. Ammonia Nitrogen TNTplus HR reagent set (Method 832);
8. Deionized (DI) water for preparation of reagent blank and dilutions as needed; and
9. Kimwipes

PROCEDURE

1. Collect samples, reagents, and supplies for analysis.

2. Turn on the DR3900 spectrophotometer.

3. Install the LZV849 light shield in Cell Compartment #2.

4. For samples where the expected ammonia nitrogen (NH_3-N) is below 2.0 mg/L, use Method 830. For standard verification and samples where the expected NH_3-N concentration is above 2.0 mg/L, use Method 832.

5. Carefully remove the foil lid from the DosiCap Zip cap, then remove the cap from the vial.

6. Pipet the appropriate volume of sample into the test vial:

   a. Method 830 – 5.0 mL using 1-10 mL pipettor
   b. Method 831 – 0.2 mL using 0.1-1.0 mL pipettor

7. Turn the DosiCap Zip cap over so that the reagent side goes into the test vial. Tighten the cap on the vial.

8. Shake the vial 2-3 times to dissolve the reagent in the cap. Look through the open end of the DosiCap to ensure that the reagent has dissolved.
9. Repeat Steps 5 to 8 above to prepare a reagent blank vial (using DI water as the sample) and a standard vial (using the ammonia standard solution as the sample).
10. Start a 15-minute reaction timer.
11. When the reaction time is complete, wipe each vial clean with a Kimwipe to remove any smudges or liquid on the vial surface.
12. Insert each vial into the cell holder on DR3900 spectrophotometer. The instrument will automatically select the appropriate method.
13. Confirm the results are reported in units of “mg/L NH_3-N.”
14. If samples report “Over Range,” rerun the sample at a dilution. Refer to procedure WWTP-200-001 on performing sample dilutions.

INTERFERENCES

1. Samples with extreme pH (< 4.0 s.u. or >8.0 s.u.) can give incorrect results. For samples with pH outside of this range, adjust pH with sulfuric acid or sodium hydroxide until the pH is within range.
2. Samples with high color or turbidity can produce false high readings. If samples are turbid or colored, prepare a sample blank for each colored/turbid sample and adjust results as follows:
    a. Prepare a vial with the colored/turbid sample but do NOT remove the foil from the vial cap.
    b. Analyze and record the result from this vial as the “SAMPLE BLANK.”
    c. Subtract the result of the “SAMPLE BLANK” from the result obtained for that sample to obtain the corrected sample concentration.
3. Refer to the Water Analysis Handbook methods for a list of other potential interfering substances. No interfering substances are expected in the WWTP samples.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Reading, Dilution Factor, Result, and Analyst Initials on the WWTP Ammonia Laboratory Analysis Worksheet.

2. Transfer results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – Ammonia Nitrogen (NH_3-N)

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

PARAMETER: **AMMONIA NITROGEN (NH3-N)**
METHOD: **HACH 10205**

SAMPLE NUMBER	SAMPLE NAME	DATE	TIME	READING	DILUTION FACTOR	RESULT	UNITS	ANALYST INITIALS
1					x		mg/L	
2					x		mg/L	
3					x		mg/L	
4					x		mg/L	
5					x		mg/L	
6					x		mg/L	
7					x		mg/L	
8					x		mg/L	
9					x		mg/L	
10					x		mg/L	
11					x		mg/L	
12					x		mg/L	
13					x		mg/L	
14					x		mg/L	
15					x		mg/L	
16					x		mg/L	
17					x		mg/L	
18					x		mg/L	
19					x		mg/L	
20					x		mg/L	
21					x		mg/L	
22					x		mg/L	
23					x		mg/L	
24					x		mg/L	
25					x		mg/L	
26					x		mg/L	
27					x		mg/L	
28					x		mg/L	
29					x		mg/L	
30					x		mg/L	

UNIT STANDARD OPERATING PROCEDURE

TITLE: CHEMICAL OXYGEN DEMAND (COD) ANALYSIS (HACH TNT METHOD)

References:	1. Hach Water Analysis Handbook, DOC312.53.94135 Method 822 (High Range)
Purpose:	To determine the amount of COD in process wastewater samples in order to evaluate the performance of the Wastewater Treatment Plant (WWTP).
Scope:	This method determines the concentration of COD in process wastewater from 20 to 1,500 mg/L.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

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7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of all spent test vials. COD vials contain sulfuric acid, hexavalent chromium, and mercury and must be disposed as hazardous waste.

EQUIPMENT AND REAGENTS

1. Pipettor, 1.0-10.0 mL with disposable tips;
2. Hach DR3900 spectrometer;
3. Hach DRB200 reactor block;
4. Hach COD TNTplus 822 (HR) vials;
5. COD standard solution (300 mg/L);
6. Deionized water (for preparation of sample blank); and
7. Permanent marker/Sharpie®

PROCEDURE

1. Samples should be adjusted to a neutral pH range (6-9 s.u.) before analysis.

2. Samples should be analyzed at a temperature between 15-25 °C.

3. Turn the DRB200 reactor on and start the heating cycle to 150 °C.

4. Write down the sample names on the next open lines on the Analysis Worksheet. Write the corresponding line numbers on the lids of the test vials.

5. Take a TNT vial and invert several times to mix.

6. Prepare a blank by carefully pipetting 2.0 mL of deionized water to a vial.

7. Prepeare each sample by carefully pipetting 2.0 mL of sample to sample vials.

8. Hold vial by the cap and invert gently several times over a sink to mix. Vials will get very hot during mixing.

9. Insert the vial into the preheated DRB200 reactor and close the lid.

10. Press “START” on the DRB200 reactor. A 2-hour timer will begin.

11. After 2 hours, remove the vials from the reactor. Hold each vial by its cap and invert gently several times.

12. Put the vial in a test tube rack and let sit until it reaches room temperature.

13. Clean vial with Kimwipe (remove smudges and liquid on surface of vial).

14. Insert vial into the DR3900. The analyer will scan the barcode and select the proper method automatically.

15. Results show in mg/L COD.

16. If samples report “Over Range,” rerun the sample at a dilution. Refer to procedure WWTP-200-001 on performing sample dilutions.

INTERFERENCES

1. The presence of high chloride could result in positive interference. The mercuric sulfate contained in the vials will eliminate this interference at chloride concentrations of up to 2,000 mg/L.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Reading, Dilution Factor, Result, and Analyst Initials on the WWTP COD Laboratory Analysis Worksheet.

2. Transfer results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – COD

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

PARAMETER: **CHEMICAL OXYGEN DEMAND (COD)**
METHOD: **HACH 8000**

SAMPLE NUMBER	SAMPLE NAME	DATE	TIME	READING	DILUTION FACTOR	RESULT	UNITS	ANALYST INITIALS
1					x		mg/L	
2					x		mg/L	
3					x		mg/L	
4					x		mg/L	
5					x		mg/L	
6					x		mg/L	
7					x		mg/L	
8					x		mg/L	
9					x		mg/L	
10					x		mg/L	
11					x		mg/L	
12					x		mg/L	
13					x		mg/L	
14					x		mg/L	
15					x		mg/L	
16					x		mg/L	
17					x		mg/L	
18					x		mg/L	
19					x		mg/L	
20					x		mg/L	
21					x		mg/L	
22					x		mg/L	
23					x		mg/L	
24					x		mg/L	
25					x		mg/L	
26					x		mg/L	
27					x		mg/L	
28					x		mg/L	
29					x		mg/L	
30					x		mg/L	

UNIT STANDARD OPERATING PROCEDURE

TITLE: NITRATE ANALYSIS (HACH TNT METHOD)

References:

1. Hach Water Analysis Handbook, DOC312.53.94138 (Method 10206)
2. Hach Water Analysis Handbook, DOC312.53.94139 (Method 10206)

Purpose:

To determine the amount of nitrate nitrogen (NO_3-N) in process wastewater samples in order to evaluate the performance of the Wastewater Treatment Plant (WWTP).

Scope:

This method determines the concentration of nitrate in process wastewater from 0.23 to 35 mg/L as NO_3-N (1.0 to 155 mg/L as NO_3). Samples above range can be diluted.

Responsibilities:

WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.

Prepared by: Callan Driscoll

VERSION: 1 REVISION DATE: July 23, 2020

DATE	REVIEWED/APPROVED	DATE	QUALITY APPROVED
7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	Date	APC Employee Name	APC Employee Title

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of all spent test vials.

EQUIPMENT AND REAGENTS

1. Hach DR3900 spectrometer;
2. Pipettor, 0.1-1.0 mL with disposable tips;
3. Hach Nitrate TNTplus 835 vials and reagents;
4. Hach Nitrate TNTplus 836 vials and reagents;
5. Nitrate standard solution, 10.0 mg/L as NO_3-N; and
6. Deionized (DI) water to be used as sample blank

PROCEDURE

1. This protocol is based on Hach Company TNTplus reagent set procedures which follows Standard Methods chemistry.

2. Samples should be adjusted to a pH range of 3-10 s.u.

3. If samples are expected to contain greater than 13.5 mg/L as NO_3-N, use the TNTplus 836 vials for analysis. If samples are expected to contain greater than 35 mg/L as NO_3-N, dilute the samples according to SOP WWTP-200-001.

4. Samples should be analyzed a temperature between 15-25°C.

5. Turn on the DR3900 spectrophotometer.

6. For the Low Range (835) analysis, pipet 1.0 mL of sample into the reagent vial. For the High Range (836) analysis, pipet 0.2 mL of sample into the reagent vial.

7. Pipet 0.2 mL of Solution A into the reagent vial.

8. Cap and invert the reaction tube 2-3 times until no more streaks can be seen in the reaction tube solution.

9. Let the vial sit for 15 minutes.
10. Clean vial with Kimwipe (remove smudges and liquid on surface of vial).
11. Insert vial into the DR3900, it will scan the barcode and select the proper method automatically.
12. Results are reported as mg/L NO_3-N.
13. If samples report “Over Range,” rerun the sample at a dilution. Refer to procedure WWTP-200-001 on performing sample dilutions.

INTERFERENCES

1. Nitrite concentrations > 2.0 mg/L produce high bias; samples can be treated with sulfamic acid to correct this.
2. High levels of oxidizable carbon compounds cause the reagents to change color and give high bias results. If the chemical oxygen demand (COD) is ≥ 500 mg/L, the test results will have high bias.
3. See section 3.0 Interferences in the referenced Hach Method 10206 for a complete list.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Reading, Dilution Factor, Result, and Analyst Initials on the WWTP Nitrate Laboratory Analysis Worksheet.
2. Transfer results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – Nitrate

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

PARAMETER: **NITRATE NITROGEN (NO3-N)**
METHOD: **HACH 10206**

SAMPLE NUMBER	SAMPLE NAME	DATE	TIME	READING	DILUTION FACTOR	RESULT	UNITS	ANALYST INITIALS
1					x		mg/L	
2					x		mg/L	
3					x		mg/L	
4					x		mg/L	
5					x		mg/L	
6					x		mg/L	
7					x		mg/L	
8					x		mg/L	
9					x		mg/L	
10					x		mg/L	
11					x		mg/L	
12					x		mg/L	
13					x		mg/L	
14					x		mg/L	
15					x		mg/L	
16					x		mg/L	
17					x		mg/L	
18					x		mg/L	
19					x		mg/L	
20					x		mg/L	
21					x		mg/L	
22					x		mg/L	
23					x		mg/L	
24					x		mg/L	
25					x		mg/L	
26					x		mg/L	
27					x		mg/L	
28					x		mg/L	
29					x		mg/L	
30					x		mg/L	

UNIT STANDARD OPERATING PROCEDURE

TITLE: NITRITE ANALYSIS (HACH TNT METHOD)

References:	1. Hach Company TNTplus 839 Method 10207
Purpose:	To determine the amount of nitrite in process wastewater samples in order to evaluate the performance of the Wastewater Treatment Plant (WWTP).
Scope:	This method determines the concentration of nitrite in process wastewater from 0.01 to 0.600 mg/L. Samples above range can be diluted.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

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7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	Date	APC Employee Name	APC Employee Title

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of all spent test vials.

EQUIPMENT AND REAGENTS

1. Hach DR3900 spectrometer;
2. Pipettor, 1.0-10.0 mL with disposable tips;
3. Hach Nitrite TNTplus 839 vials;
4. Deionized (DI) water for preparation of sample blank and dilutions as needed;
5. Stopwatch/timer; and
6. Kimwipes.

PROCEDURE

1. This protocol is based on Hach Company TNTplus reagent set procedures which follows Standard Methods chemistry.

2. Samples should be adjusted to a pH range of 3-10 s.u.

3. Samples should be analyzed at a temperature between 15-25 °C.

4. Remove foil from TNTplus vial lid.

5. Pipet 2.0 mL of sample into the vial.

6. Cap the vial with the reagent powder side inside the vial (fluting at the top).

7. Shake the vial vigorously until the reagent powder dissolves completely.

8. Start a 10-minute reaction timer.

9. Clean vial with Kimwipe (remove smudges and liquid on surface of vial)

10. Insert vial into the DR3900, it will scan the barcode and select the proper method automatically.

11. Results can be reported as mg/L NO_2-N or NO_2.

INTERFERENCES

1. See referenced Hach Method 10207, “Interferences” for complete tables of known interferences.

2. Chemical oxygen demand (COD) higher than 500 mg/L will interfere. If the analyzed sample is expected to contain high COD, perform analysis on a diluted sample to reduce the COD below 500 mg/L.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Reading, Dilution Factor, Result, and Analyst Initials on the WWTP Nitrite Laboratory Analysis Worksheet.

2. Transfer results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – Nitrite

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

PARAMETER: **NITRITE NITROGEN (NO_2-N)**
METHOD: **HACH 10207**

SAMPLE NUMBER	SAMPLE NAME	DATE	TIME	READING	DILUTION FACTOR	RESULT	UNITS	ANALYST INITIALS
1					x		mg/L	
2					x		mg/L	
3					x		mg/L	
4					x		mg/L	
5					x		mg/L	
6					x		mg/L	
7					x		mg/L	
8					x		mg/L	
9					x		mg/L	
10					x		mg/L	
11					x		mg/L	
12					x		mg/L	
13					x		mg/L	
14					x		mg/L	
15					x		mg/L	
16					x		mg/L	
17					x		mg/L	
18					x		mg/L	
19					x		mg/L	
20					x		mg/L	
21					x		mg/L	
22					x		mg/L	
23					x		mg/L	
24					x		mg/L	
25					x		mg/L	
26					x		mg/L	
27					x		mg/L	
28					x		mg/L	
29					x		mg/L	
30					x		mg/L	

UNIT STANDARD OPERATING PROCEDURE

TITLE: PHOSPHOROUS ANALYSIS (HACH TNT METHOD)

References:	1. Hach Water Analysis Handbook, DOC312.53.94142 (Method 10209/10210)
Purpose:	To determine the amount of orthophosphate in process wastewater samples in order to evaluate the performance of the Wastewater Treatment Plant (WWTP) and ensure compliance with NPDES Permit discharge limits.
Scope:	This method determines the concentration of reactive phosphorus (orthophosphate) in process wastewater from 0.05 to 1.50 mg/L as PO_4-P (0.15 to 4.50 mg/L as PO_4^{3-}). Samples above range can be diluted.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

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7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	Date	APC Employee Name	APC Employee Title

PROCEDURE

HEALTH AND SAFETY

1) Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2) WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3) Properly dispose of all spent test vials.

EQUIPMENT AND REAGENTS

1. Hach DR3900 spectrophotometer;
2. Pipettor, 1.0-10.0 mL with disposable tips;
3. Hach TNTplus 843 vials and reagents;
4. Phosphate standard solution, 3.0 mg/L as PO_4^{3-};
5. Deionized (DI) water for preparation of reagent blank and dilutions as needed; and,
6. Kimwipes

PROCEDURE

1. Remove cap from a TNTplus vial.

2. Pipet 2.0 mL of sample into the vial.

3. Pipet 0.2 mL of Reagent B into the vial. Close Reagent B immediately after use.

4. Screw a gray DosiCap C onto the vial and invert several times to ensure that all of the reagent is completely dissolved.

5. Start a 10-minute reaction timer.

6. Invert the vial 2-3 additional times then wipe the vial clean with a Kimwipe.

7. Insert the vial into the DR3900 and record results. Apply any dilution factors.

8. Results can be displayed as “mg/L PO_4,” “mg/L P_2O_5,” or “mg/L PO_4-P .” Results should be recorded as “mg/L PO_4-P.”

9. If samples report “Over Range,” rerun the sample at a dilution. Refer to procedure WWTP-200-001 on performing sample dilutions.

INTERFERENCES

1. See the “Interferences” section of the referenced Hach method for known interferences. Normal WWTP process samples are not expected to contain known interferences.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Reading, Dilution Factor, Result, and Analyst Initials on the WWTP Phosphorous Laboratory Analysis Worksheet.

2. Transcribe results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – Orthophosphate

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

Note: Ensure Hach is reporting results as PO4-P, NOT as PO4

PARAMETER: ORTHOPHOSPHATE (PO4-P)
METHOD: HACH 10209/10210

SAMPLE NUMBER	SAMPLE NAME	DATE	TIME	READING	DILUTION FACTOR	RESULT	UNITS	ANALYST INITIALS
1					x		mg/L	
2					x		mg/L	
3					x		mg/L	
4					x		mg/L	
5					x		mg/L	
6					x		mg/L	
7					x		mg/L	
8					x		mg/L	
9					x		mg/L	
10					x		mg/L	
11					x		mg/L	
12					x		mg/L	
13					x		mg/L	
14					x		mg/L	
15					x		mg/L	
16					x		mg/L	
17					x		mg/L	
18					x		mg/L	
19					x		mg/L	
20					x		mg/L	
21					x		mg/L	
22					x		mg/L	
23					x		mg/L	
24					x		mg/L	
25					x		mg/L	
26					x		mg/L	
27					x		mg/L	
28					x		mg/L	
29					x		mg/L	
30					x		mg/L	

UNIT STANDARD OPERATING PROCEDURE

TITLE: SSV AND SVI ANALYSIS

References:	1. *Standard Methods for the Examination of Water and Wastewater*, Methods 2710C and 2710D, approved 2017.
Purpose:	To quantify the rate and extent of biomass settling and compaction, through Settled Sludge Volume (SSV) and Sludge Volume Index (SVI) in activated sludge samples in order to evaluate the performance of the Wastewater Water Treatment Plant (WWTP).
Scope:	This method is applicable to process waters.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

DATE	REVIEWED/APPROVED	DATE	QUALITY APPROVED
7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1) Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2) WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3) Properly dispose of samples.

EQUIPMENT AND REAGENTS

1. Settleometer, 1,000 mL with 10 mL graduations; and
2. Stopwatch/timer

PROCEDURE

1. Collect a representative sample of the Aeration Basin mixed liquor (at least 1 L).

2. Shake or mix the sample and immediately pour 1 L of the sample into the settleometer.

3. Immediately start the stopwatch or 30-minute timer. DO NOT disturb the sample once the test is initiated.

4. Record the final volume of sludge once the timer sounds or the stopwatch reaches 30 minutes. This is the 30 minute Settled Sludge Volume (SSV_{30}) with units of mL/L.

5. Dispose of the sample in the Dewatering Sump.

6. Obtain the most recent TSS/MLSS result for the analyzed sample.

7. Calculate the Sludge Volume Index (SVI) for the sample per the equation below.

$$SVI, \frac{mL}{g} = \frac{SSV, \frac{mL}{L} \times 1{,}000}{MLSS, \frac{mg}{L}}$$

RECORDKEEPING

1. Record the Sample ID, Sample Date/Time, all measurements/ calculations, Analyst Initials on the SSV and SVI Laboratory Analysis Worksheet.

2. Transfer results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – SSV and SVI

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

SSV_{30} = 30-min volume
SVI = SSV_{30} x 1,000 / MLSS

PARAMETER: SSV_{30}, SVI
METHOD: ____________

SAMPLE NUMBER	SAMPLE NAME	DATE	TIME	30-MIN VOLUME	MLSS mg/L	SVI mL/g	ANALYST INITIALS
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
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23							
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25							
26							
27							
28							
29							
30							

UNIT STANDARD OPERATING PROCEDURE

TITLE: TSS & VSS ANALYSIS

References:	1. *Standard Methods for the Examination of Water and Wastewater, Method 2320 B, approved 2011.*
Purpose:	To quantify results at Total Suspended Solids (TSS) & Volatile Suspended Solids (VSS) in Wastewater Treatment Plant (WWTP) process samples.
Scope:	This method is applicable to process waters.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION: 1 REVISION DATE: July 23, 2020

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7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1) Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2) Heat-resistant gloves must be worn when transferring tins into or out of the muffle furnace.

3) WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

4) Properly dispose of used filter papers.

EQUIPMENT AND REAGENTS

1. Drying oven (adjustable from 100 to 180 °C);
2. Muffle furnace (set at 550 °C);
3. Vacuum filtration apparatus (vacuum pump, vacuum flask);
4. Filter funnel;
5. Analytical balance;
6. Whatman 934-AH, 45 mm glass fiber filters;
7. Aluminum weigh tins;
8. Graduated cylinder or adjustable pipettor with disposable tips;
9. Desiccator;
10. Tweezers;
11. Tongs;
12. Heat-resistant gloves; and
13. Deionized (DI) water

PROCEDURE

Preparation of Sample Tins

1. Place a filter paper on the filter funnel, apply vacuum, and wash the filter paper with three successive 20-mL portions of DI water.

2. Continue suction to remove all traces of water, turn off vacuum, and discard washings.

3. Prepare tins by gently scoring letters or numbers into the bottoms of the tins to allow for later identification.

4. Transfer washed filter papers to aluminum weighing tins and place in the drying oven at 103 to 105 °C for a minimum of one hour.

5. After drying, remove the tins from the oven and store in the desiccator until needed.

Sample Analysis – Total Suspended Solids

1. Assemble vacuum filtration apparatus.

2. Remove prepared tin from the desiccator and weigh on the analytical balance. Record this weight as "INITIAL WEIGHT (A)" on the Laboratory Analysis Worksheet.

3. Using tweezers, remove the filter paper from the tin and place on the filter flask.

4. Attach the filter funnel to the top of the flask.

5. Wet filter with small volume of DI water.

6. Stir sample thoroughly.

7. While stirring, pipet a measured volume onto the seated glass fiber filter. If larger samples are required, pour a measured volume from a graduated cylinder onto the seated glass fiber filter. Refer to the table below for recommended sample volumes at different sampling locations.

Sample Location	Expected TSS	Recommended Sample Volume
Influent (EQ Tanks)	< 100 mg/L	20-50 mL
Bioreactors	1,500-4,000 mg/L	5-10 mL
Effluent	< 50 mg/L	50-100 mL

8. If complete filtration takes longer than ten minutes, restart with a new sample tin and decrease sample volume.

9. Record volume used for each sample on the Laboratory Analysis Worksheet.

10. Wash filters with three successive 10-mL volumes of DI water, allowing complete drainage between washings and continue suction for at least three minutes after last washing is complete.

11. NOTE: Samples with high dissolved solids may require additional washings. This is not required for typical WWTP process samples.

12. Carefully remove filter from filtration apparatus using tweezers and return to aluminum weighing dish as a support.

13. Place in oven and dry for at least one hour at 103 to 105 °C.

14. Remove tins from oven and cool in desiccator to room temperature (10-15 minutes).

15. Weigh each tin on the analytical balance. Record this weight as "POST-OVEN WEIGHT (B)" on the Laboratory Analysis Worksheet.

16. If the balance will not stabilize, allow tin to cool for an additional 5 minutes and repeat Step 15 until a constant weight is obtained or until the weight change is less than 4 percent of the previous weight or 0.5 mg, whichever is less.

Sample Analysis – Volatile Suspended Solids

17. Don heat-resistant gloves.

18. Using tongs, place the weighed filter and aluminum tin from Step 15 into the muffle furnace and ignite at 550 °C for 15 minutes.

19. Remove tins from furnace and cool in desiccator to room temperature (15-20 minutes).

20. Weigh each tin on the analytical balance. Record this weight as "POST-FURNACE WEIGHT (C)" on the Laboratory Analysis Worksheet.

21. If the balance will not stabilize, allow tin to cool for an additional 5 minutes and repeat Step 20 until a constant weight is obtained or until the weight change is less than 4 percent of the previous weight or 0.5 mg, whichever is less.

22. Calculate the TSS and VSS of samples according to the following equations:

$$TSS, mg/L = [Post\ Oven\ Weight\ (B), g - Initial\ Weight\ (A), g] \times \frac{1{,}000{,}000}{Sample\ Volume, mL}$$

$$VSS, mg/L = [Post\ Oven\ Weight\ (B), g - Post\ Furnace\ Weight\ (C), g] \times \frac{1{,}000{,}000}{Sample\ Volume, mL}$$

INTERFERENCES

1. For the best accuracy, use as much filtered sample as possible (Step 7). Samples that contain more than 15 mg of solids will clog the fiber filter disc. Adjust the volume of the

water sample as necessary to get accurate results. Some completed tests will show if adjustments are necessary.

2. Moisture from fingers can add moisture to the fiber filter disc and cause a weighing error. Always use tweezers when handling filter papers and tongs when handling tins.

RECORDKEEPING

1. Record the Sample Name, Date, Time, Sample Volume, all Weights, TSS, VSS, and Analyst Initials on the TSS & VSS Laboratory Analysis Worksheet.

2. Transcribe results from the Laboratory Analysis Worksheet to the prescribed electronic spreadsheet.

ATTACHMENTS

1. Laboratory Analysis Worksheet – TSS and VSS

LABORATORY ANALYSIS WORKSHEET
AUSTIN POWDER -MCARTHUR, OHIO

PARAMETER: **TOTAL + VOLATILE SUSPENDED SOLIDS**
METHOD: **HACH 8158**

Weight (A) = tin + filter paper before sample addition
Weight (B) = tin + filter + sample after drying in 105 °C oven
Weight (C) = tin + filter + sample after firing in 550 °C furnace

TSS = [(B) - (A)] x 1,000,000 / (Sample Vol., mL)
VSS = [(B) - (C)] x 1,000,000 / (Sample Vol., mL)

SAMPLE #	TIN #	SAMPLE NAME	DATE	TIME	SAMPLE VOL., mL	INITIAL WEIGHT (A), g	POST-OVEN WEIGHT (B), g	POST-FURNACE WEIGHT (C), g	TSS mg/L	VSS mg/L	ANALYST INITIALS
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

UNIT STANDARD OPERATING PROCEDURE

TITLE: pH METER CALIBRATION AND MEASUREMENT

References:	1. *User Manual – Refillable pH Probe: Model PHC 30101 or 30103*. HACH Document No. DOC022.53.80032
Purpose:	To perform routine calibration of the laboratory pH probe and ensure accurate pH measurement of WWTP samples.
Scope:	This procedure provides instructions on proper calibration of the PHC301 pH probe and the HQ40d multimeter, and instructions on measuring pH of WWTP process samples.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Todd Lusk

VERSION:	1	REVISION DATE:	August 24, 2020

DATE	REVIEWED/APPROVED	DATE	QUALITY APPROVED
8/24/2020	Jeff Naumoff		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of samples after analysis.

EQUIPMENT AND REAGENTS

1. HACH HQ40d multimeter;
2. HACH PHC301 pH probe;
3. pH Calibration Standard Solutions (4.01, 7.0, and 10.01 s.u.);
4. pH Electrode Storage Bottle ;
5. Deionized Water; and,
6. Process sample for analysis.

PROCEDURE

1. Collect samples, reagents, and supplies for analysis.

pH Probe Calibration

1. Connect the pH probe to the multimeter. Make sure that the cable locking nut is securely connected to the meter.

2. Remove any other probes connected to the meter.

3. Press the power button ⏻ to turn on the multimeter.

4. Press the **blue** button (“Calibrate”) to begin the calibration process.

5. Slightly loosen the cap on the pH Electrode Storage Bottle and remove the probe from the bottle.

6. Prepare fresh containers of each standard solution from the supply bottles.

7. Rinse the probe with deionized water.

8. Place the probe in one of the standard solutions and stir gently. Make sure that the bottom 1 inch of the probe is completely submerged in the solution.

9. Press the **green** button (“Read”) and continue to stir gently. The display will show “Stabilizing” and a progress bar as the probe stabilizes in the standard. When the reading has stabilized, the measurement will display on the screen.

10. Repeat Steps 7-9 in the other two standard solutions.

11. Press the ▲ button (“Done”) to view the calibration summary. If the calibration summary gives an error message, refer to the user manual (Reference 1) for troubleshooting guidelines.

12. Press the **green** button (“Store”) to store the calibration.

pH Measurement

1. Connect the pH probe to the multimeter. Make sure that the cable locking nut is securely connected to the meter.

2. Press the power button ⏻ to turn on the multimeter.

3. Slightly loosen the cap on the pH Electrode Storage Bottle and remove the probe from the bottle.

4. Rinse the probe with deionized water.

5. Place the pH probe in the sample to be analyzed and swirl gently.

6. Press the **green** button (“Read”) and continue to stir gently. The display will show “Stabilizing” and a progress bar as the probe stabilizes in the sample. When the reading has stabilized, the measurement will display on the screen.

7. Repeat Steps 4-6 for all samples to be measured.

Electrode Storage

1. Rinse the probe with deionized water before storage.

2. Dab the probe dry with a lint-free cloth (e.g., Kimwipe).

3. Check the Electrode Storage Bottle to make sure the sponge is saturated with pH Storage Solution. Add solution if needed.

4. Place the probe into the bottle and tighten the cap.

RECORDKEEPING

1. Record all pH measurements in the WWTP operator log book and prescribed electronic spreadsheet.

UNIT STANDARD OPERATING PROCEDURE

TITLE: DISSOLVED OXYGEN CALIBRATION AND MEASUREMENT

References:	1. *User Manual – Luminescent Dissolved Oxygen Probe: Model LDO10101, LDO10103, LDO10105, LDO10110, LDO10115 or LDO10130*. HACH Document No. DOC022.53.80021
Purpose:	To perform routine calibration of the laboratory DO probe and ensure accurate DO measurement of WWTP samples.
Scope:	This procedure provides instructions on proper calibration of the LDO101 DO probe and the HQ40d multimeter, and instructions on measuring DO of WWTP process samples.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Todd Lusk

VERSION:	1	REVISION DATE:	August 24, 2020

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8/24/2020	Jeff Naumoff		

AMENDMENT RECORD

Rev #	Date	APC Employee Name	APC Employee Title

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of samples after analysis.

EQUIPMENT AND REAGENTS

1. HACH HQ40d multimeter;
2. HACH LDO101 DO probe;
3. DO Probe Calibration Bottle
4. Deionized Water; and,
5. Process sample for analysis.

PROCEDURE

1. Collect samples, reagents, and supplies for analysis.

DO Probe Calibration

1. Check the DO Proble Calibration Bottle to ensure it has at least ¼" of water in the bottom. Add deionized water if it is dry.

2. Cover the hole in the bottle cap and shake vigorously for 30 seconds.

3. Allow the Calibration Bottle to sit for up to 30 minutes to let the air inside the bottle saturate with water vapor.

4. Connect the DO probe to the multimeter. Make sure that the cable locking nut is securely connected to the meter.

5. Remove any other probes connected to the meter.

6. Press the power button ⏻ to turn on the multimeter.

7. Press the **blue** button ("Calibrate") to begin the calibration process.

8. Rinse the DO probe with deionized water and blot dry with a lint-free cloth.

9. Place the probe into the DO Calibration Bottle.

10. Press the **green** button ("Read") and continue to stir gently. The display will show "Stabilizing" and a progress bar as the probe stabilizes in the standard. When the reading has stabilized, the measurement will display on the screen as percent saturation.

11. Press the ▲ button ("Done") to view the calibration summary.

12. Press the **green** button ("Store") to store the calibration.

DO Measurement

1. Connect the DO probe to the multimeter. Make sure that the cable locking nut is securely connected to the meter.

2. Press the power button ⏻ to turn on the multimeter.

3. Rinse the probe with deionized water.

4. Samples must be measured immediately after collection. Ideally, measurements should be made directly in the process vessel rather than collecting and transporting samples to the laboratory.

5. Place the DO probe in the sample to be analyzed and swirl gently. Ensure the probe is at least 1" deep in the sample.

6. Press the **green** button ("Read") and continue to stir gently. The display will show "Stabilizing" and a progress bar as the probe stabilizes in the sample. When the reading has stabilized, the measurement will display on the screen.

7. Repeat Steps 3-5 for all samples to be measured.

Electrode Storage

1. Rinse the probe with deionized water before storage.

2. Blot the probe dry with a lint-free cloth (e.g., Kimwipe).

3. The DO probe should be stored in a dry area with minimal exposure to dust or moisture.

RECORDKEEPING

1. Record all DO measurements in the WWTP operator log book and prescribed electronic spreadsheet.

UNIT STANDARD OPERATING PROCEDURE

TITLE: CONDUCTIVITY CALIBRATION AND MEASUREMENT

References:	1. *Conductivity Probe: Model CDC40101, CDC40103, CDC40105, CDC40110, CDC40115 or CDC40130*. HACH Document No. DOC022.53.80022
Purpose:	To perform routine calibration of the laboratory conductivity probe and ensure accurate conductivity measurement of WWTP samples.
Scope:	This procedure provides instructions on proper calibration of the CDC401 conductivity probe and the HQ40d multimeter, and instructions on measuring conductivity of WWTP process samples.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Todd Lusk

VERSION: 1 REVISION DATE: August 24, 2020

DATE	REVIEWED/APPROVED	DATE	QUALITY APPROVED
8/24/2020	Jeff Naumoff		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of samples after analysis.

EQUIPMENT AND REAGENTS

1. HACH HQ40d multimeter;
2. HACH CDC401 Conductivity probe;
3. Conductivity Standard Solution;
4. Deionized Water; and,
5. Process samples for analysis.

PROCEDURE

1. Collect samples, reagents, and supplies for analysis.

Conductivity Probe Calibration

1. Connect the Conductivity probe to the multimeter. Make sure that the cable locking nut is securely connected to the meter.

2. Remove any other probes connected to the meter.

3. Press the power button ⏻ to turn on the multimeter.

4. Press the **blue** button (“Calibrate”) to begin the calibration process.

5. Rinse the probe with deionized water and blot dry with a lint-free cloth.

6. Prepare a fresh container of conductivity standard solution.

7. Place the probe into the container of standard solution and stir gently. Make sure the temperature sensor on the probe is completely submerged.

8. Press the **green** button (“Read”) and continue to stir gently. The display will show “Stabilizing” and a progress bar as the probe stabilizes in the standard. When the reading has stabilized, the measurement will display on the screen.
9. Press the ▲ button (“Done”) to view the calibration summary.
10. Press the **green** button (“Store”) to store the calibration.

Conductivity Measurement

1. Connect the Conductivity probe to the multimeter. Make sure that the cable locking nut is securely connected to the meter.
2. Press the power button ⏻ to turn on the multimeter.
3. Rinse the probe with deionized water.
4. Place the probe in the sample to be analyzed and swirl gently. Make sure the temperature sensor on the probe is completely submerged. Do not touch the probe to the bottom or sides of the container.
5. Press the **green** button (“Read”) and continue to stir gently. The display will show “Stabilizing” and a progress bar as the probe stabilizes in the sample. When the reading has stabilized, the measurement will display on the screen.
6. Repeat Steps 3-5 for all samples to be measured.

Electrode Storage

1. Rinse the probe with deionized water before storage.
2. Blot the probe dry with a lint-free cloth (e.g., Kimwipe).
3. The conductivity probe should be stored in a dry area with minimal exposure to dust or moisture.

RECORDKEEPING

1. Record all conductivity measurements in the WWTP operator log book and prescribed electronic spreadsheet.

UNIT STANDARD OPERATING PROCEDURE

TITLE: TURBIDITY METER CALIBRATION AND MEASUREMENT

References:	1. *Instruction Manual: HI93703 Portable Microprocessor Turbidimeter*
Purpose:	To perform routine calibration of the laboratory turbidimeter and ensure accurate conductivity measurement of WWTP samples.
Scope:	This procedure provides instructions on proper calibration of the Hanna HI98703 portable turbidimeter, and instructions on measuring turbidity of WWTP process samples.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Todd Lusk

VERSION: 1 REVISION DATE: August 27, 2020

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8/27/2020	Jeff Naumoff		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Standard laboratory PPE (lab coat or long sleeves, safety glasses, and nitrile gloves or equivalent) should be worn throughout this procedure.

2. WWTP wastewater samples can contain biological and chemical hazards, including pathogens, ammonia, and other process-related chemicals.

3. Properly dispose of samples after analysis.

EQUIPMENT AND REAGENTS

1. Hanna HI93703 turbidimeter;
2. Sample cuvettes;
3. Kimwipes;
4. 10.0 FTU turbidity standard solution;
5. 500 FTU turbidity standard solution;
6. Deionized Water; and,
7. Process samples for analysis.

PROCEDURE

1. Collect samples, reagents, and supplies for analysis.

Turbidimeter Calibration

1. Inspect the cuvettes for any signs of dirt or smudges. Wipe off any visible dirt on the exterior of the cuvette with a Kimwipe.

2. Turn on the meter by pressing the **ON/OFF** key. After performing a self-check, the meter will display “**- - - -**“ indicating it is ready to measure.

3. If a “**LO BAT**” message appears on the screen, replace the batteries (4 x 1.5V AA alkaline batteries).

4. Press the **CAL** key once. The “**CAL**” message will flash on the screen for approximately 5 seconds.

5. The date will display on the screen. If the date displayed is correct, press the **CAL** key again or wait for the date display to disappear, then skip to Step 8**.** If the date is incorrect, proceed to Step 6.

6. Press the **DATE/▶** key to set the date. When the year starts flashing, press the **READ/▲** key to set the year.

7. Repeat Step 5 to set the month, day, hour and minute on the meter (in order). Press the **DATE/▶** key one final time.

8. Fill a cuvette with deionized water to approximately ¼" from the top.

9. Insert the cuvette into the measurement cell and press the **CAL** key. A blinking "**SIP**" message indicates that measurement is in progress.

10. After approximately 45 seconds, the meter will display "**10.0**" indicating it is ready for the next calibration solution.

11. Repeat Steps 8-9 using the 10.0 FTU turbidity standard solution in place of deionized water.

12. After approximately 45 seconds, the meter will display "**500**" indicating it is ready for the next calibration solution.

13. Repeat Steps 8-9 using the 500 FTU turbidity standard solution in place of deionized water

14. After the final calibration solution is read, the meter will display "**- - - -**" indicating the calibration is complete and the meter is ready for measurement.

Turbidity Measurement

1. Inspect the cuvettes for any signs of dirt or smudges. Wipe off any visible dirt on the exterior of the cuvette with a Kimwipe.

2. Turn on the meter by pressing the **ON/OFF** key. After performing a self-check, the meter will display "**- - - -**" indicating it is ready to measure.

3. If a "**LO BAT**" message appears on the screen, replace the batteries (4 x 1.5V AA alkaline batteries).

4. Agitate the sample to ensure it is thoroughly mixed.

5. Fill a clean cuvette with the sample to approximately ¼" from the top. Allow time for any air bubbles in the sample to rise to the top and escape before securing the cap.

6. Attach the cap securely to the top of the cuvette and place it in the measurement cell. The notch on the cap should fit into the corresponding groove in the measurement cell and the mark on the top of the cap should be pointing towards the LCD display.

7. Press the **READ/▲** key. The display will blink "**SIP**" (Sampling in Progress).

8. After approximately 30 seconds, the meter will display the turbidity measurement in FTU.

9. Repeat Steps 4-8 for all samples to be analyzed.

10. Discard samples immediately after analysis and rinse the cuvettes with deionized water.

RECORDKEEPING

1. Record all turbidity measurements in the WWTP operator log book and prescribed electronic spreadsheet.

UNIT STANDARD OPERATING PROCEDURE

TITLE: WWTP ANALYTICAL DILUTIONS

References:	1. SOPs for Wastewater Treatment Plant (WWTP) analytical procedures.
Purpose:	Provide instructions for diluting WWTP process samples as needed to ensure that analytical procedures will produce measurable results.
Scope:	This method provides instructions for preparing dilutions of WWTP process samples for analytical measurement.
Responsibilities:	WWTP APC Operator of Record are responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

VERSION:	1	REVISION DATE:	July 23, 2020

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7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Appropriate PPE (long sleeves, safety glasses, gloves) should be worn when performing any laboratory analysis.

2. Handle glassware carefully. Discard and replace any chipped or cracked glassware.

EQUIPMENT AND REAGENTS

1. Deionized (DI) water;
2. Volumetric flasks (various sizes);
3. Beakers (various sizes);
4. Pipettor, 1-10 mL with tips;
5. Disposable transfer pipettes; and
6. WWTP process samples

PROCEDURE

1. This procedure is to be applied when an analytical result on a WWTP process sample produces a result of “Over Range” or when a WWTP sample is expected to produce a result of “Over Range” when analyzed by a given method.

2. Glassware used in this procedure should be inspected prior to use to ensure it is clean.

3. The table below provides guidance on appropriate volumes of DI water and sample to mix to prepare various dilution factors.

Dilution Factor	Volumetric Flask Size	Volume of DI Water	Volume of Sample
2:1	50 mL	25 mL	25 mL
4:1	100 mL	75 mL	25 mL
5:1	50 mL	40 mL	10 mL
10:1	100 mL	90 mL	10 mL
25:1	100 mL	96 mL	4 mL
100:1	100 mL	99 mL	1 mL

4. Fill the volumetric flask approximately 1/3 full with DI water.

5. Using the adjustable pipettor, add the prescribed volume of sample. DO NOT USE THE SAME PIPETTE TIP FOR MULTIPLE SAMPLES – this can skew analytical results.

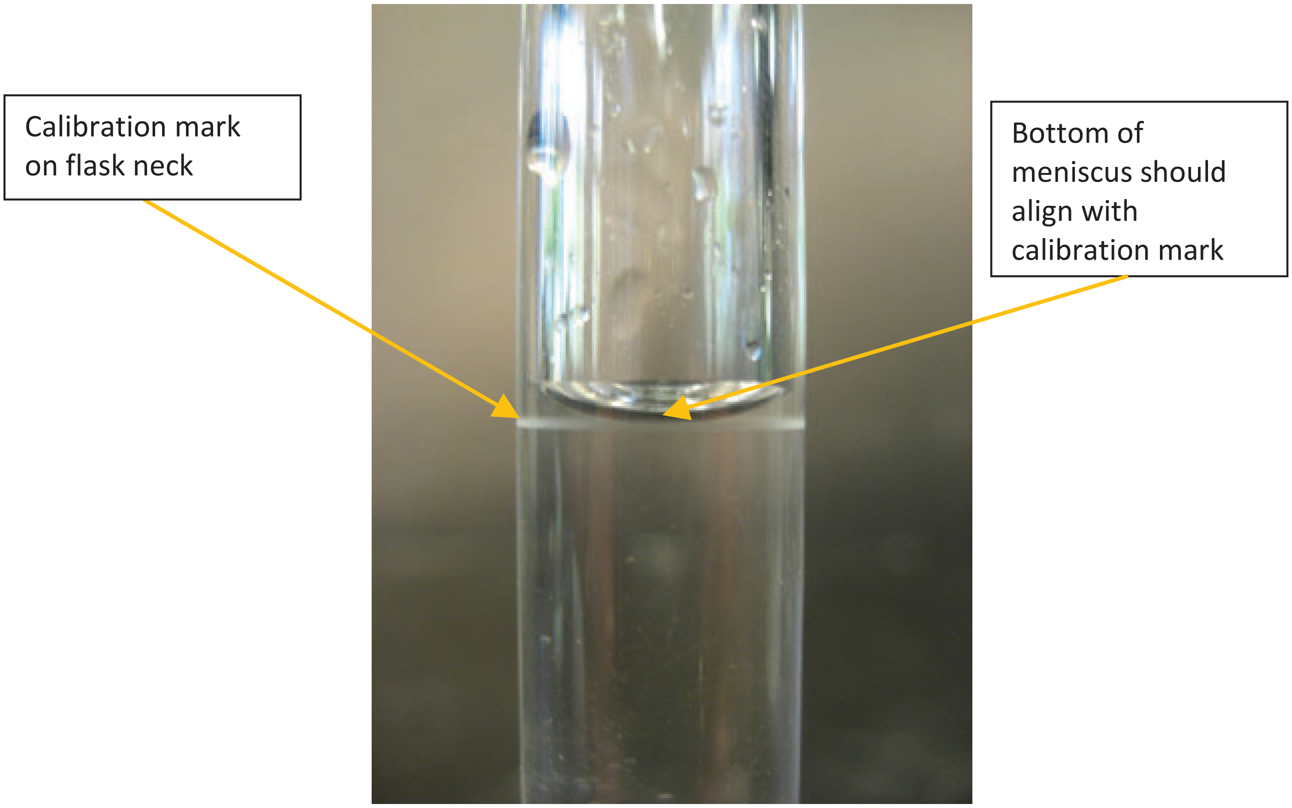
6. Fill the volumetric flask to the etched calibration mark on the neck with DI water. When nearing the calibration mark, use a disposable pipette to slowly add DI water and ensure

that the bottom of the meniscus (the curved surface of the liquid) is precisely aligned with the mark on the flask. See Figure 1 attached at the end of this procedure.

7. Invert the flask several times to mix the sample.
8. Pour the diluted sample into a beaker.
9. Follow the instructions on the analytical procedure(s) to be performed on the diluted sample.
10. Record the selected dilution in the “Dilution Factor” column on the Laboratory Analysis Worksheet.
11. When calculating the sample result, multiply the reading from the spectrophotometer by the dilution factor to obtain the sample concentration.
12. Thoroughly clean all glassware used in preparation of dilutions.

ATTACHMENTS

1. Figure 1. Reading the Meniscus Level in a Volumetric Flask



UNIT STANDARD OPERATING PROCEDURE

TITLE: CLEANING WWTP LABORATORY GLASSWARE

References: 1. N/A

Purpose: Provide instructions for proper cleaning and storage of glassware used in Wastewater Treatment Plant (WWTP) analyses.

Scope: This method provides instructions for proper inspection, cleaning, and storage of WWTP glassware.

Responsibilities: WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.

Prepared by: Callan Driscoll

VERSION: 1 REVISION DATE: July 23, 2020

DATE	REVIEWED/APPROVED	DATE	QUALITY APPROVED
7/30/2020	Todd Lusk		

AMENDMENT RECORD

Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Appropriate PPE (long sleeves, safety glasses, gloves) should be worn when performing any laboratory procedure. Textured, slip-resistant gloves are strongly recommended.

2. Handle glassware carefully. Glassware containing Liquinox will be slippery. Discard and replace any chipped or cracked glassware.

3. Read the Safety Data Sheets for any chemicals to be used as part of the cleaning procedure.

EQUIPMENT AND REAGENTS

1. Deionized (DI) water;
2. Glassware (to be cleaned);
3. Scrubbing brushes (various sizes);
4. Liquinox detergent; and
5. Sulfuric acid, 0.02 normal.

PROCEDURE

1. This procedure is to be applied to all glassware and reusable plasticware routinely utilized by WWTP laboratory personnel to perform analyses. Items covered under this procedure include, but are not limited to:

   - Beakers;
   - Volumetric cylinders;
   - Volumetric flasks;
   - Burettes; and
   - HACH spectrophotometer sample vials for non-TNT methods

2. Clean glassware is critical for obtaining accurate results from PWTP laboratory analyses. Contaminated glassware can potentially bias analytical methods and produce incorrect results.

3. FOR MINIMALLY CONTAMINATED GLASSWARE: rinse with tap water followed by a rinse with DI water.

4. FOR MODERATELY CONTAMINATED GLASSWARE: soak for 10-15 minutes in warm tap water with Liquinox detergent added (10 mL of Liquinox per 1,000 mL of water). Scrub any stained surfaces with a brush until contaminants have been visibly removed. Rinse with tap watter followed by a rinse with DI water.

5. FOR HEAVILY CONTAMINATED GLASSWARE: Soak overnight with 0.02N sulfuric acid. Thoroughly rinse acid down the drain with large volumes of tap water, then follow Step 4 above for additional cleaning.

6. If rinse water is observed running off the glassware in smooth sheets, it has been sufficiently cleaned. If not, repeat the appropriate cleaning step above.

7. Hang cleaned glassware on the drying rack and allow to air dry completely. DO NOT DRY WITH PAPER TOWELS.

8. Once glassware has dried completely, return it to its appropriate storage location in the laboratory.

UNIT STANDARD OPERATING PROCEDURE

TITLE: WWTP LABORATORY QUALITY ASSURANCE/ QUALITY CONTROL PROCEDURES

References:	1. Hach Water Analysis Handbook. 2. SOPs for Wastewater Treatment Plant (WWTP) analytical procedures.
Purpose:	Provide instructions for appropriate QA/QC measures to ensure reliability of analytical results.
Scope:	This method provides instructions for performing standard and duplicate analyses to ensure consistent and reliable results for WWTP process monitoring samples.
Responsibilities:	WWTP APC Operator of Record is responsible for ensuring compliance to this procedure.
Prepared by:	Callan Driscoll

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Rev #	**Date**	**APC Employee Name**	**APC Employee Title**

PROCEDURE

HEALTH AND SAFETY

1. Appropriate PPE (long sleeves, safety glasses, gloves) should be worn when performing any laboratory analysis.

2. Refer to the associated analytical SOPs for proper handling and disposal of spent test materials.

PROCEDURE

STANDARD ANALYSES

1. Standard analysis should be performed once per day for each analysis where a standard solution is available.

2. For the analysis being performed, obtain the standard solution from the PWTP Laboratory if available. Refer to the table below for available standard solutions.

Analysis	Standard Solution
Chemical Oxygen Demand (COD)	Hach 1218629 (300 mg/L as COD)
Ammonia Nitrogen (NH_3-N)	Hach 15349 (10 mg/L as NH_3-N)
Nitrate Nitrogen (NO_3-N)	Hach 30749 (10 mg/L as NO_3-N)
Nitrite Nitrogen (NO_2-N)[1]	Hach 2340249 (250 mg/L as NO_2-N)
Orthophosphate (PO_4-P)	Hach 2833249 (3.0 mg/L as PO_4)

Notes:
1. Nitrite nitrogen standard must be diluted 1,000:1 for use with the TNT 839 vials. Refer to SOP WWTP-200-001 for performing dilutions.

3. Prepare a sample vial for each analysis, using the standard solution in place of the process sample.

4. Analyze the standard vial concurrent with process monitoring samples.

5. Calculate the percent recovery for the standard analysis as follows. The desired result for all standards is a value between 90-110 percent recovery.

$$\%\ \boldsymbol{Recovery} = \frac{Measured\ Value}{Standard\ Value} \times 100\%$$

6. Record the date, method name/number, standard value, measured value, percent recovery, analyst initials, and any relevant notes on the Quality Control Log – Method Standards sheet.

7. If the standard analysis falls outside the target range of 90-110 percent, complete the following steps:

    a. Confirm that the standard solution and reagents are not expired. Reorder fresh supplies if the current stock has expired.

    b. If the standard solution and reagents are not expired, repeat the standard analysis.

    c. Confirm that the sample vials and the optics in the spectrophotometer are clean.

    d. If the steps above do not produce an acceptable result, contact Hach technical support.

DUPLICATE ANALYSES

1. Duplicate analyses should be performed on one sample for each of the following analyses each day they are performed:

    - Chemical Oxygen Demand (COD)
    - Ammonia Nitrogen (NH_3-N)
    - Nitrate Nitrogen (NO_3-N)
    - Nitrite Nitrogen (NO_2-N)
    - Orthophosphate (PO_4-P)
    - Total/Volatile Suspended Solids (TSS/VSS)
    - Alkalinity

2. Select a suitable sample on which to perform duplicate analyses. Samples suitable for duplicate analysis are provided in the table below.

Analysis	Recommended Samples
Chemical Oxygen Demand (COD)	EQ Tank
Ammonia Nitrogen (NH_3-N)	EQ Tank
Nitrate Nitrogen (NO_3-N)	EQ Tank, Anoxic Bioreactor #2 (Filtered)
Nitrite Nitrogen (NO_2-N)	EQ Tank, Anoxic Bioreactor #2 (Filtered)
Orthophosphate (PO_4-P)	Clarifier Effluent
Total/Volatile Suspended Solids (TSS/VSS)	Post-Oxidation Bioreactor
Alkalinity	Aerobic Bioreactor

3. Using the selected sample, prepare two identical test vials for Hach spectrophotometer analyses, two weighing tins for TSS/VSS analyses, or two sample flasks for Alkalinity analyses. When recording sample IDs on the associated laboratory analysis log sheets, mark the samples as “[SAMPLE LOCATION] A” and “[SAMPLE LOCATION] B.”

4. Conduct analyses on samples per the instructions in the WWTP Laboratory SOP.

5. Calculate the relative percent difference (RPD) for the duplicated sample using the equation below. The desired RPD for all duplicates is less than 20 percent.

$$\boldsymbol{RPD} = \left| 2 \times \frac{Sample\ B\ Result - Sample\ A\ Result}{Sample\ B\ Result + Sample\ A\ Result} \times 100\% \right|$$

6. Record the date, method name/number, Sample A result, Sample B result, RPD, analyst initials, and any relevant notes on the Quality Control Log – Method Duplicates sheet.

7. If the calculated RPD for the duplicate samples is within the desired range, record the result for that analysis as the average of the two duplicate samples.

8. If the calculated RPD for the duplicate samples is outside the desired range, complete the following steps:

    a. For spectrophotometer and alkalinity analyses, confirm that the reagents are not expired. Reorder fresh supplies if the current stock has expired.

    b. For spectrophotometer analyses, confirm that the sample vials and the optics in the spectrophotometer are clean.

    c. Confirm that the sample selected for duplicate analysis is properly homogenized (i.e. well mixed) and repeat the duplicate analysis.

    d. If the steps above do not produce an acceptable result, contact Hach technical support.

ATTACHMENTS

1. Quality Control Log – Method Standards

2. Quality Control Log – Method Duplicates

QUALITY CONTROL LOG - METHOD STANDARDS
AUSTIN POWDER -MCARTHUR, OHIO

Percent Recovery = (Measured / Standard) x 100%
Target is 90-110%

DATE	METHOD NAME/#	STANDARD VALUE mg/L	MEASURED VALUE mg/L	PERCENT RECOVERY	ANALYST INITIALS	NOTES

QUALITY CONTROL LOG - METHOD DUPLICATES
AUSTIN POWDER -MCARTHUR, OHIO

RPD = Relative Percent Difference

RPD = 2 x (Sample B - Sample A) / (Sample B + Sample A) x 100%

Target RPD < 20%

DATE	METHOD NAME/#	SAMPLE A RESULT mg/L	SAMPLE B RESULT mg/L	RPD %	ANALYST INITIALS	NOTES

APPENDIX D

WWTP SAMPLING AND ANALYSIS PLAN

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

APPENDIX D. OUTFALL 010 WWTP PROCESS SAMPLING AND ANALYSIS PLAN

Sample Location	Parameter	Method/Analyst	Frequency	Purpose of Analysis
Outfall 010 Process Sampling				
Booster Buildings Finished Water Tanks	TNT	QA Lab	1/Week	Monitor GAC treatment performance and need for replacement
	COD	WWTP Lab	1/Week	Monitor GAC treatment performance and need for replacement
Feed Well/Equalization Tank Effluent	Flow	Online Meter	1/Day	Monitor/control WWTP loading
	COD	WWTP Lab	1/Day	Monitor/control WWTP loading
	Ammonia (NH_3-N)	WWTP Lab	3/Week	Monitor/control WWTP nutrients
Aeration Basin	pH	Online Meter	1/Day	Monitor/control bioreactor environment
	DO	Online Meter	1/Day	Monitor/control bioreactor environment
	Temperature	Online Meter	1/Day	Monitor/control bioreactor environment
	Conductivity	Handheld Meter	3/Week	Monitor/control bioreactor environment
	MLSS	WWTP Lab	2/Week	Monitor/control biomass inventory
	MLVSS	WWTP Lab	2/Week	Monitor/control biomass inventory
	F/M Ratio, COD Basis	Calculation	1/Day	Monitor/control WWTP loading
	Surface Foam Coverage	Observation	1/Day	Monitoring for upset/abnormal conditions
	Microscope Evaluation	SLR	1/Month	Monitor biomass health and diversity
	Settled Sludge Volume (SSV-30)	WWTP Lab	1/Week	Monitor biomass settling/secondary clarifier loading
	Sludge Volume Index	Calculation	1/Week	Monitor biomass settling/secondary clarifier loading
MicroC Pump	Flow Rate	Online Meter	1/Day	Monitor/adjust supplemental carbon loading
	Calibration Check	Field SOP	1/Month	Confirm pump flow rate
Dosing Chamber	Turbidity	Online Meter	1/Day	Monitor secondary clarifier performance/filter feed quality
	TSS	WWTP Lab	2/Week	Monitor secondary clarifier performance/filter feed quality
UV Feed Well	Turbidity	WWTP Lab	1/Day	Monitor secondary clarifier performance/filter feed quality
	Ammonia (NH_3-N)	WWTP Lab	3/Week	Monitor nitrification performance/nutrient availability
	Nitrate (NO_3-N) + Nitrite (NO_2-N)	WWTP Lab	3/Week	Monitor nitrification performance/nutrient availability
	Ortho-phosphate (PO_4-P)	WWTP Lab	2/Week	Monitor nutrient availability
	TSS	WWTP Lab	2/Week	Monitor secondary clarifier performance/filter feed quality
	COD	WWTP Lab	1/day	Monitor bioreactor treatment performance
UV Disinfection System	UV Transmittance	Online Meter	1/day	Montior UV system operation and performance

APPENDIX E

BIOASSESSMENT INTERPRETATION GUIDE

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

APPENDIX E. INTERPRETATION GUIDE FOR WWTP BIOMASS ASSESSMENTS

PARAMETER	REPORTED OBSERVATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
Floc Shape/Density	Firm	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	Round, Compact	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	Weak, Diffuse	1) Slow settling rate/high SVI 2) Rapid blinding of Filter	a) Low F/M, high sludge age b) Biomass inhibition	i) Check F/M calculation, increase COD loading or increase biomass wastage ii) Check COD removal rate and effluent COD concentration iii) Consider bioaugmentation if needed
	Irregular	1) Slow settling rate/high SVI 2) Rapid blinding of Filter	a) Open floc due to low F/M filaments b) Biomass inhibition	i) Check F/M calculation, increase COD loading or increase biomass wastage ii) Refer to Filamentous Bacteria section for specific actions iii) Check COD removal rate and effluent COD concentration iv) Consider bioaugmentation if needed
	Bridging Floc	1) Slow settling rate/high SVI 2) Rapid blinding of Filter	a) High filament content	i) Refer to Filamentous Bacteria section for specific actions
	Open Floc	1) Slow settling rate/high SVI 2) Rapid blinding of Filter	a) High filament content	i) Refer to Filamentous Bacteria section for specific actions
	Dispersed Growth	1) High effluent turbidity 2) Poor solids removal in Filter 3) Effluent noncompliance (TSS)	a) High F/M, low sludge age b) Deflocculation due to inhibition/toxicity c) Septic conditions	i) Check F/M calculation, decrease COD loading or decrease biomass wastage ii) Check for signs of inhibition/toxicity (high effluent BOD/NH_3-N) iii) Check mixers and ORP in Anoxic Bioreactors, increase return sludge flow iv) Consider flocculant addition
Filament Content	0 – None	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	1 – Few	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	2 – Some	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	3 – Common	1) Acceptable condition, no consequences	a) Conditions conducive to filament growth	i) Increase monitoring to ensure filament content does not increase ii) Refer to Filamentous Bacteria section for specific actions
	4 – Very Common	1) Filamentous bulking (slow settling, high SVI, Filter blinding)	a) Conditions conducive to filament growth	i) Refer to Filamentous Bacteria section for specific actions
	5 – Abundant	1) Filamentous bulking (slow settling, high SVI, Filter blinding)	a) Conditions conducive to filament growth	i) Refer to Filamentous Bacteria section for specific actions
	6 – Excessive	1) Filamentous bulking (slow settling, high SVI, Filter blinding)	a) Conditions conducive to filament growth	i) Refer to Filamentous Bacteria section for specific actions
Floc Size Distribution	**>50% under 150 µm**	1) Rapid blinding of Filter 2) High effluent TSS	a) Low F/M, high sludge age	i) Check F/M calculation, increase COD loading or increase biomass wastage
	>50% between 150-500 µm	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	> 50% over 500 µm	1) Poor BOD removal 2) Effluent noncompliance	a) Excessive flocculant usage	i) Reduce dosing of flocculant
Polysaccharide Content	Normal	1) Desired condition, no consequences	a) N/A	i) No corrective action required
	Elevated or Excessive	1) Viscous bulking (slow settling rate/high SVI) 2) Rapid blinding of filter 3) Poor solids dewatering (Outfall 011)	a) Nutrient deficiency b) Biomass upset/inhibition	i) Check residual nutrient concentrations, supplement with urea if residual nitrogen < 2 mg/L, increase sodium phosphate addition if residual phosphorus < 0.5 mg/L ii) Check COD removal rate and effluent COD concentration iii) Consider bioaugmentation if needed
Zoogloea	**Marked Present**	1) Same as for elevated/excessive polysaccharide content	a) High F/M b) Low pH	i) Check F/M calculation, increase COD loading or increase biomass wastage ii) Check bioreactor pH, add additional soda ash to raise pH > 6.5

APPENDIX E. INTERPRETATION GUIDE FOR WWTP BIOMASS ASSESSMENTS

PARAMETER	REPORTED OBSERVATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
Indicator Organism Distribution (Abnormal Situations)	**Sudden Decrease in Abundance/Variety**	1) Effluent noncompliance with NH_3-N and/or BOD	a) Biomass inhibition b) Nitrification inhibition	i) Check F/M(TKN), reduce NH_3-N loading or reduce sludge wasting rate if high ii) Add supplemental nitrifiers if elevated effluent NH_3-N is observed iii) Increase alkalinity (soda ash addition)
	High Abundance of Worms	1) Effluent noncompliance with BOD, TSS, and/or DO	a) Septicity b) Low F/M, high sludge age	i) Check DO in aerobic bioreactors, maintain above 2.0 mg/L ii) Check ORP in anoxic bioreactors, maintain between -300 and -50 mV iii) Check F/M calculation, increase COD loading or increase biomass wastage
Filamentous Bacteria (Very Common or Higher)	***S. natans,* *H. hydrossis,* or Type 1701**	1) Filamentous bulking 2) Effluent noncompliance (BOD, TSS, and/or DO)	a) Low Dissolved Oxygen in aerobic bioreactors	i) Increase aeration rate if available ii) Maintain DO > 2.0 mg/L iii) Confirm F/M ratio is within target range iv) Consider chlorination treatment for filament control
	***Beggiatoa,* Type 021N, *Thiothrix I/II,* or Type 0914 with sulfur granules**	1) Filamentous bulking 2) Effluent noncompliance (BOD, TSS, and/or DO)	a) Septic conditions in bioreactors	i) Check DO in aerobic bioreactors, maintain above 2.0 mg/L ii) Check ORP in anoxic bioreactors, maintain between -300 and -50 mV iii) Check F/M calculation, reduce COD loading or reduce wastage if high iv) Consider chlorination treatment for filament control
	Type 021N, *Thiothrix I/II* Type 0914, *N. limicola I/I/III,* Type 0411, Type 0961, Type 0092, Type 0581, or Type 0211	1) Filamentous bulking 2) Effluent noncompliance (BOD and/or TSS)	a) High organic acid content in influent	i) Check F/M calculation, increase COD loading or increase biomass wastage ii) Check influent for high Volatile Fatty Acid concentrations iii) Consider chlorination treatment for filament control
	Type 021N or *Thiothrix I/II*	1) Filamentous bulking 2) Viscous bulking 3) Effluent noncompliance (BOD and/or TSS)	a) Nutrient deficiency (nitrogen)	i) Check residual nutrient concentrations, supplement with urea if residual nitrogen < 2 mg/L
	S. natans,* *H. hydrossis,* or *N. limicola III	1) Filamentous bulking 2) Viscous bulking 3) Effluent noncompliance (BOD and/or TSS)	a) Nutrient deficiency (phosphorus)	i) Check residual nutrient concentrations, supplement with sodium phosphate if residual phosphorus < 0.5 mg/L
	Type 0041, Type 0675, Type 1851, or Type 0803	1) Filamentous bulking (open floc) 2) Effluent noncompliance (TSS)	a) Low F/M	i) Increase forward flow from Equalization Tank if possible ii) Increase feed of MicroC iii) Increase wastage to reduce MLSS/MLVSS iv) Increase return sludge flow if settling is poor
	***M. parvicella,* *Nocardia* spp., or Type 1863**	1) Excessive foaming 2) Loss of biomass 3) Effluent noncompliance (TSS)	a) High influent Oil & Grease	i) Check influent O&G concentrations

APPENDIX F

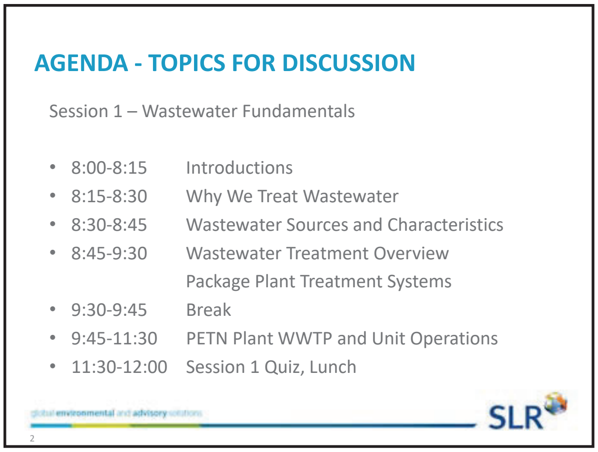
WWTP OPERATIONS TRAINING MATERIALS

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

WASTEWATER TREATMENT OPERATION TRAINING
SESSION 1 – WASTEWATER FUNDAMENTALS

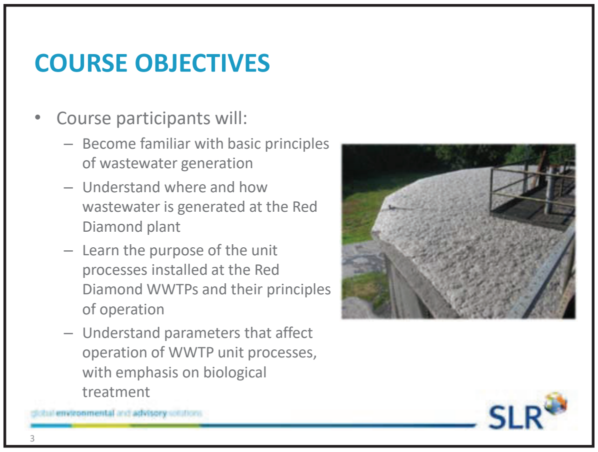
Austin Powder Company
MacArthur, Ohio



AGENDA - TOPICS FOR DISCUSSION

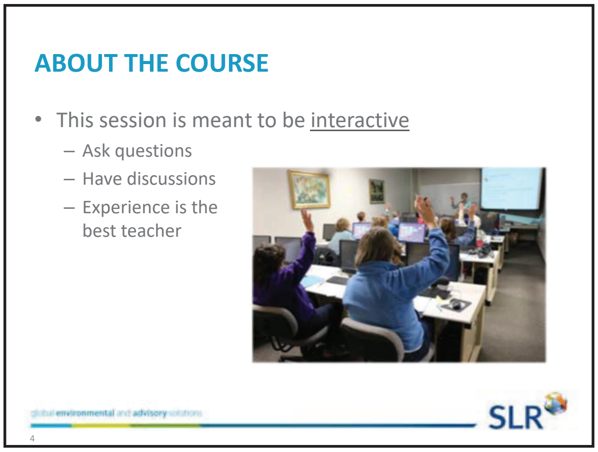
Session 1 – Wastewater Fundamentals

8:00-8:15	Introductions
8:15-8:30	Why We Treat Wastewater
8:30-8:45	Wastewater Sources and Characteristics
8:45-9:30	Wastewater Treatment Overview Package Plant Treatment Systems
9:30-9:45	Break
9:45-11:30	PETN Plant WWTP and Unit Operations
11:30-12:00	Session 1 Quiz, Lunch



COURSE OBJECTIVES

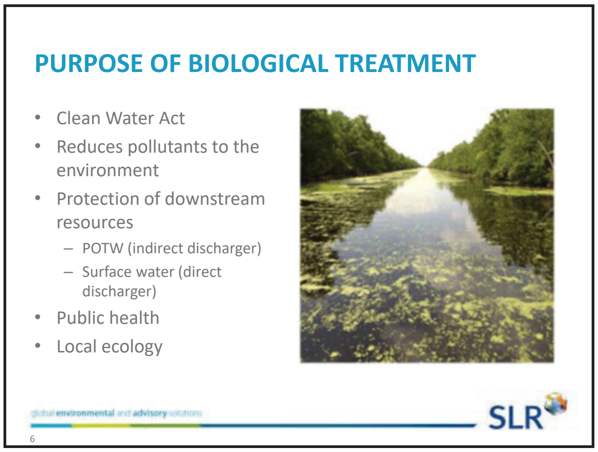
- Course participants will:
  - Become familiar with basic principles of wastewater generation
  - Understand where and how wastewater is generated at the Red Diamond plant
  - Learn the purpose of the unit processes installed at the Red Diamond WWTPs and their principles of operation
  - Understand parameters that affect operation of WWTP unit processes, with emphasis on biological treatment



ABOUT THE COURSE

- This session is meant to be interactive
  - Ask questions
  - Have discussions
  - Experience is the best teacher

WHY WE TREAT WASTEWATER



PURPOSE OF BIOLOGICAL TREATMENT

- Clean Water Act
- Reduces pollutants to the environment
- Protection of downstream resources
  - POTW (indirect discharger)
  - Surface water (direct discharger)
- Public health
- Local ecology

CLEAN WATER ACT

- CWA Summary: 33 U.S.C. §1251 et seq. (1972)
- The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act
- Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977

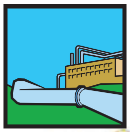
CLEAN WATER ACT

- EPA has implemented pollution control programs such as setting wastewater standards for industry
- Set water quality standards for all contaminants in surface waters
- The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit is obtained
- Point sources are discrete conveyances such as pipes or man-made ditches
- EPA's National Pollution Discharge Elimination System (NPDES) permit program controls discharges

TYPES OF DISCHARGE

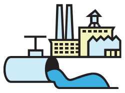
Indirect Dischargers:

- Classified as:
  - Industrial Users (less than 25,000 gpd)
  - Significant Industrial Users (greater than 25,000 gpd)
- Protect the City POTW from high industrial loads
- Limits are usually standard for each user of the POTW and are derived on what the POTW can handle
  - Total loading (flow, organics, nutrients)
  - Pass-through interferences (salt)
  - Toxicants (e.g. heavy metals)



TYPES OF DISCHARGE

- Direct Dischargers:
  - Treatment is almost always necessary
  - Discharges permitted by USEPA (or states)
  - Limits exist to protect receiving water beneficial uses
  - Industrial permit limits are based on
    - What you manufacture
    - Water body use protection (recreation, sensitive species, navigation, etc.)



OWNER/OPERATOR OBLIGATIONS

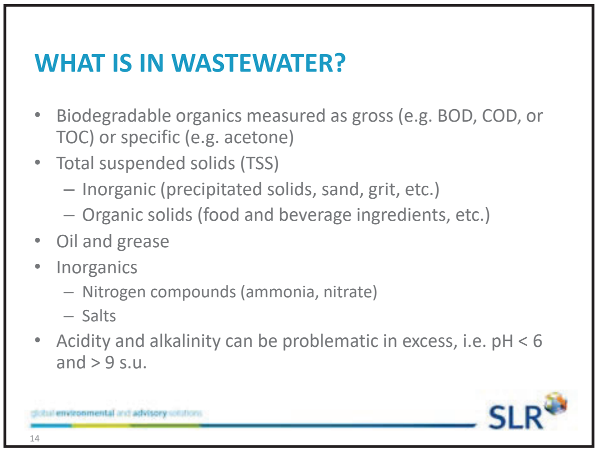
- Facility must be properly operated and maintained, including adequate:
  - Funding
  - Staffing and training
  - Laboratory and process controls
  - Quality assurance protocols
- Operations must follow Best Management Practices
  - No dilution to achieve compliance
  - Process monitoring and reporting

RED DIAMOND OUTFALLS

- The current NPDES permit for the facility allows for discharge at up to eight individual outfalls
- Outfalls discharge to unnamed tributaries of both Raccoon Creek and Elk Fork
- Wastewater includes sanitary, stormwater, and/or process wastewater

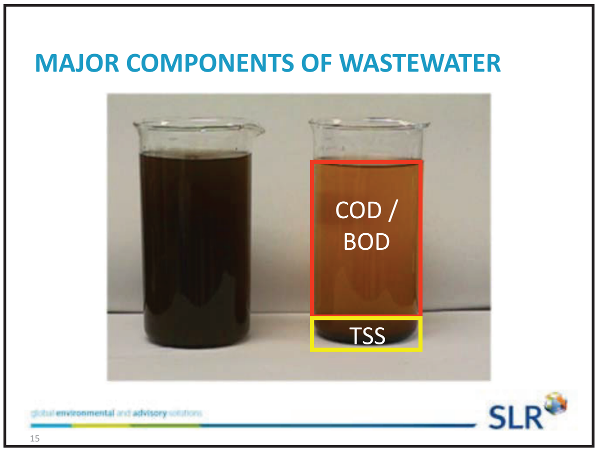
Outfall Number	001	003	004	005	006	007	010	011
Treatment Type	WWTP (Package Plant)	WWTP (Package Plant)	Not in service	Not in service	WWTP (Package Plant)	Solids Removal	WWTP (Package Plant)	WWTP (Engineered)
Wastewater Sources	Sanitary, Process	Sanitary	N/A	N/A	Sanitary	Wash Water + Stormwater	Sanitary, Process	Process (PETN)

WASTEWATER SOURCES AND CHARACTERISTICS



WHAT IS IN WASTEWATER?

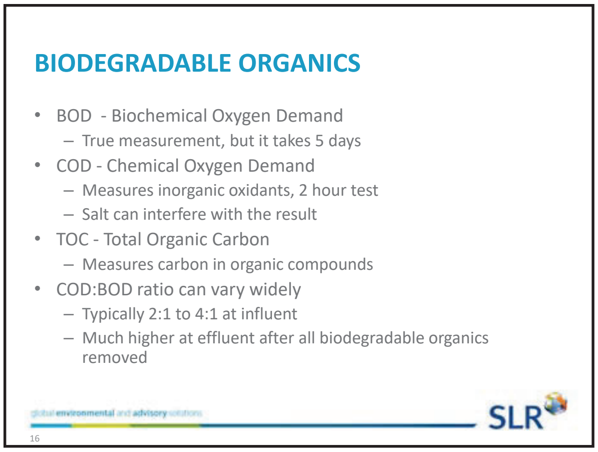
- Biodegradable organics measured as gross (e.g. BOD, COD, or TOC) or specific (e.g. acetone)
- Total suspended solids (TSS)
  - Inorganic (precipitated solids, sand, grit, etc.)
  - Organic solids (food and beverage ingredients, etc.)
- Oil and grease
- Inorganics
  - Nitrogen compounds (ammonia, nitrate)
  - Salts
- Acidity and alkalinity can be problematic in excess, i.e. pH < 6 and > 9 s.u.



MAJOR COMPONENTS OF WASTEWATER

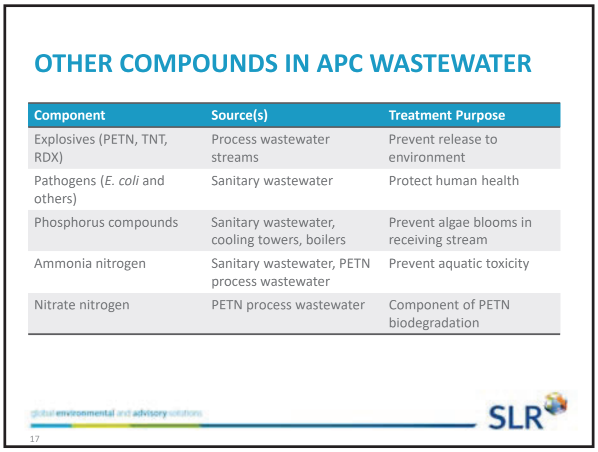
COD / BOD

TSS



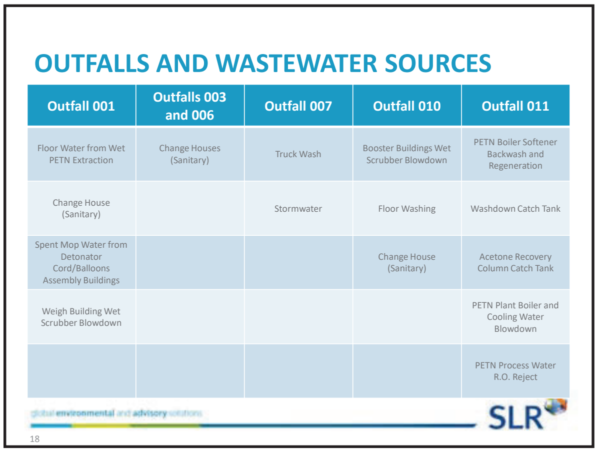
BIODEGRADABLE ORGANICS

- BOD - Biochemical Oxygen Demand
  - True measurement, but it takes 5 days
- COD - Chemical Oxygen Demand
  - Measures inorganic oxidants, 2 hour test
  - Salt can interfere with the result
- TOC - Total Organic Carbon
  - Measures carbon in organic compounds
- COD:BOD ratio can vary widely
  - Typically 2:1 to 4:1 at influent
  - Much higher at effluent after all biodegradable organics removed



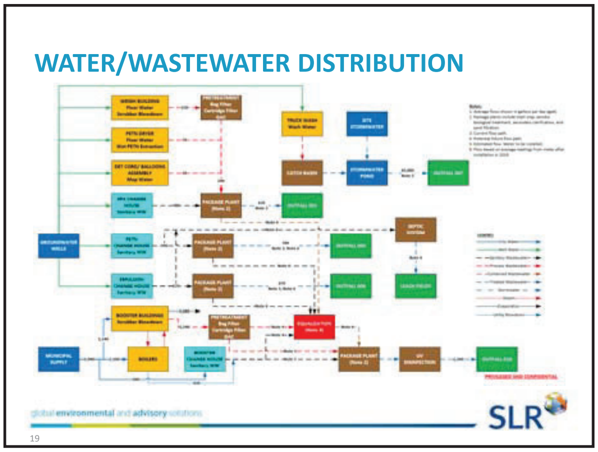
OTHER COMPOUNDS IN APC WASTEWATER

Component	Source(s)	Treatment Purpose
Explosives (PETN, TNT, RDX)	Process wastewater streams	Prevent release to environment
Pathogens (*E. coli* and others)	Sanitary wastewater	Protect human health
Phosphorus compounds	Sanitary wastewater, cooling towers, boilers	Prevent algae blooms in receiving stream
Ammonia nitrogen	Sanitary wastewater, PETN process wastewater	Prevent aquatic toxicity
Nitrate nitrogen	PETN process wastewater	Component of PETN biodegradation



OUTFALLS AND WASTEWATER SOURCES

Outfall 001	Outfalls 003 and 006	Outfall 007	Outfall 010	Outfall 011
Floor Water from Wet PETN Extraction	Change Houses (Sanitary)	Truck Wash	Booster Buildings Wet Scrubber Blowdown	PETN Boiler Softener Backwash and Regeneration
Change House (Sanitary)		Stormwater	Floor Washing	Washdown Catch Tank
Spent Mop Water from Detonator Cord/Balloons Assembly Buildings			Change House (Sanitary)	Acetone Recovery Column Catch Tank
Weigh Building Wet Scrubber Blowdown				PETN Plant Boiler and Cooling Water Blowdown
				PETN Process Water R.O. Reject



WATER/WASTEWATER DISTRIBUTION

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WASTEWATER TREATMENT OVERVIEW

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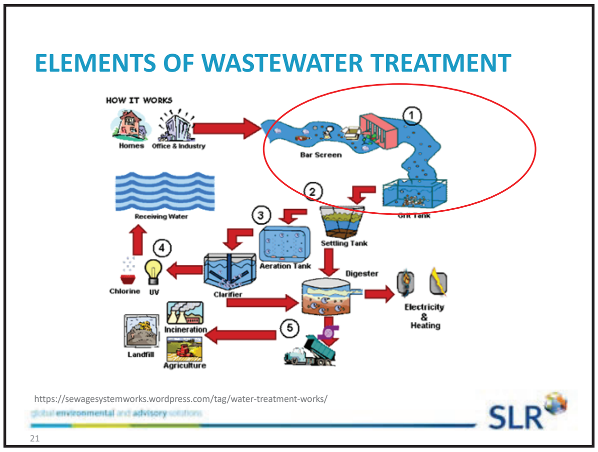

ELEMENTS OF WASTEWATER TREATMENT

https://sewagesystemworks.wordpress.com/tag/water-treatment-works/

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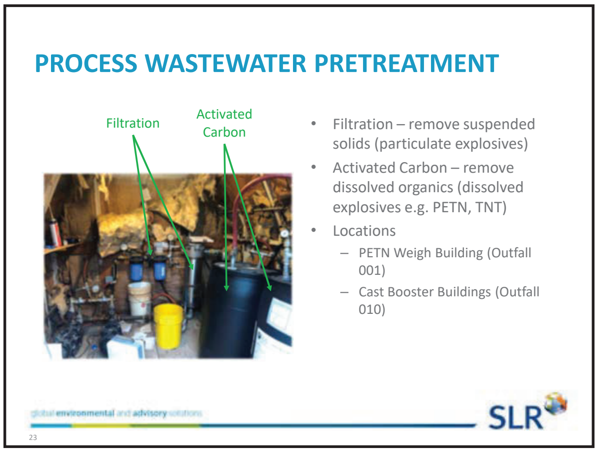
PRIMARY TREATMENT

- Physical process that separates water from solids or items that you do not want in the WWTP (grit chambers, bar screens, trash traps)
- Removal of suspended solids, colloidal particles, oil, and grease
- Package plants use trash traps

Example of a grit chamber

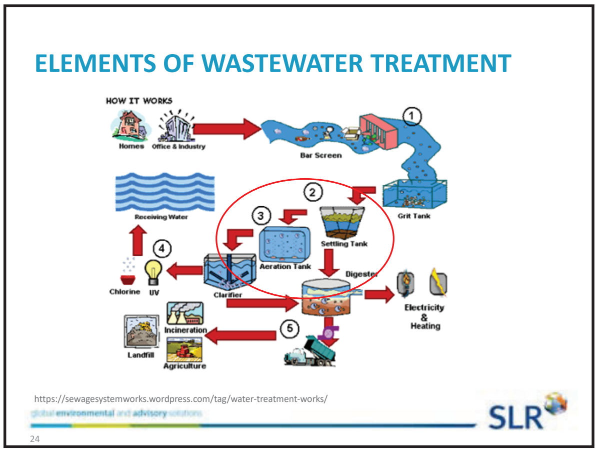
22



PROCESS WASTEWATER PRETREATMENT

- Filtration – remove suspended solids (particulate explosives)
- Activated Carbon – remove dissolved organics (dissolved explosives e.g. PETN, TNT)
- Locations
  - PETN Weigh Building (Outfall 001)
  - Cast Booster Buildings (Outfall 010)

23



ELEMENTS OF WASTEWATER TREATMENT

https://sewagesystemworks.wordpress.com/tag/water-treatment-works/

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OBJECTIVES OF BIOLOGICAL TREATMENT

- Utilize bacteria (biomass) to remove organic pollutants
- Mix wastewater with biomass
- Maintain proper environment for biomass
- Separate biomass from treated wastewater to be recycled and/or wasted

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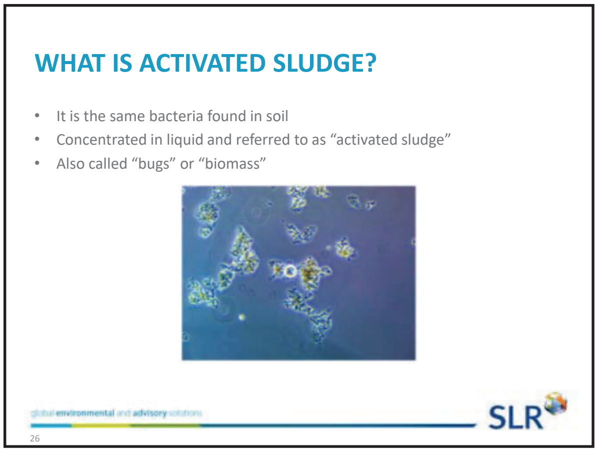

WHAT IS ACTIVATED SLUDGE?

- It is the same bacteria found in soil
- Concentrated in liquid and referred to as "activated sludge"
- Also called "bugs" or "biomass"

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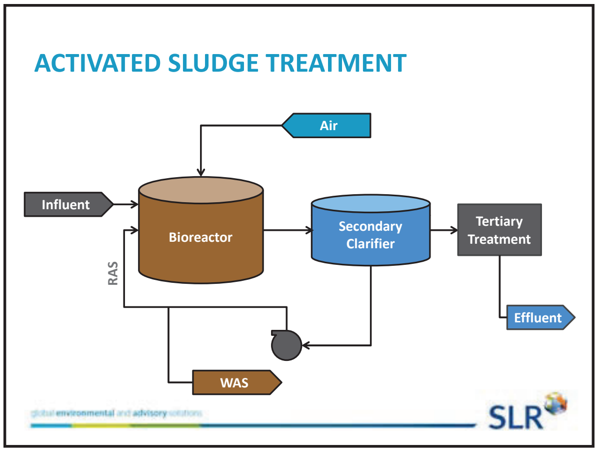

ACTIVATED SLUDGE TREATMENT

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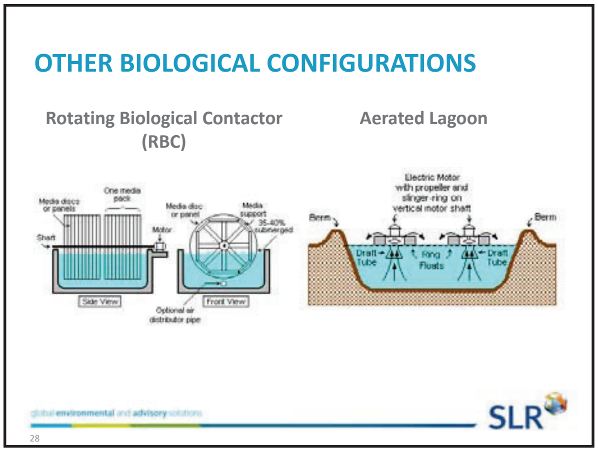

OTHER BIOLOGICAL CONFIGURATIONS

Rotating Biological Contactor (RBC) **Aerated Lagoon**

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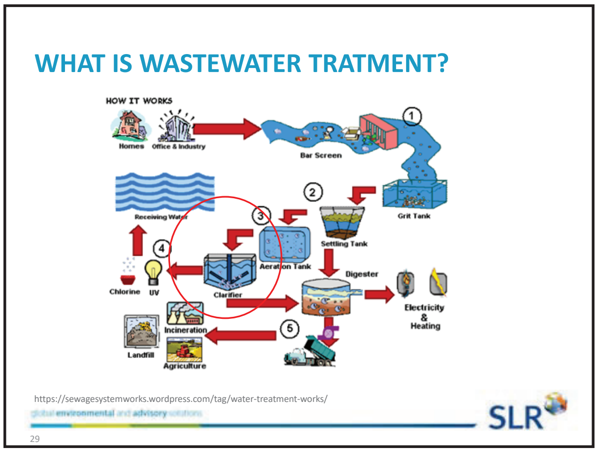

WHAT IS WASTEWATER TRATMENT?

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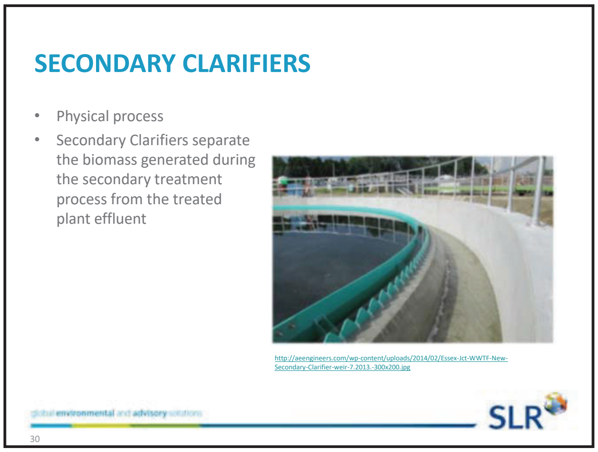

SECONDARY CLARIFIERS

- Physical process
- Secondary Clarifiers separate the biomass generated during the secondary treatment process from the treated plant effluent

http://aeengineers.com/wp-content/uploads/2014/02/Essex-Jct-WWTF-New-Secondary-Clarifier-weir-7.2013.-300x200.jpg

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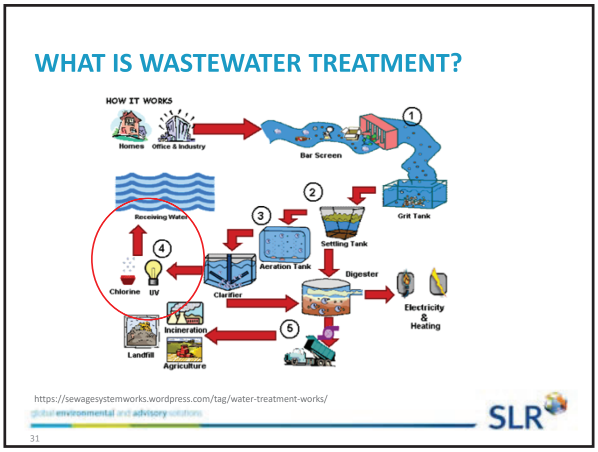

WHAT IS WASTEWATER TREATMENT?

https://sewagesystemworks.wordpress.com/tag/water-treatment-works/

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TERTIARY TREATMENT

- Filtration
  - Removal of residual particulates (solids)
  - "Polishing" step
- Water passes through media bed
  - Downflow or upflow
  - Singular or multi-media
- Accumulated solids collected and disposed

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TERTIARY TREATMENT

- Disinfection
  - The destruction, inactivation, or removal of pathogenic (disease-causing) microorganisms can be achieved by chemical, physical, or biological means.
  - Chlorine
  - Ozone
  - UV

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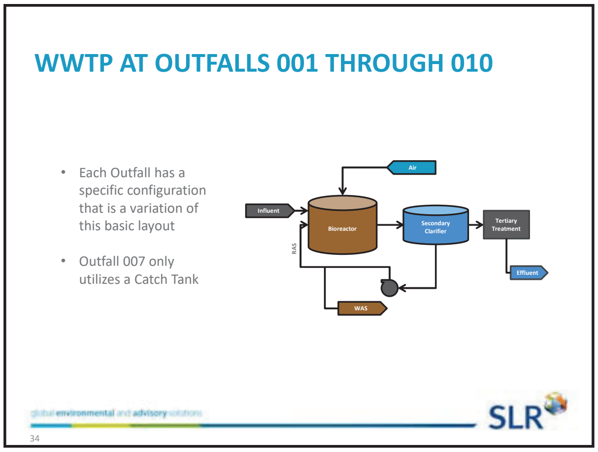

WWTP AT OUTFALLS 001 THROUGH 010

- Each Outfall has a specific configuration that is a variation of this basic layout
- Outfall 007 only utilizes a Catch Tank

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OUTFALL 001 WWTP

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OUTFALL 003 AND 006 WWTPS

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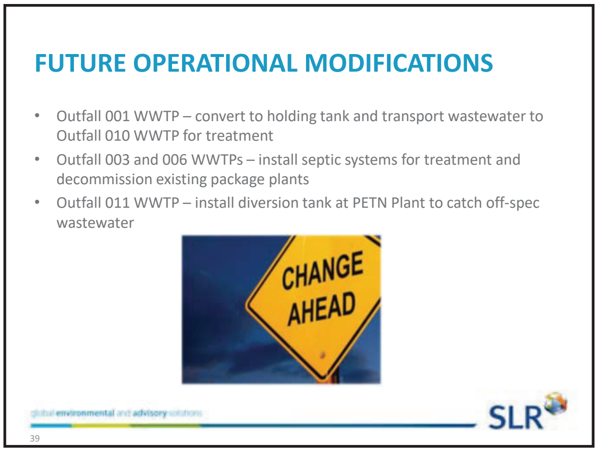
OUTFALL 007 (PRETREATMENT)

Solids Catch Tank

Stormwater Basin

OUTFALL 010 WWTP

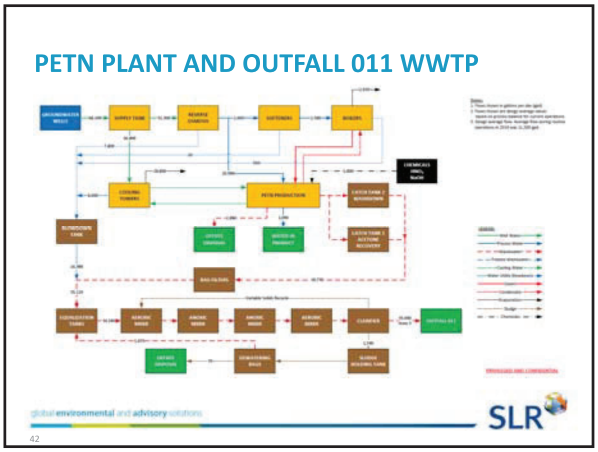


FUTURE OPERATIONAL MODIFICATIONS

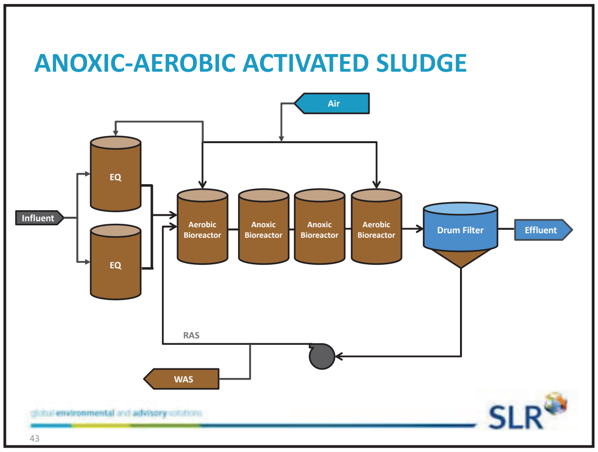
- Outfall 001 WWTP – convert to holding tank and transport wastewater to Outfall 010 WWTP for treatment
- Outfall 003 and 006 WWTPs – install septic systems for treatment and decommission existing package plants
- Outfall 011 WWTP – install diversion tank at PETN Plant to catch off-spec wastewater

15-MINUTE BREAK

OUTFALL 011 WWTP UNIT OPERATIONS



PETN PLANT AND OUTFALL 011 WWTP



ANOXIC-AEROBIC ACTIVATED SLUDGE

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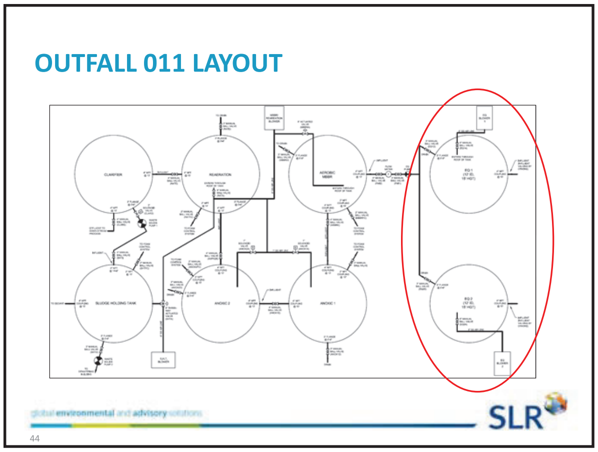

OUTFALL 011 LAYOUT

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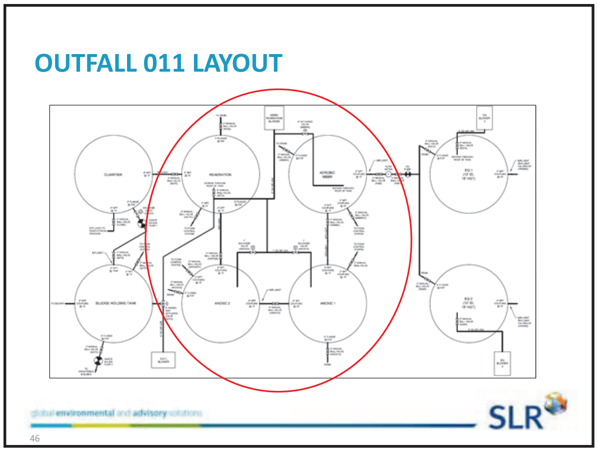
ATTENUATION/EQUALIZATION

- Dampen flow and load variations
- Provide some inventory capacity
- Prevent shock loadings to WWTP
- Operators adjust discharge flow to suit biological system
- Manage tank inventories

45



OUTFALL 011 LAYOUT

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BIOLOGICAL TREATMENT OVERVIEW

- Aerobic bacteria biologically utilize pollutants as source of carbon
- Typically soluble pollutants (BOD, COD, nitrogen, etc.)
- Industry standard for organic pollutants and ammonia is activated sludge
- APC also has used fixed-film biomass on media to provide additional treatment (IFAS process)

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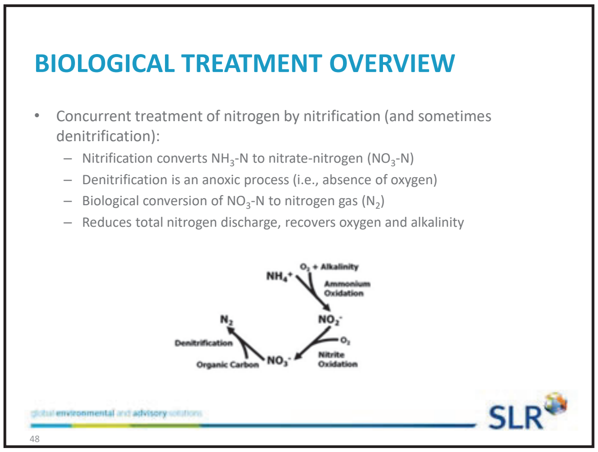

BIOLOGICAL TREATMENT OVERVIEW

- Concurrent treatment of nitrogen by nitrification (and sometimes denitrification):
  - Nitrification converts NH_3-N to nitrate-nitrogen (NO_3-N)
  - Denitrification is an anoxic process (i.e., absence of oxygen)
  - Biological conversion of NO_3-N to nitrogen gas (N_2)
  - Reduces total nitrogen discharge, recovers oxygen and alkalinity

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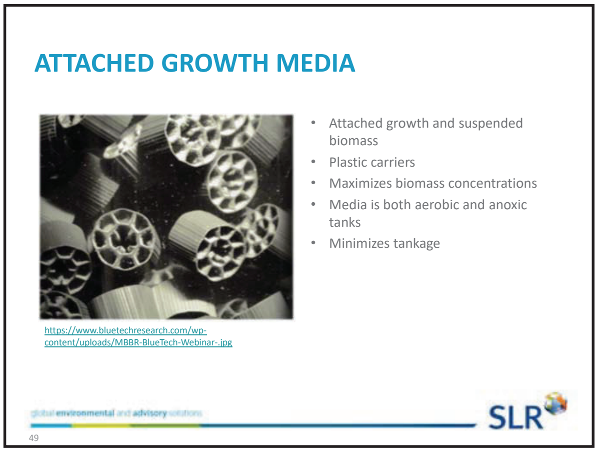

ATTACHED GROWTH MEDIA

- Attached growth and suspended biomass
- Plastic carriers
- Maximizes biomass concentrations
- Media is both aerobic and anoxic tanks
- Minimizes tankage

https://www.bluetechresearch.com/wp-content/uploads/MBBR-BlueTech-Webinar-.jpg

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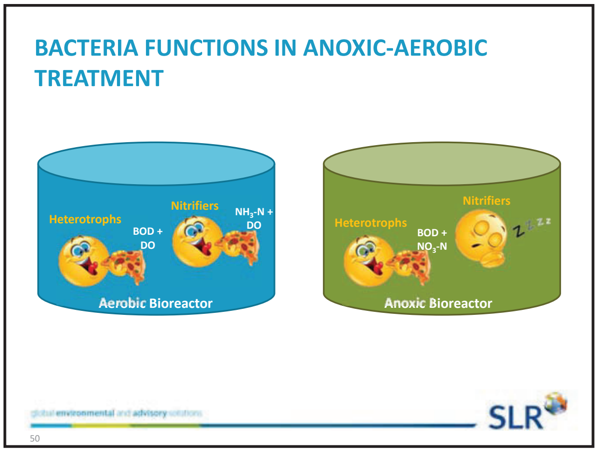

BACTERIA FUNCTIONS IN ANOXIC-AEROBIC TREATMENT

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TYPES OF GROWTH ENVIRONMENTS

Environment	Oxygen Source	Carbon Source	End Products
Septic	Sulfates (SO_4^{2-})	BOD	H_2S, CO_2, H_2O
Anaerobic	None	BOD	CH_4, CO_2, H_2O
Aerobic – Heterotrophic	Dissolved Oxygen (DO)	BOD	CO_2, H_2O
Aerobic – Nitrifying	Dissolved Oxygen (DO)	Alkalinity (HCO_3^-)	NO_3^-, H_2O, H^+
Anoxic	Dissolved Nitrates (NO_3^-)	BOD	CO_2, H_2O, N_2, HCO_3^-

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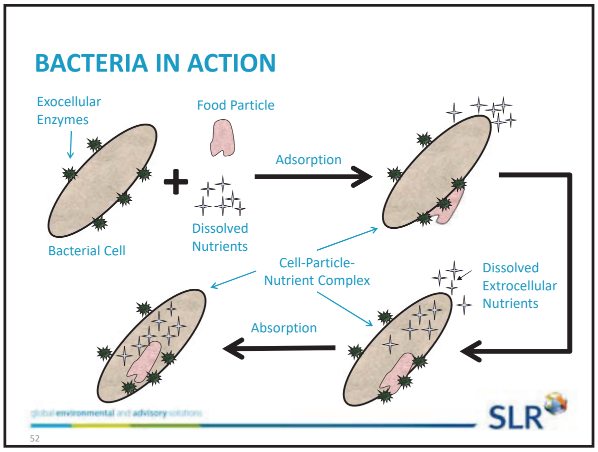

BACTERIA IN ACTION

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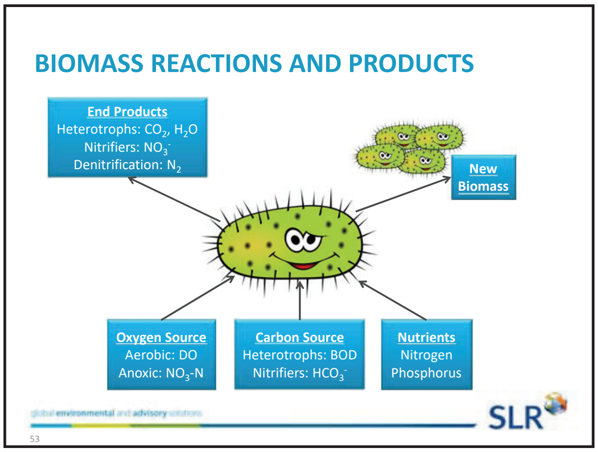

BIOMASS REACTIONS AND PRODUCTS

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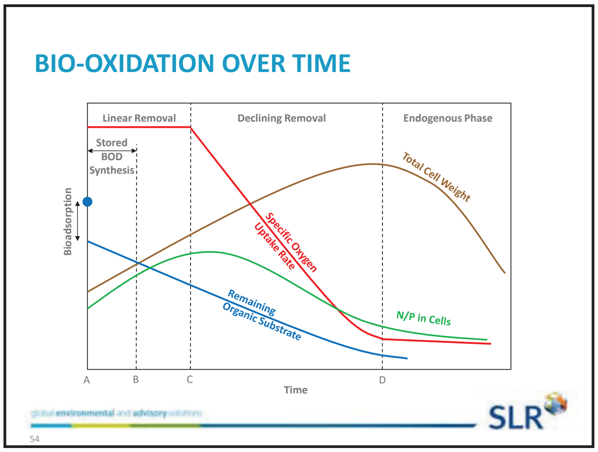

BIO-OXIDATION OVER TIME

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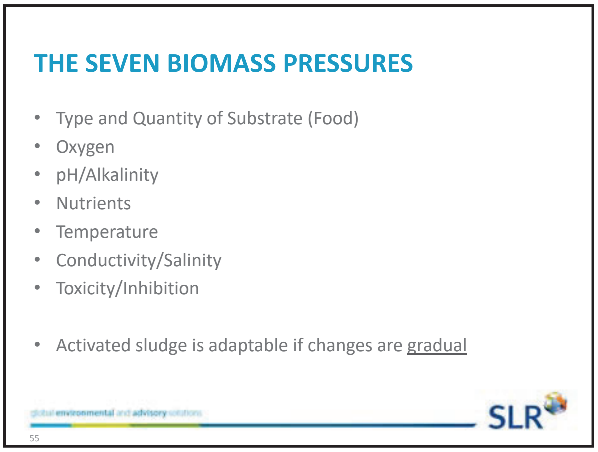
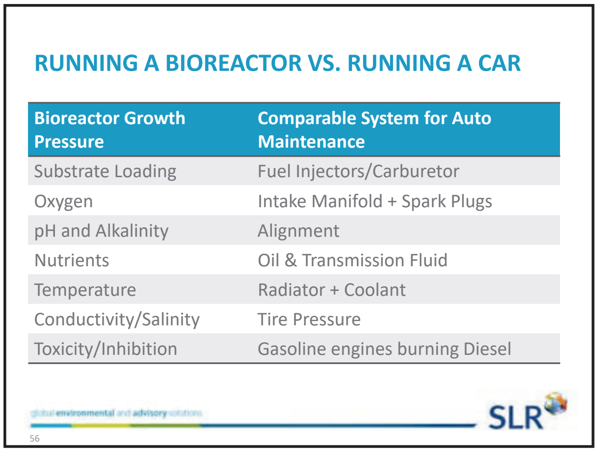


THE SEVEN BIOMASS PRESSURES

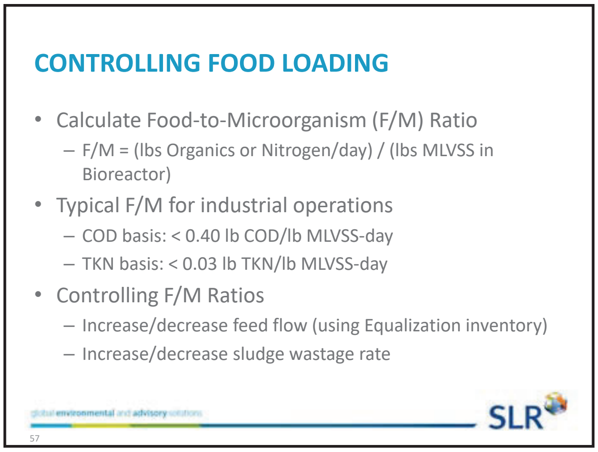
- Type and Quantity of Substrate (Food)
- Oxygen
- pH/Alkalinity
- Nutrients
- Temperature
- Conductivity/Salinity
- Toxicity/Inhibition

- Activated sludge is adaptable if changes are <u>gradual</u>



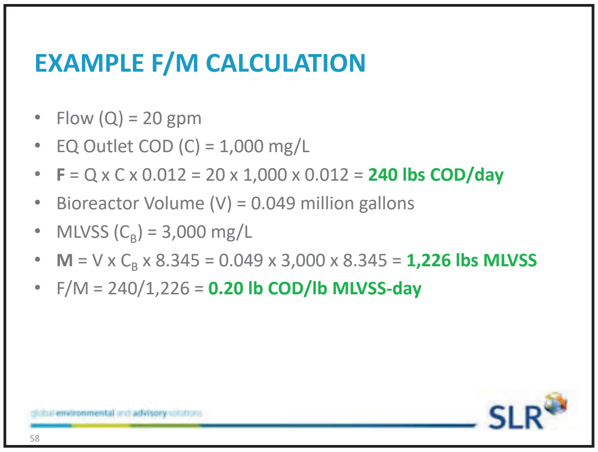
RUNNING A BIOREACTOR VS. RUNNING A CAR

Bioreactor Growth Pressure	Comparable System for Auto Maintenance
Substrate Loading	Fuel Injectors/Carburetor
Oxygen	Intake Manifold + Spark Plugs
pH and Alkalinity	Alignment
Nutrients	Oil & Transmission Fluid
Temperature	Radiator + Coolant
Conductivity/Salinity	Tire Pressure
Toxicity/Inhibition	Gasoline engines burning Diesel



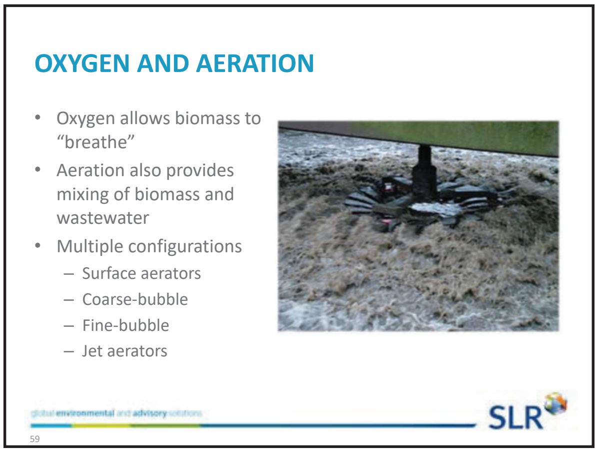
CONTROLLING FOOD LOADING

- Calculate Food-to-Microorganism (F/M) Ratio
  - F/M = (lbs Organics or Nitrogen/day) / (lbs MLVSS in Bioreactor)
- Typical F/M for industrial operations
  - COD basis: < 0.40 lb COD/lb MLVSS-day
  - TKN basis: < 0.03 lb TKN/lb MLVSS-day
- Controlling F/M Ratios
  - Increase/decrease feed flow (using Equalization inventory)
  - Increase/decrease sludge wastage rate



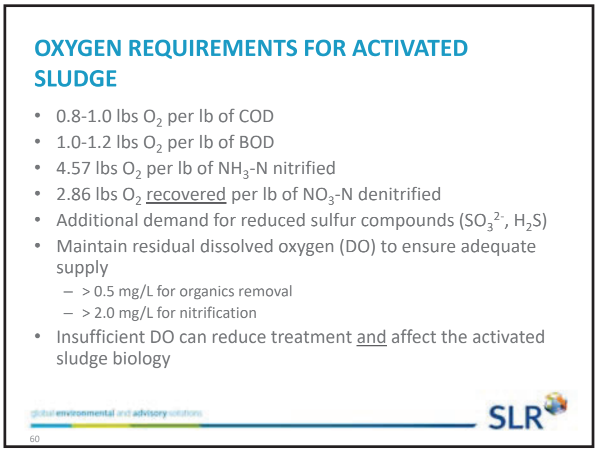
EXAMPLE F/M CALCULATION

- Flow (Q) = 20 gpm
- EQ Outlet COD (C) = 1,000 mg/L
- **F** = Q x C x 0.012 = 20 x 1,000 x 0.012 = **240 lbs COD/day**
- Bioreactor Volume (V) = 0.049 million gallons
- MLVSS (C_B) = 3,000 mg/L
- **M** = V x C_B x 8.345 = 0.049 x 3,000 x 8.345 = **1,226 lbs MLVSS**
- F/M = 240/1,226 = **0.20 lb COD/lb MLVSS-day**



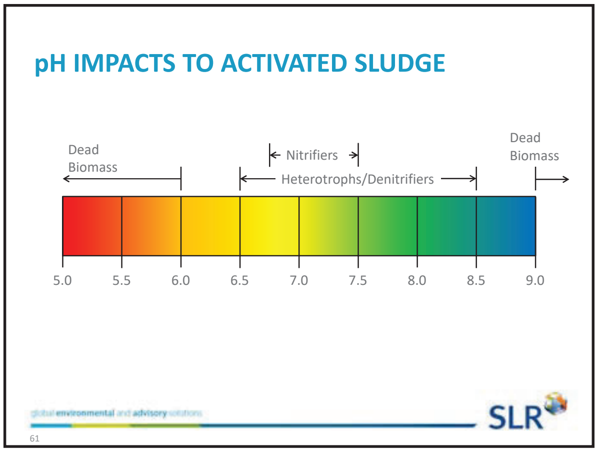
OXYGEN AND AERATION

- Oxygen allows biomass to "breathe"
- Aeration also provides mixing of biomass and wastewater
- Multiple configurations
  - Surface aerators
  - Coarse-bubble
  - Fine-bubble
  - Jet aerators



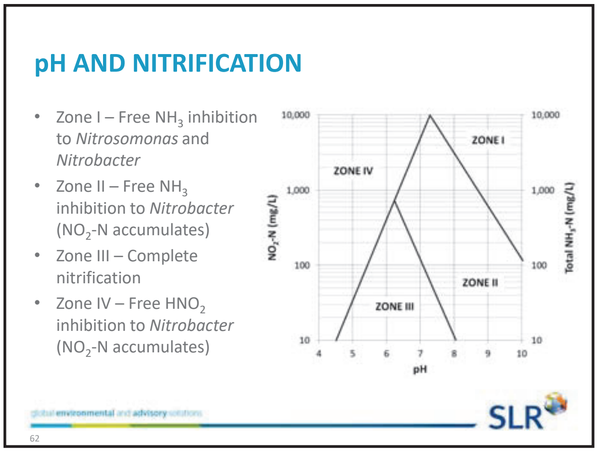
OXYGEN REQUIREMENTS FOR ACTIVATED SLUDGE

- 0.8-1.0 lbs O_2 per lb of COD
- 1.0-1.2 lbs O_2 per lb of BOD
- 4.57 lbs O_2 per lb of NH_3-N nitrified
- 2.86 lbs O_2 <u>recovered</u> per lb of NO_3-N denitrified
- Additional demand for reduced sulfur compounds (SO_3^{2-}, H_2S)
- Maintain residual dissolved oxygen (DO) to ensure adequate supply
  - > 0.5 mg/L for organics removal
  - > 2.0 mg/L for nitrification
- Insufficient DO can reduce treatment <u>and</u> affect the activated sludge biology



pH IMPACTS TO ACTIVATED SLUDGE

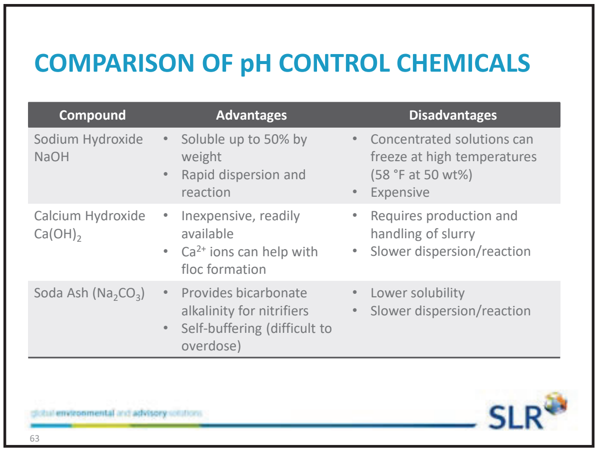
global environmental and advisory solutions



pH AND NITRIFICATION

- Zone I – Free NH_3 inhibition to *Nitrosomonas* and *Nitrobacter*
- Zone II – Free NH_3 inhibition to *Nitrobacter* (NO_2-N accumulates)
- Zone III – Complete nitrification
- Zone IV – Free HNO_2 inhibition to *Nitrobacter* (NO_2-N accumulates)

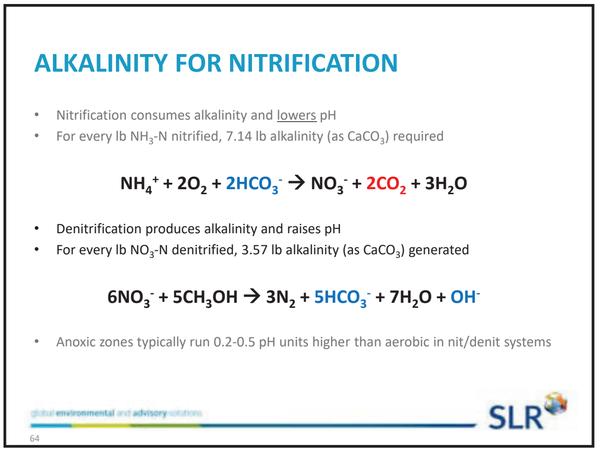
global environmental and advisory solutions



COMPARISON OF pH CONTROL CHEMICALS

Compound	Advantages	Disadvantages
Sodium Hydroxide NaOH	• Soluble up to 50% by weight • Rapid dispersion and reaction	• Concentrated solutions can freeze at high temperatures (58 °F at 50 wt%) • Expensive
Calcium Hydroxide $Ca(OH)_2$	• Inexpensive, readily available • Ca^{2+} ions can help with floc formation	• Requires production and handling of slurry • Slower dispersion/reaction
Soda Ash (Na_2CO_3)	• Provides bicarbonate alkalinity for nitrifiers • Self-buffering (difficult to overdose)	• Lower solubility • Slower dispersion/reaction

global environmental and advisory solutions



ALKALINITY FOR NITRIFICATION

- Nitrification consumes alkalinity and lowers pH
- For every lb NH_3-N nitrified, 7.14 lb alkalinity (as $CaCO_3$) required

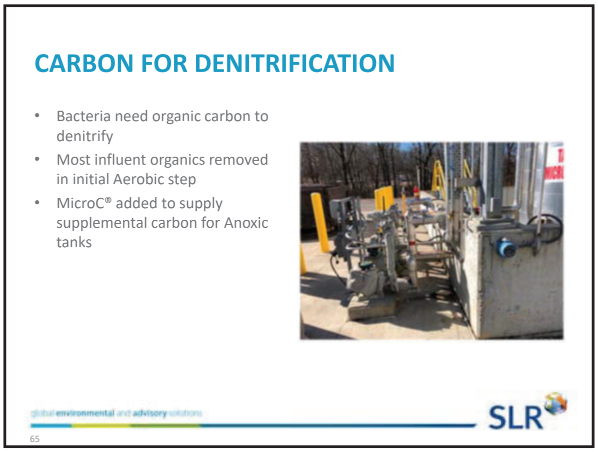
$$NH_4^+ + 2O_2 + 2HCO_3^- \rightarrow NO_3^- + 2CO_2 + 3H_2O$$

- Denitrification produces alkalinity and raises pH
- For every lb NO_3-N denitrified, 3.57 lb alkalinity (as $CaCO_3$) generated

$$6NO_3^- + 5CH_3OH \rightarrow 3N_2 + 5HCO_3^- + 7H_2O + OH^-$$

- Anoxic zones typically run 0.2-0.5 pH units higher than aerobic in nit/denit systems

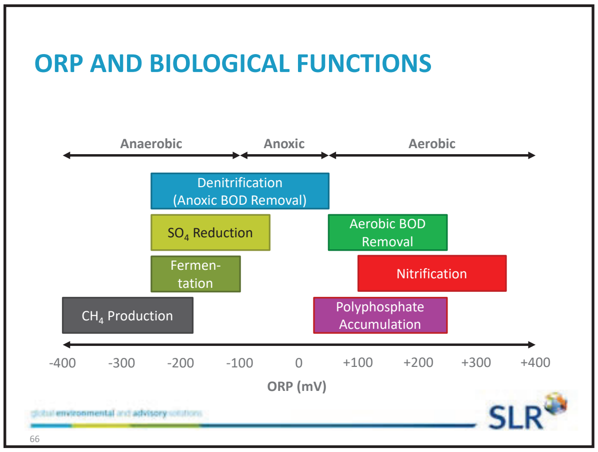
global environmental and advisory solutions



CARBON FOR DENITRIFICATION

- Bacteria need organic carbon to denitrify
- Most influent organics removed in initial Aerobic step
- MicroC® added to supply supplemental carbon for Anoxic tanks

global environmental and advisory solutions

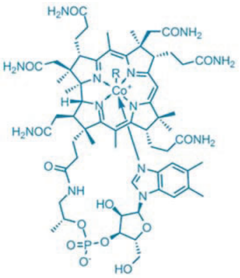


ORP AND BIOLOGICAL FUNCTIONS

global environmental and advisory solutions

NUTRIENT REQUIREMENTS FOR BIOMASS

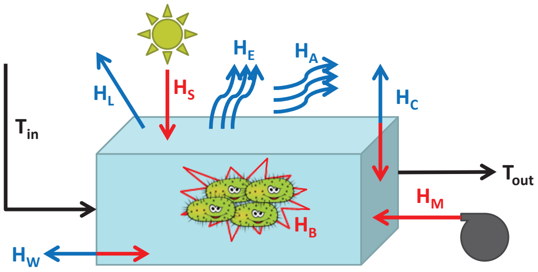
- Bacteria require nutrients as "vitamins" to grow and synthesize
- Macronutrients (nitrogen, phosphorus)
  - Sanitary has sufficient nutrients, industrial is often deficient
- Micronutrients
  - Iron, manganese, cobalt, various other metals
- 100:5:1 BOD:N:P for macronutrients is generally a "safe" demand but actual will be driven by sludge production rate (function of F/M and sludge age)



NUTRIENT ADDITION SYSTEMS

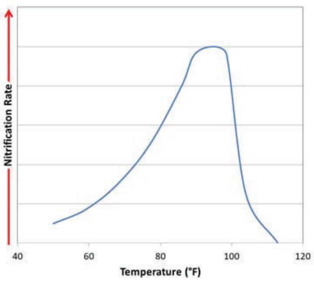
- Phosphoric acid or sodium phosphate for P
- Vendor-provided micronutrient broths (if required)
- Nutrients should be added on a continuous basis
- Options for controlling addition rate:
  - Measure effluent residual (feedback control)
  - Measure influent COD/BOD (feedforward control)
  - Measure MLSS wastage (secondary control)

TEMPERATURE MODELING AND CONTROL



TEMPERATURE RANGES

- Peak heterotroph performance between 25-40 °C (77-104 °F)
- Peak nitrifier performance between 30-35 °C (86-95 °F)
- Sharp decline in nitrifier activity above 37 °C (99 °F)
- Temperature control may be required



TEMPERATURE CONTROLS

- Package Plants – Tarps
- PETN WWTP – Insulated Tanks
- Plans to include steam addition for additional heating at Outfall 010 WWTP

CONDUCTIVITY

- Surrogate measure of Total Dissolved Solids (TDS) or salinity
- Activated sludge can operate anywhere from fresh water (<500 mg/L TDS) to marine water (>30,000 TDS) but adapts slowly
- Bacteria must balance osmotic pressure inside and outside the cell
  - TDS rises too fast → bacteria lose water to surroundings and shrivel
  - TDS drops too fast → bacteria take in too much water and explode

SOURCES OF CONDUCTIVITY

- High conductivity streams
  - Softener regenerant (boilers, makeup water)
  - Boiler blowdown
  - Cooling tower blowdown
- Low conductivity streams
  - Stormwater
  - Boiler condensate
  - Sanitary wastewater
  - PETN Process wastewater

CONTROLLING CONDUCTIVITY

- Conductivity should not vary appreciably under normal operations
- Best control option is flow management
  - Diversion/metered introduction of off-spec or high-strength streams

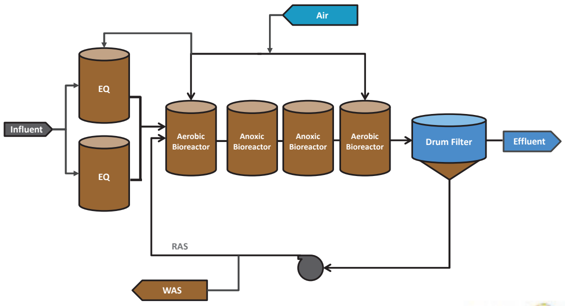
INHIBITION VS. TOXICITY

- **Inhibition** disrupts bacteria activity and/or reproduction
- **Toxicity** kills bacteria
- Can be acute or chronic
- Can be chemical, environmental, or both
- Compounds can cause either effect (function of concentration)

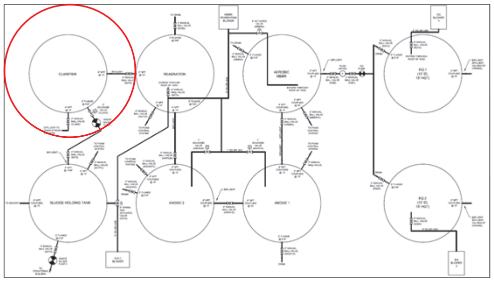
IDENTIFYING TOXICITY OR INHIBITION

- Known inhibitory compounds in APC wastewater
  - Acetone degradation products
  - NH_3-N, NO_3-N from Acetone recovery column bottoms
- Indicators of potential inhibition/toxicity
  - Sudden change in residual DO
  - Sudden change in pH
  - Deteriorating effluent quality (BOD, NH_3-N, turbidity/TSS)

ANOXIC-AEROBIC ACTIVATED SLUDGE

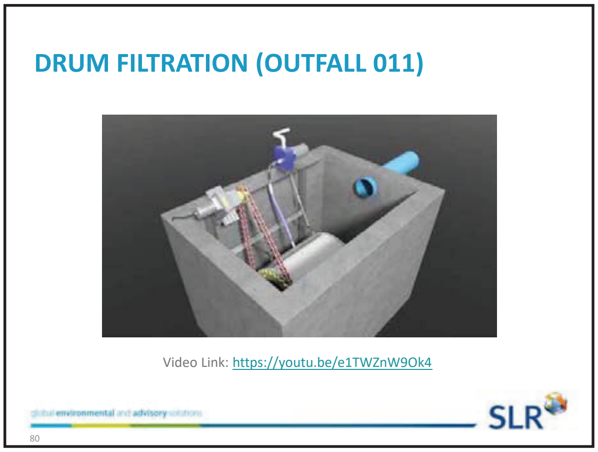


OUTFALL 011 LAYOUT



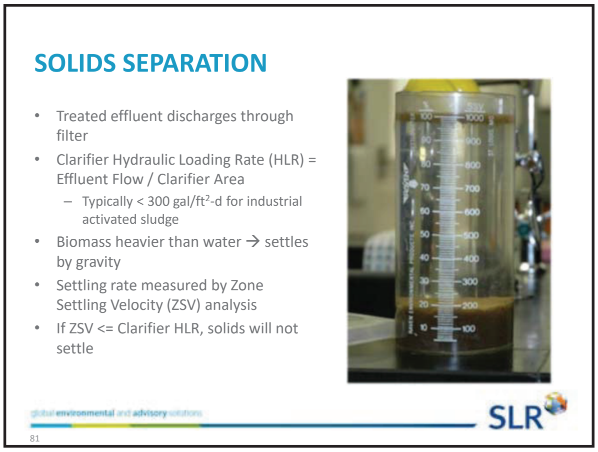
CLARIFICATION PROCESS

- Biomass forms small aggregates known as “flocs”
- Settle out biomass and put it back to work
- Treated water leaves the system over the weirs



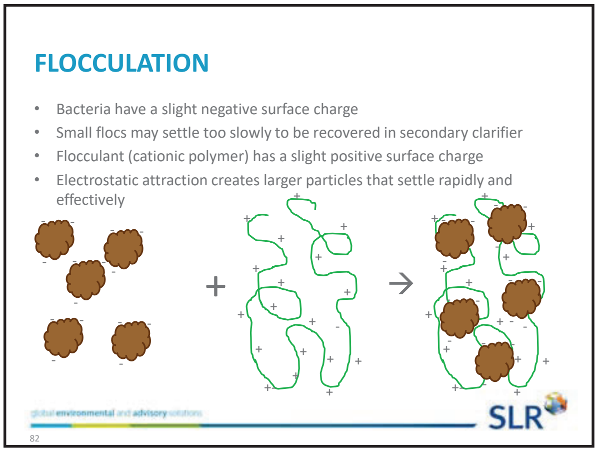
DRUM FILTRATION (OUTFALL 011)

Video Link: https://youtu.be/e1TWZnW9Ok4



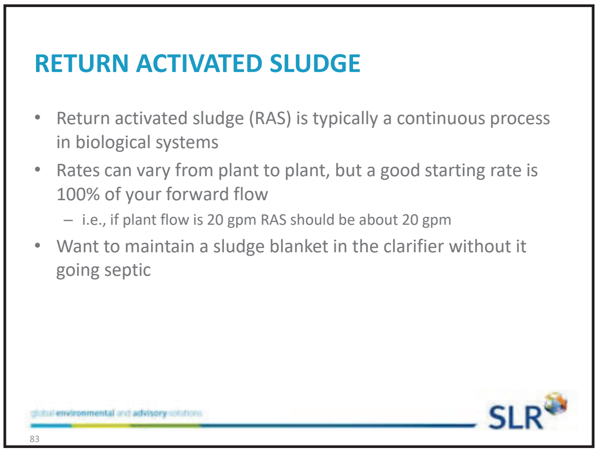
SOLIDS SEPARATION

- Treated effluent discharges through filter
- Clarifier Hydraulic Loading Rate (HLR) = Effluent Flow / Clarifier Area
  - Typically < 300 gal/ft^2-d for industrial activated sludge
- Biomass heavier than water → settles by gravity
- Settling rate measured by Zone Settling Velocity (ZSV) analysis
- If ZSV <= Clarifier HLR, solids will not settle



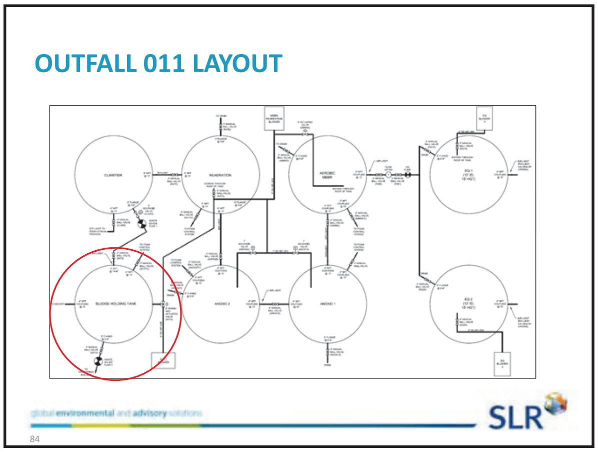
FLOCCULATION

- Bacteria have a slight negative surface charge
- Small flocs may settle too slowly to be recovered in secondary clarifier
- Flocculant (cationic polymer) has a slight positive surface charge
- Electrostatic attraction creates larger particles that settle rapidly and effectively



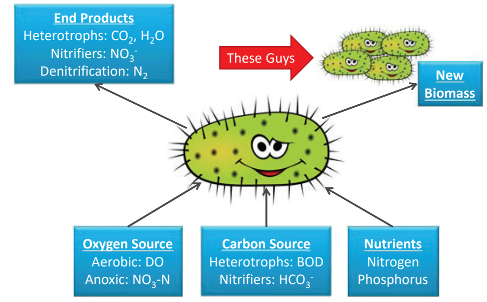
RETURN ACTIVATED SLUDGE

- Return activated sludge (RAS) is typically a continuous process in biological systems
- Rates can vary from plant to plant, but a good starting rate is 100% of your forward flow
  - i.e., if plant flow is 20 gpm RAS should be about 20 gpm
- Want to maintain a sludge blanket in the clarifier without it going septic



OUTFALL 011 LAYOUT

SLUDGE WASTING



End Products
Heterotrophs: CO_2, H_2O
Nitrifiers: NO_3^-
Denitrification: N_2

These Guys

New Biomass

Oxygen Source
Aerobic: DO
Anoxic: NO_3-N

Carbon Source
Heterotrophs: BOD
Nitrifiers: HCO_3^-

Nutrients
Nitrogen
Phosphorus

DETERMINING SLUDGE WASTAGE

- Biomass must be purged to compensate for new growth
- Mean Cell Residence Time (MCRT or "Sludge Age") – average time any given bacteria spends in the system
  - Anywhere from < 10 to > 50 days
  - Longer in systems that have to nitrify (nitrifiers grow slower)
- Philosophies on sludge wasting rates
  - Option 1 – pick a target F/M, adjust wastage to maintain Bioreactor mixed liquor
  - Option 2 – pick a target sludge age, allow mixed liquor and F/M to fluctuate
- Waste sludge is hauled or dewatered

CHEMICAL FEED SYSTEMS

Chemical	Purpose	Addition Point
Sodium Phosphate	Provide nutrient phosphorus for biomass	Outfall 011 WWTP
Sodium Carbonate (Soda Ash)	Alkalinity supply for biomass (nitrification), pH control	Outfall 011 WWTP (Aerobic Bioreactor)
MicroC®	Supplemental carbon for denitrification	Outfall 011 WWTP (Anoxic Bioreactors)
Flocculant Polymer*	Dewatering aid for biomass	Outfall 011 WWTP Waste Solids Pump #2 Discharge
Defoamer*	Foam control in Bioreactors	Outfall 011 WWTP Aerobic and Post-Oxidation Bioreactors)
MicroC®*	Supplemental carbon for organic load management	Outfall 010 WWTP

*Planned future systems

FOR MORE INFORMATION

Todd Lusk, PE
tlusk@slrconsulting.com
(859) 287-9801

END OF SESSION 1

QUIZ AND LUNCH

TRAINING REVIEW QUIZ

APC SESSION 1 OPERATIONS TRAINING

Name: ______________________________ Score: ______ / 100

1. The NPDES permit for the Red Diamond plant indicates that the facility must provide which of the following?
   a. Adequate funding, staffing, and training
   b. Laboratory and process controls
   c. Donuts for the operators
   d. Both A and B

2. Primary treatment is provided mainly to remove which type of pollutant?
   a. Dissolved Organics
   b. Suspended Solids
   c. Ammonia
   d. Explosives

3. What is the purpose of wasting biomass from the WWTP bioreactors?
   a. Maintain a suitable MCRT/sludge age
   b. Maintain the proper MLSS concentration
   c. Maintain the correct F/M ratio
   d. All of the above

4. Which of these chemicals is added at the PETN Plant WWTP to provide carbon for the Anoxic Bioreactors?
   a. MicroC
   b. Sodium Phosphate
   c. Soda Ash
   d. Polymer

5. What is the purpose of having the Equalization Tanks in a wastewater treatment plant?
   a. Dampening variations in flow and load
   b. Preventing shock loads
   c. Providing space to store wastewater inventory
   d. All of the above

6. What process is used at the Outfall 010 WWTP to remove pathogens from wastewater?
   a. Chlorine disinfection
   b. Steam addition
   c. Ultraviolet disinfection
   d. Filtration

7. What parameter is used at the PETN Plant WWTP to confirm that the Anoxic Bioreactors have the correct environment to perform denitrification?
   a. Dissolved Oxygen
   b. Oxidation-Reduction Potential
   c. pH
   d. Temperature

8. Which of the following statements about nutrients in wastewater at Red Diamond is **true**?
   a. All WWTPs have plenty of nutrients
   b. Industrial wastewater has plenty of nutrients, sanitary wastewater requires addition
   c. Sanitary wastewater has plenty of nutrients, industrial wastewater requires addition
   d. All WWTPs require nutrient addition

9. If today's COD load to the PETN Plant WWTP is approximately 200 lbs, and the Aeration Basins have a biomass inventory of approximately 2,000 lbs, what is the current F/M_{COD} in the Bioreactors?
   a. 200
   b. 2,000
   c. 0.1
   d. 10.0

10. Activated sludge can adapt to changes in its environment if those changes are:
    a. Gradual
    b. Sudden
    c. Only during the summer
    d. Sung by David Bowie

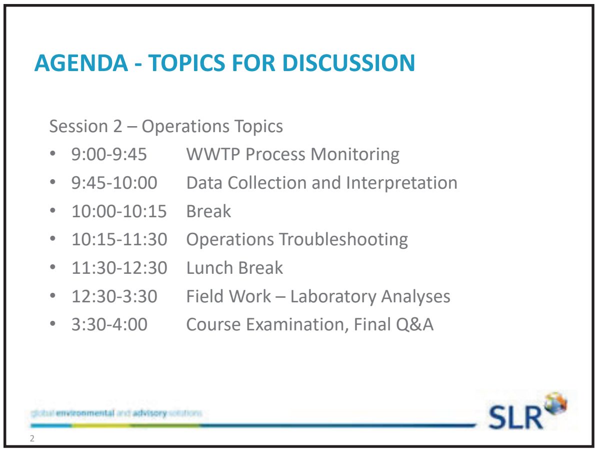
Answer Key:

1. D
2. B
3. D
4. A
5. D
6. C
7. B
8. C
9. C
10. A

WASTEWATER TREATMENT OPERATIONS TRAINING
SESSION 2 – OPERATIONS TOPICS

Austin Powder Company
MacArthur, Ohio

global environmental and advisory solutions



AGENDA - TOPICS FOR DISCUSSION

Session 2 – Operations Topics

9:00-9:45	WWTP Process Monitoring
9:45-10:00	Data Collection and Interpretation
10:00-10:15	Break
10:15-11:30	Operations Troubleshooting
11:30-12:30	Lunch Break
12:30-3:30	Field Work – Laboratory Analyses
3:30-4:00	Course Examination, Final Q&A

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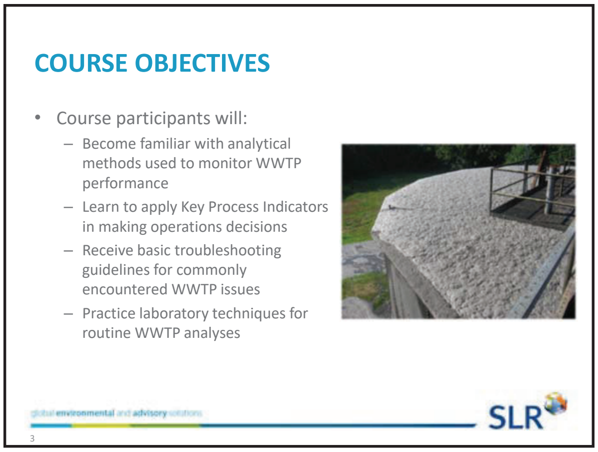

COURSE OBJECTIVES

- Course participants will:
  - Become familiar with analytical methods used to monitor WWTP performance
  - Learn to apply Key Process Indicators in making operations decisions
  - Receive basic troubleshooting guidelines for commonly encountered WWTP issues
  - Practice laboratory techniques for routine WWTP analyses

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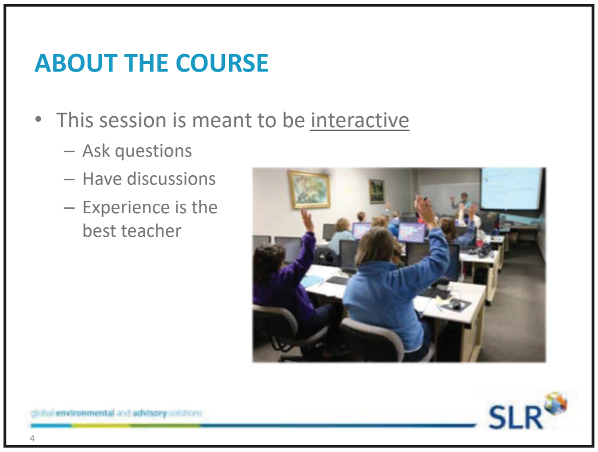

ABOUT THE COURSE

- This session is meant to be interactive
  - Ask questions
  - Have discussions
  - Experience is the best teacher

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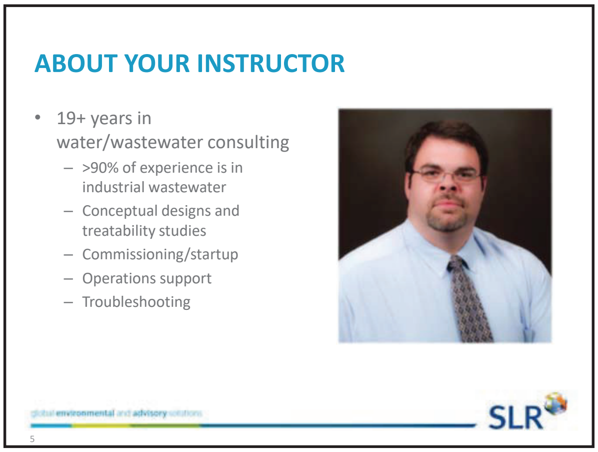

ABOUT YOUR INSTRUCTOR

- 19+ years in water/wastewater consulting
  - >90% of experience is in industrial wastewater
  - Conceptual designs and treatability studies
  - Commissioning/startup
  - Operations support
  - Troubleshooting

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PROCESS MONITORING

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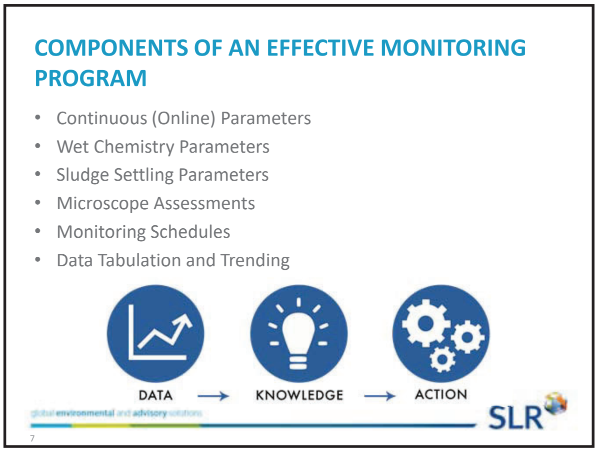
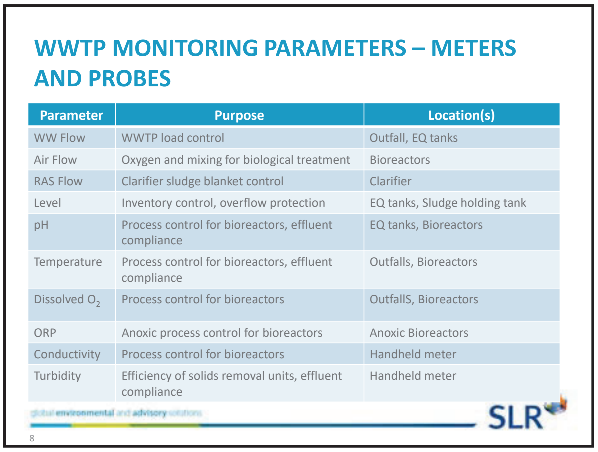


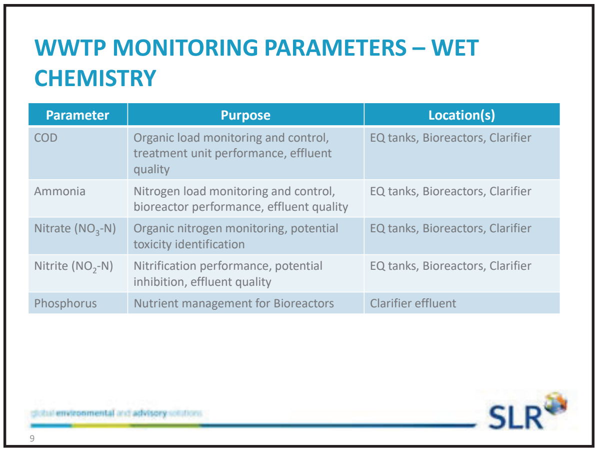
COMPONENTS OF AN EFFECTIVE MONITORING PROGRAM

- Continuous (Online) Parameters
- Wet Chemistry Parameters
- Sludge Settling Parameters
- Microscope Assessments
- Monitoring Schedules
- Data Tabulation and Trending



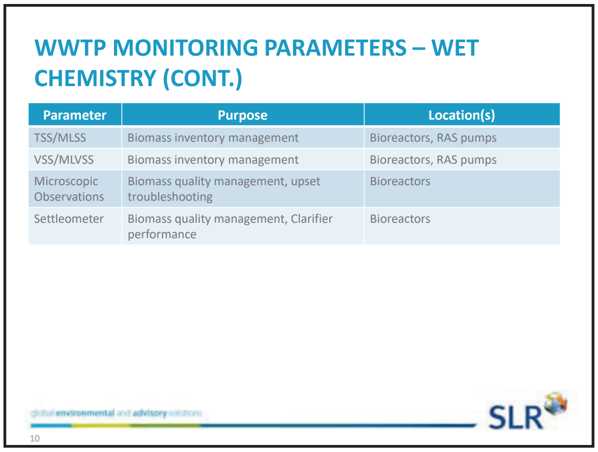
WWTP MONITORING PARAMETERS – METERS AND PROBES

Parameter	Purpose	Location(s)
WW Flow	WWTP load control	Outfall, EQ tanks
Air Flow	Oxygen and mixing for biological treatment	Bioreactors
RAS Flow	Clarifier sludge blanket control	Clarifier
Level	Inventory control, overflow protection	EQ tanks, Sludge holding tank
pH	Process control for bioreactors, effluent compliance	EQ tanks, Bioreactors
Temperature	Process control for bioreactors, effluent compliance	Outfalls, Bioreactors
Dissolved O_2	Process control for bioreactors	OutfallS, Bioreactors
ORP	Anoxic process control for bioreactors	Anoxic Bioreactors
Conductivity	Process control for bioreactors	Handheld meter
Turbidity	Efficiency of solids removal units, effluent compliance	Handheld meter



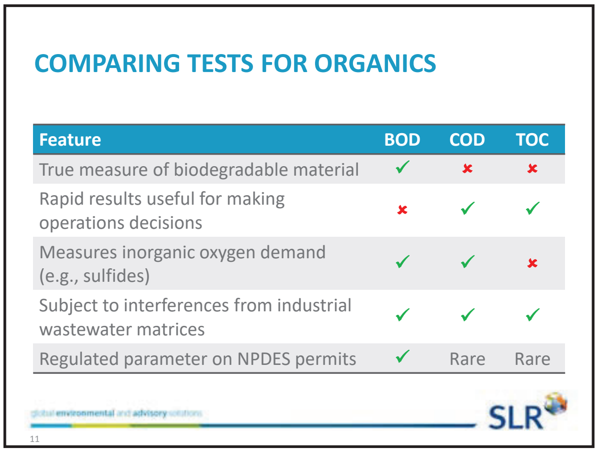
WWTP MONITORING PARAMETERS – WET CHEMISTRY

Parameter	Purpose	Location(s)
COD	Organic load monitoring and control, treatment unit performance, effluent quality	EQ tanks, Bioreactors, Clarifier
Ammonia	Nitrogen load monitoring and control, bioreactor performance, effluent quality	EQ tanks, Bioreactors, Clarifier
Nitrate (NO_3-N)	Organic nitrogen monitoring, potential toxicity identification	EQ tanks, Bioreactors, Clarifier
Nitrite (NO_2-N)	Nitrification performance, potential inhibition, effluent quality	EQ tanks, Bioreactors, Clarifier
Phosphorus	Nutrient management for Bioreactors	Clarifier effluent



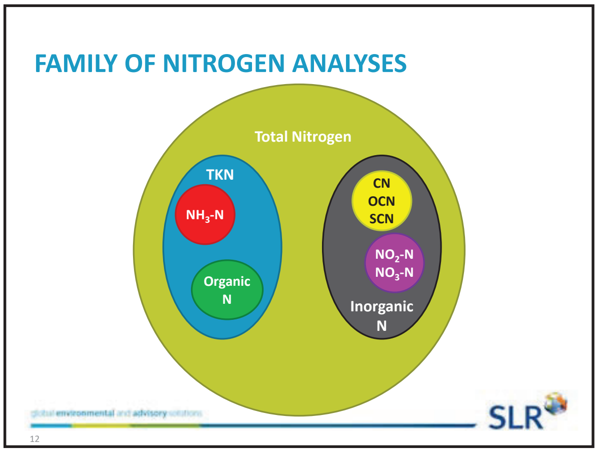
WWTP MONITORING PARAMETERS – WET CHEMISTRY (CONT.)

Parameter	Purpose	Location(s)
TSS/MLSS	Biomass inventory management	Bioreactors, RAS pumps
VSS/MLVSS	Biomass inventory management	Bioreactors, RAS pumps
Microscopic Observations	Biomass quality management, upset troubleshooting	Bioreactors
Settleometer	Biomass quality management, Clarifier performance	Bioreactors

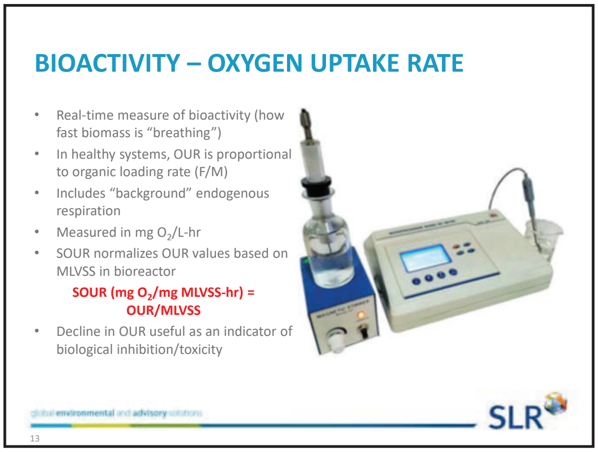


COMPARING TESTS FOR ORGANICS

Feature	BOD	COD	TOC
True measure of biodegradable material	✓	✗	✗
Rapid results useful for making operations decisions	✗	✓	✓
Measures inorganic oxygen demand (e.g., sulfides)	✓	✓	✗
Subject to interferences from industrial wastewater matrices	✓	✓	✓
Regulated parameter on NPDES permits	✓	Rare	Rare



FAMILY OF NITROGEN ANALYSES

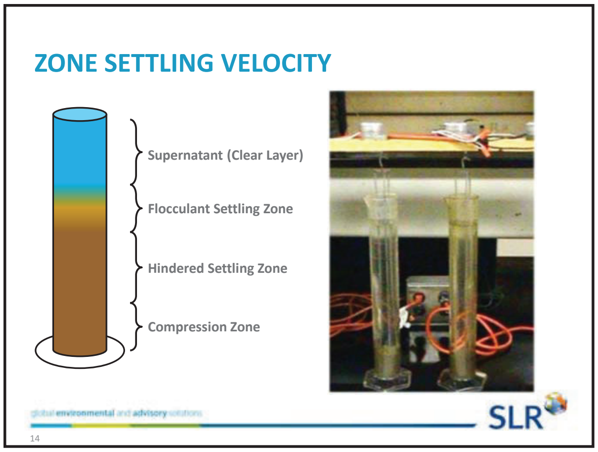


BIOACTIVITY – OXYGEN UPTAKE RATE

- Real-time measure of bioactivity (how fast biomass is "breathing")
- In healthy systems, OUR is proportional to organic loading rate (F/M)
- Includes "background" endogenous respiration
- Measured in mg O_2/L-hr
- SOUR normalizes OUR values based on MLVSS in bioreactor

SOUR (mg O_2/mg MLVSS-hr) = OUR/MLVSS

- Decline in OUR useful as an indicator of biological inhibition/toxicity

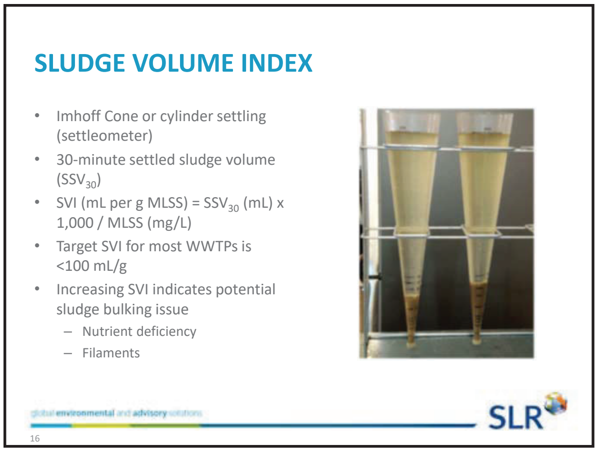


ZONE SETTLING VELOCITY

Supernatant (Clear Layer)
Flocculant Settling Zone
Hindered Settling Zone
Compression Zone

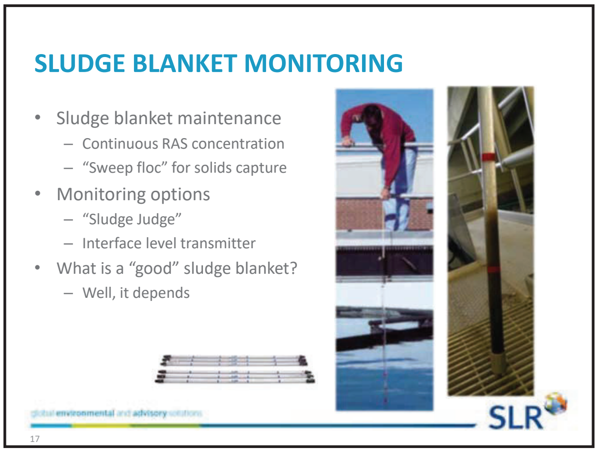
INTERPRETING ZSV OBSERVATIONS AND DATA

- "Hanging" floc
  - Not enough MLSS to produce a coherent sludge blanket
  - Possible gas entrainment
  - Oily sludge
- Slow settling rates (< 1 ft/hr)
  - Viscous bulking
  - Filamentous bulking
- Floating solids
  - Denitrification



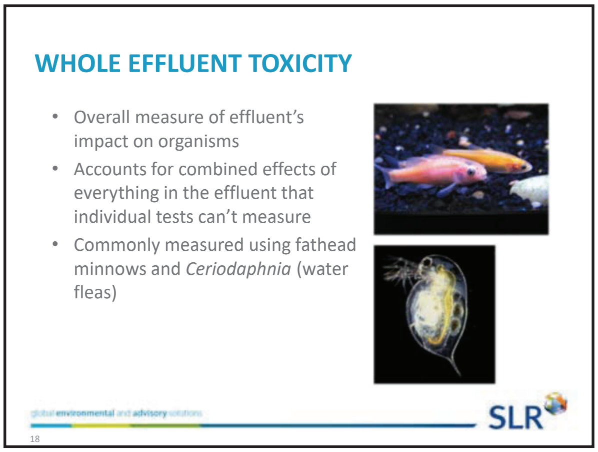
SLUDGE VOLUME INDEX

- Imhoff Cone or cylinder settling (settleometer)
- 30-minute settled sludge volume (SSV_{30})
- SVI (mL per g MLSS) = SSV_{30} (mL) x 1,000 / MLSS (mg/L)
- Target SVI for most WWTPs is <100 mL/g
- Increasing SVI indicates potential sludge bulking issue
  - Nutrient deficiency
  - Filaments



SLUDGE BLANKET MONITORING

- Sludge blanket maintenance
  - Continuous RAS concentration
  - "Sweep floc" for solids capture
- Monitoring options
  - "Sludge Judge"
  - Interface level transmitter
- What is a "good" sludge blanket?
  - Well, it depends



WHOLE EFFLUENT TOXICITY

- Overall measure of effluent's impact on organisms
- Accounts for combined effects of everything in the effluent that individual tests can't measure
- Commonly measured using fathead minnows and *Ceriodaphnia* (water fleas)

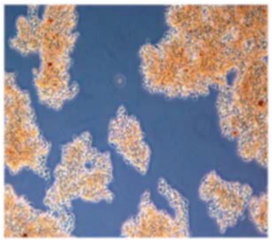
MICROSCOPIC EVALUATIONS

WHAT THE MICROSCOPE CAN TELL US

Operational Issue	Cause(s) Determined by Microscopic Analysis
High Effluent TSS	Pin Floc, Dispersed Growth
Poor BOD/COD Removal	Nutrient Deficiency, Toxicity (Indicator Organisms)
Odors	Septicity
Foaming	Nutrient Deficiency, Foam-Causing Filaments
Poor Sludge Settling (Bulking)	Nutrient Deficiency (Viscous Bulking), Filaments (Compaction or Settling Bulking)

IDEAL ACTIVATED SLUDGE APPEARANCE

- **Floc Size**: Between 150 and 500 microns
- **Floc Density**: High (individual flocs appear gold or brown in color)
- **Floc Shape**: Round, no ragged edges or irregular shapes
- **Floc Diversity**: Different types of bacteria visible at high magnification and when staining
- **Free Liquid**: Mostly free of bacteria or other particles
- **Filaments**: Common or lower
- **Indicator Organisms**: Present

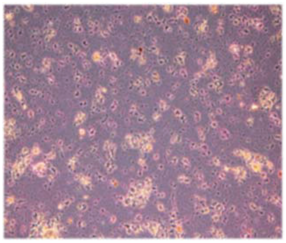


UPSET CONDITIONS IN ACTIVATED SLUDGE

- Dispersed Growth
- Pin Floc
- Polysaccharide Bulking
- Filamentous Bulking
- Zoogleal Bulking
- Foaming – Filamentous and Others

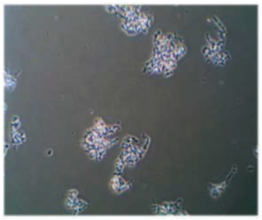
DISPERSED GROWTH

- Individual bacteria that will cause high effluent turbidity and TSS
- Typically seen at high F/M or during shock loads where growth rate exceeds flocculation rate
- Relatively rare in industrial WWT where design F/M is often lower than municipal
- Appearance in industrial WWT may be due to toxicity
- Best treatment is to increase MLSS and equalize shock loads



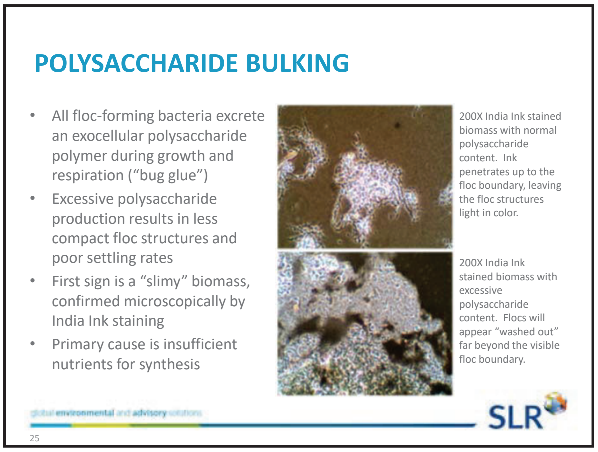
100X phase contrast image of biomass with high quantities of dispersed growth

PIN FLOC



100X phase contrast image of biomass with pin floc

- Smaller floc particles (< 150 µm) caused by high sludge age or excessive floc shearing
- Target floc sizes are typically 150-500 µm
- Will not produce effluent quality problems except during high hydraulic loads
- Corrected by lowering sludge age (increasing F/M) or by enhancing flocculation before clarification (polymer addition)
- Chemical addition only treats the symptoms – **not** the causes

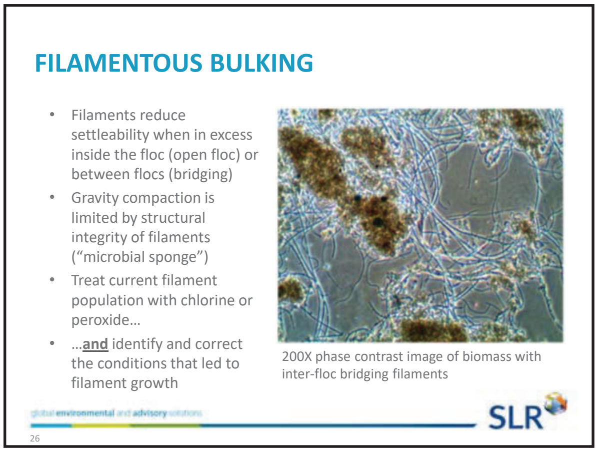


POLYSACCHARIDE BULKING

- All floc-forming bacteria excrete an exocellular polysaccharide polymer during growth and respiration ("bug glue")
- Excessive polysaccharide production results in less compact floc structures and poor settling rates
- First sign is a "slimy" biomass, confirmed microscopically by India Ink staining
- Primary cause is insufficient nutrients for synthesis

200X India Ink stained biomass with normal polysaccharide content. Ink penetrates up to the floc boundary, leaving the floc structures light in color.

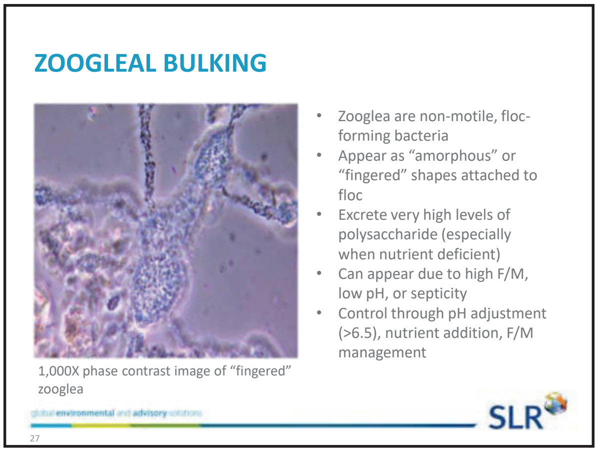
200X India Ink stained biomass with excessive polysaccharide content. Flocs will appear "washed out" far beyond the visible floc boundary.



FILAMENTOUS BULKING

- Filaments reduce settleability when in excess inside the floc (open floc) or between flocs (bridging)
- Gravity compaction is limited by structural integrity of filaments ("microbial sponge")
- Treat current filament population with chlorine or peroxide…
- …**and** identify and correct the conditions that led to filament growth

200X phase contrast image of biomass with inter-floc bridging filaments



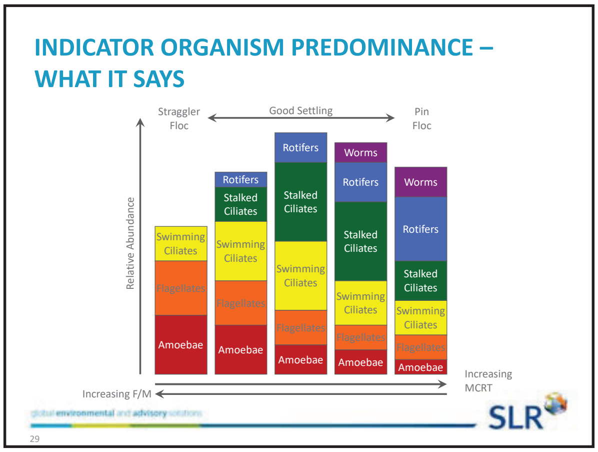
ZOOGLEAL BULKING

1,000X phase contrast image of "fingered" zooglea

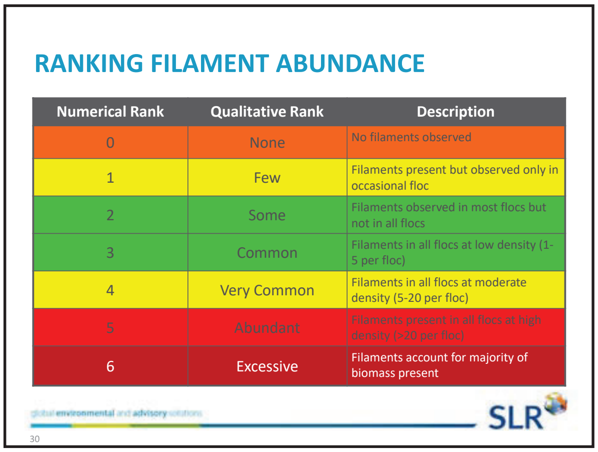
- Zooglea are non-motile, floc-forming bacteria
- Appear as "amorphous" or "fingered" shapes attached to floc
- Excrete very high levels of polysaccharide (especially when nutrient deficient)
- Can appear due to high F/M, low pH, or septicity
- Control through pH adjustment (>6.5), nutrient addition, F/M management

INDICATOR ORGANISMS

- Higher life forms (protozoa and metazoa) that cohabit with bacteria in activated sludge
- Feed on bacteria or on each other
- Used to gauge biomass health and relative age of biomass
  - During toxic events, higher life forms often die first
- High quantities of IOs actually improve effluent quality by feeding on dispersed bacterial growth

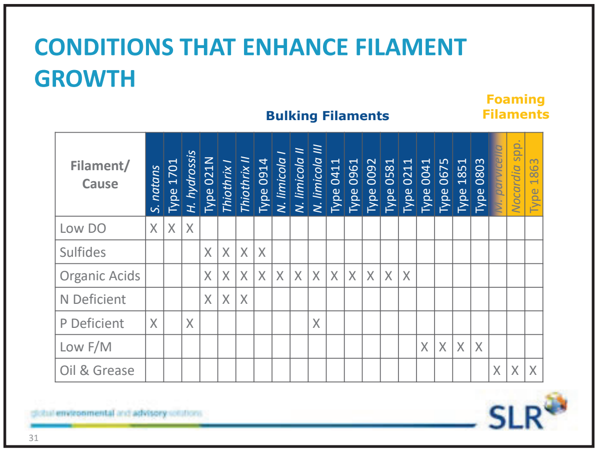


INDICATOR ORGANISM PREDOMINANCE – WHAT IT SAYS



RANKING FILAMENT ABUNDANCE

Numerical Rank	Qualitative Rank	Description
0	None	No filaments observed
1	Few	Filaments present but observed only in occasional floc
2	Some	Filaments observed in most flocs but not in all flocs
3	Common	Filaments in all flocs at low density (1-5 per floc)
4	Very Common	Filaments in all flocs at moderate density (5-20 per floc)
5	Abundant	Filaments present in all flocs at high density (>20 per floc)
6	Excessive	Filaments account for majority of biomass present

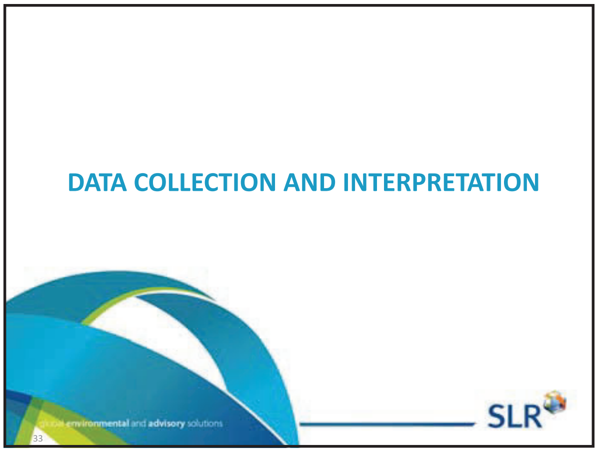


CONDITIONS THAT ENHANCE FILAMENT GROWTH

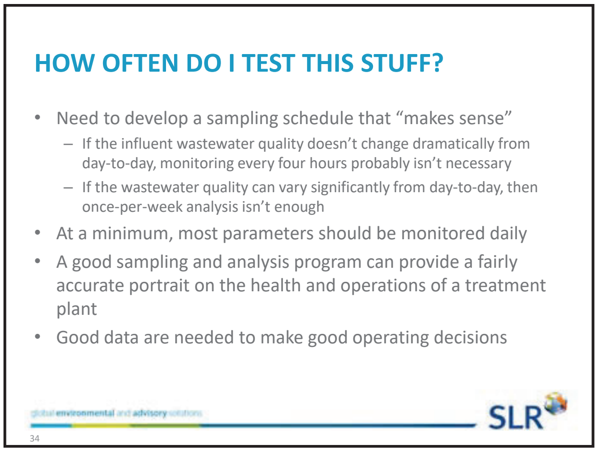
	Bulking Filaments																			Foaming Filaments		
Filament/ Cause	*S. natans*	Type 1701	*H. hydrossis*	Type 021N	*Thiothrix I*	*Thiothrix II*	Type 0914	*N. limicola I*	*N. limicola II*	*N. limicola III*	Type 0411	Type 0961	Type 0092	Type 0581	Type 0211	Type 0041	Type 0675	Type 1851	Type 0803	*M. parvicella*	*Nocardia* spp.	Type 1863
Low DO	X	X	X																			
Sulfides				X	X	X	X															
Organic Acids				X	X	X	X	X	X	X	X	X	X	X	X							
N Deficient				X	X	X																
P Deficient	X		X							X												
Low F/M																X	X	X	X			
Oil & Grease																				X	X	X

TROUBLESHOOTING BEYOND THE BASIN

- Solving the problem means finding all the symptoms
- Foaming? Analyze the MLSS and the foam
  - Foaming filaments selectively partition
- High effluent TSS? Analyze the MLSS and the effluent
  - Pin floc
- Problems can start upstream of the activated sludge
  - Primary treatment
  - EQ Tank

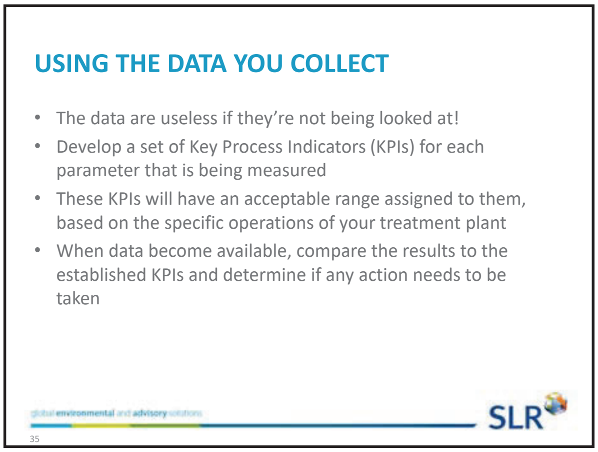


DATA COLLECTION AND INTERPRETATION



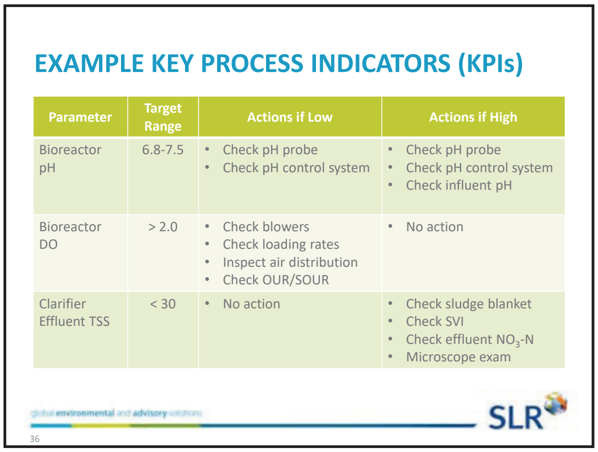
HOW OFTEN DO I TEST THIS STUFF?

- Need to develop a sampling schedule that "makes sense"
  - If the influent wastewater quality doesn't change dramatically from day-to-day, monitoring every four hours probably isn't necessary
  - If the wastewater quality can vary significantly from day-to-day, then once-per-week analysis isn't enough
- At a minimum, most parameters should be monitored daily
- A good sampling and analysis program can provide a fairly accurate portrait on the health and operations of a treatment plant
- Good data are needed to make good operating decisions



USING THE DATA YOU COLLECT

- The data are useless if they're not being looked at!
- Develop a set of Key Process Indicators (KPIs) for each parameter that is being measured
- These KPIs will have an acceptable range assigned to them, based on the specific operations of your treatment plant
- When data become available, compare the results to the established KPIs and determine if any action needs to be taken



EXAMPLE KEY PROCESS INDICATORS (KPIs)

Parameter	Target Range	Actions if Low	Actions if High
Bioreactor pH	6.8-7.5	• Check pH probe • Check pH control system	• Check pH probe • Check pH control system • Check influent pH
Bioreactor DO	> 2.0	• Check blowers • Check loading rates • Inspect air distribution • Check OUR/SOUR	• No action
Clarifier Effluent TSS	< 30	• No action	• Check sludge blanket • Check SVI • Check effluent NO_3-N • Microscope exam

TRUSTING YOUR DATA

- Routine instrument calibration
- "Backup" methods – verifying online instruments with handheld probes
- Laboratory Quality Assurance/Quality Control (QA/QC)
  - Standards – verify the accuracy of the instrument
  - Duplicates – verify the repeatability of the procedure

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SAMPLING AND ANALYTICAL PLAN

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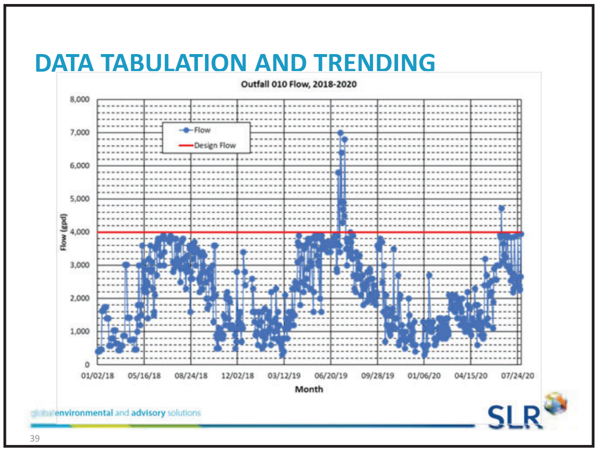

DATA TABULATION AND TRENDING

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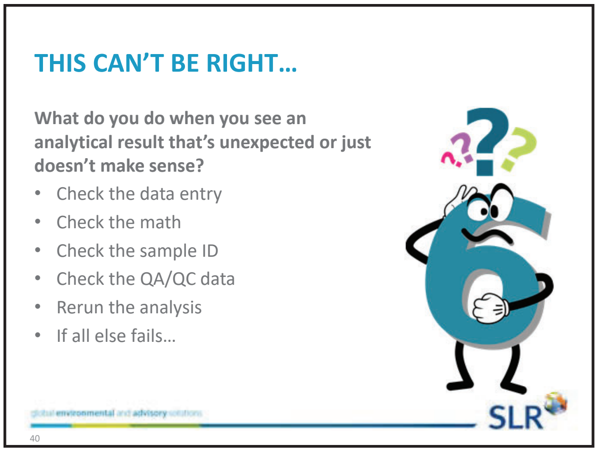

THIS CAN'T BE RIGHT…

What do you do when you see an analytical result that's unexpected or just doesn't make sense?

- Check the data entry
- Check the math
- Check the sample ID
- Check the QA/QC data
- Rerun the analysis
- If all else fails…

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15-MINUTE BREAK

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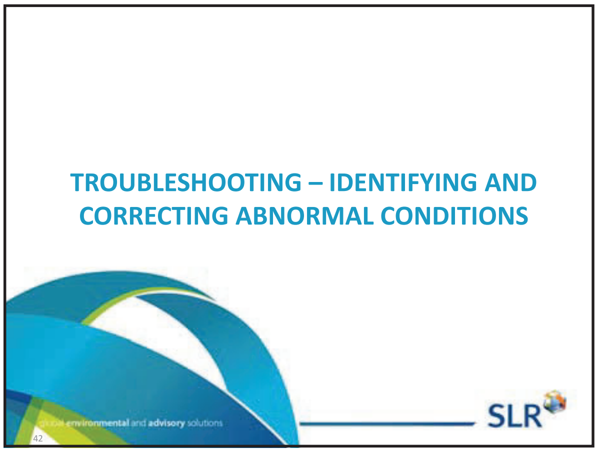

TROUBLESHOOTING – IDENTIFYING AND CORRECTING ABNORMAL CONDITIONS

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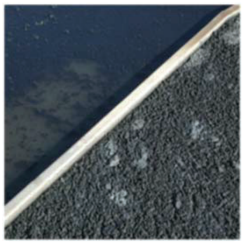
UPSET PREVENTION

- WWTP is a process, not a sewer
- Communication when spills occur
- Monitor operating parameters
  - Understand the data
  - Adjust accordingly (increase aeration, decrease WAS, etc.)
- Keep the biomass properly fed and oxygenated, and the bacteria will do the rest

BIOLOGICAL TREATMENT TROUBLESHOOTING



- Common Causes of Upsets
  - Primary Treatment Upset
  - Nutrient Deficiency
  - Environmental Factors (DO, pH, Temperature)
  - Toxicity/Inhibition
  - Slug Loading (Organics/Nitrogen)
  - Organic Overload/Underload
  - Hydraulic Overload/Underload
  - Load Composition Shift (Cleaning, Turnaround)

ACTIVATED SLUDGE OPERATIONAL GOALS

- Biomass will adapt to changing situations, but it takes time
- Rapid or significant changes in loading or environment will cause system upset
- Goal of Operator = Good Biomass health
  - Stable environment
  - Consistent feed
- Challenge is preventative vs. trauma care

EVIDENCE OF UPSET CONDITIONS

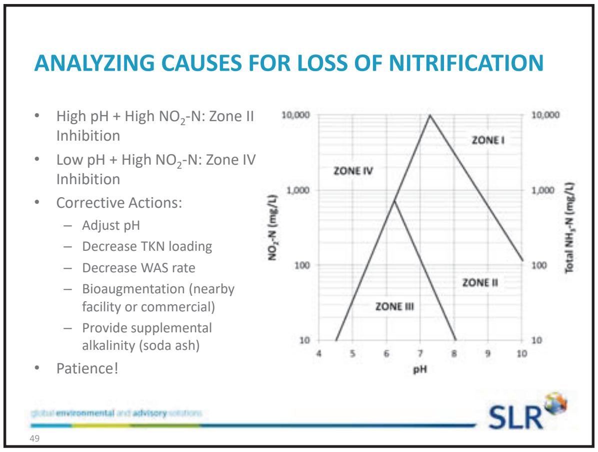
- Reduction or total loss of treatment
- Excessive foaming
- Floating solids in clarifiers
- High effluent turbidity/TSS

TROUBLESHOOTING LOSS OF ORGANIC TREATMENT

- Potential causes:
  - Not enough biomass in system to handle influent loading (high F/M)
  - Environmental conditions within the sludge are not favorable (DO, pH, temperature, conductivity)
  - Toxicity or inhibition
  - Nutrient deficiency
- Investigative actions:
  - Analyze MLSS/MLVSS and calculate F/M values
  - Ensure sufficient DO (> 2 mg/L)
  - Ensure proper pH (6.8 – 7.8 s.u.)
  - Provide cooling if needed
  - Run OUR to determine bio-activity

TROUBLESHOOTING LOSS OF NITRIFICATION

- Nitrification performed by:
  - NH_3-N converted to NO_2 by *Nitrosomonas*
  - NO_2 converted to NO_3 by *Nitrobacter*
- Nitrifiers are more sensitive than heterotrophic bacteria
- Nitrifiers have slower growth rates than heterotrophs
- "First to die off, last to come back"
- Optimum environmental conditions for nitrification:
  - DO: 2.0 – 4.0 mg/L
  - pH: 6.8 – 7.5 s.u. (maintain <7.8 s.u.)
  - Optimum temperature range: 85-90°F
  - Maintain sludge age >25 days (though >40 days can be preferable as a function of ammonia concentration)



ANALYZING CAUSES FOR LOSS OF NITRIFICATION

- High pH + High NO_2-N: Zone II Inhibition
- Low pH + High NO_2-N: Zone IV Inhibition
- Corrective Actions:
  - Adjust pH
  - Decrease TKN loading
  - Decrease WAS rate
  - Bioaugmentation (nearby facility or commercial)
  - Provide supplemental alkalinity (soda ash)
- Patience!

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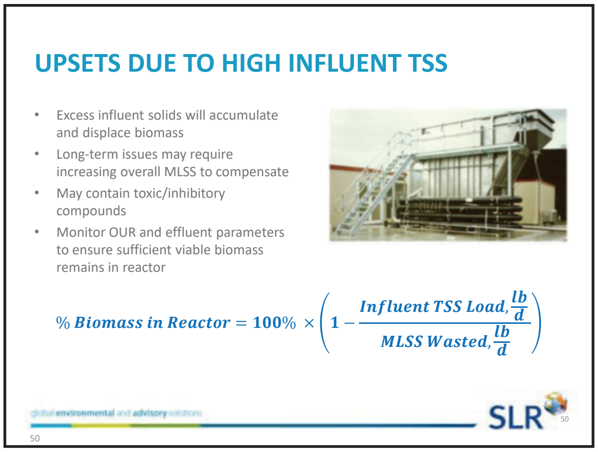
SLR



UPSETS DUE TO HIGH INFLUENT TSS

- Excess influent solids will accumulate and displace biomass
- Long-term issues may require increasing overall MLSS to compensate
- May contain toxic/inhibitory compounds
- Monitor OUR and effluent parameters to ensure sufficient viable biomass remains in reactor

$$\% \; Biomass \; in \; Reactor = 100\% \times \left(1 - \frac{Influent \; TSS \; Load, \frac{lb}{d}}{MLSS \; Wasted, \frac{lb}{d}}\right)$$

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SLR

CONTROLLING MLSS FOR SETTLING

- Concentration of MLSS is major impact on clarifier settleability
- MLSS settles faster at lower MLSS concentrations – up to a point

MLSS Concentration (mg/L)	Applicable Operations
< 2,000 mg/L	Not recommended – sludge will not form a blanket and cause high TSS carryover
2,000-4,000 mg/L	Typical operating range for conventional activated sludge and secondary clarifier
4,000-6,000 mg/L	Marginal operating range for systems with rapid settling sludge or excess clarifier capacity
6,000-12,000 mg/L	Typical operating range for membrane bioreactor systems (upper limit of 15,000 mg/L due to oxygen transfer rates)

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SLR

MANAGING SLUG LOADS OF ORGANICS

- Problems
  - Rapid DO depletion (and higher OURs)
  - More BOD causes a high growth rate
  - High growth rate yields lots of new bacteria
  - New bacteria are not established in a floc structure
  - Less floc structure causes settling issues in the Secondary Clarifier
  - Increase in white foam in Aeration Tank
  - Possible change in pH due to higher BOD removal
- Solution: Load Balancing
  - Temporary load reduction (utilize EQ and/or Diversion)
  - Decrease wastage to stabilize F/M
  - Defoamer for foam control
  - Coagulant/flocculant for settling issues

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SLR

UNDERLOADING

- Excess bacteria in the system begin a process of "cannibalization" called endogenous digestion
- Problems/Symptoms
  - Broken down bacteria release polysaccharides
  - Polysaccharides can inhibit settling in the clarifier
  - Digested bacteria ("bug bones") settle poorly, causing high effluent turbidity
  - Increase in DO
  - Reduced sludge growth to handle future load increase
  - Encourages growth of certain undesirable filamentous bacteria
- Solution – F/M Control
  - Load balancing
  - Temporary increase in sludge wastage

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SLR

BIOLOGICAL FOAMING – COMMON CAUSES

Appearance of Foam	Likely Cause of Foam
White, frothy foam low in solids content	Surfactants, low sludge age, upset recovery
Sticky, viscous foam with moderate solids content	Excess polysaccharide content (nutrient deficiency)
Pumice-like grey foam with high inorganic content	Excess influent solids
Stable, brown foam with high volatile solids content	Filamentous growth, often due to *nocardia* presence

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FILAMENTOUS BACTERIA FOAM

- Rare in industrial biological treatment, common in municipal POTWs
- May not respond well to defoamer
- Filaments provide a stable "skeleton" for foam
- Bleach can be used for control
  - Surface application

NUTRIENT-DEFICIENT FOAM

- Increased bacterial polysaccharides (EPS)
- Reduced settling rates
- Difficulty with solids dewatering
- May see rise in filamentous bacteria
- Defoamer may or may not be effective
- Check residual PO_4-P

HIGH TSS CARRYOVER IN CLARIFIERS

- Biomass upset
- Scum
- Denitrification
- Filamentous bacteria
- Old sludge
- Young sludge
- Incorrect polymer type or dose
- Hydraulic overload

CLARIFIER OPERATIONS ASSESSMENT

Potential Problems	What to Evaluate in Visual Inspection	What to Evaluate in Data Review
Sludge does not settle as well as it used to (Sludge Bulking) Excess pin-point floc carryover (TSS) in effluent Excess scum carryover (TSS) to effluent Failure to meet other (non-TSS) permit limits	• Changes in depth of sludge blanket • Changes in color/turbidity of effluent • Changes in amount of scum on clarifier • Changes in appearance of floc in center-well • Equal distribution of flow over weirs • Blooming solids • Fine bubbling in clarifier • Changes to biology of the biomass by microscopic exam	• Trends in sludge blanket depth • Change in Zone Settling Velocity (ZSV) or Sludge Volume Index (SVI) • Excessive sludge wasting • Change in sludge age • Change in polymer usage • Increased abundance of filaments in microscopic exam

ANALYZING FLOATING SOLIDS

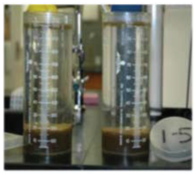
Cause of Floating Solids	Microscopic Evidence
Slow settling rate	Pin floc
Viscous bulking	High polysaccharides (Nutrient deficiency)
Denitrification	Larger flocs in floating material
Algae growth	Algae visible in microscope sample

CLARIFIER TROUBLESHOOTING – BIOLOGICAL AND HYDRAULIC UPSETS

- Biomass Upset:
  - Toxicity can cause biomass to die off
  - Dead biomass floats, forming a scum layer
  - Low nutrients can cause polysaccharide buildup, which floats
- Poor Hydraulics:
  - Hydraulic loading rate
  - Overflow weir level
  - Centerwell configuration
  - Scum baffle
  - Plugged drum filter/poor filter cleaning (Outfall 011)

CLARIFIER TROUBLESHOOTING - DENITRIFICATION

- Denitrification in the bottom of the clarifier can generate nitrogen gas resulting in floating solids
- Cause:
  - Requires excess nitrates and degradable organics
  - Can occur in plants that nitrify (incidental denitrification)
  - Potential to occur when aerobic bioreactor NO_3-N concentrations greater than 20-30 mg/L
- Simple Confirmation Test:
  - Collect a sample and let it settle (float) on a bench for 1-2 hours
  - Mix vigorously to shear out any bubbles trapped in floc, then settle again
- Solutions
  - Increase RAS rate to reduce clarifier retention time
  - Improve BOD removal to reduce residual organics
  - Increase anoxic recycle to lower NO_3-N in effluent



SETTLING AIDS FOR SECONDARY CLARIFIERS

- For most industrial wastewaters, chemical addition at the Secondary Clarifier may be required to achieve quality effluent
- Two main types of chemicals used for settling enhancement
  - Coagulants
  - Flocculants
- Coagulants - used to neutralize charge
- Flocculants - used to enhance floc size
- Each application is different, but many industrial WWTPs need some help
- Conduct jar testing to determine optimum products and dosages

CHEMICAL ADDITION FOR UPSET RESPONSE

- Coagulants likely needed as a response to turbidity
- Flocculants work best to capture small (pin) flocs that are carrying over weirs
- Flocculant type, charge density, or dosage may need to be adjusted
- Chemical addition will <u>not</u> help with:
  - Viscous bulking (nutrient deficiency)
  - Filamentous bulking
  - Floating solids from denitrification

OPTIMUM ENVIRONMENTAL CONDITIONS

Parameter	Organic Removal	Nitrification	Denitrification
pH, s.u.	6.5 to 8.5	Optimum 6.8 to 7.5	Same as Organics
Temperature, ˚F	75 to 95 -105	Optimum 85 to 90	Same as Organics
DO, mg/L	2 @ average 1 @ minimum	2 to 4 (never < 2)	< 0.1 mg/L
Oxygen Requirements	1.0 lb O_2 / lb COD	4.56 lb O_2 / lb NH_3-N	Removes ~ 3.5 lbs COD / lb NO_3-N
SRT (Sludge Age), days	7 to 15	> 25; Preferably > 40 (depends on relative BOD/NH_3-N loads)	Same as Organics
Alkalinity, lbs $CaCO_3$ per lb	Varies depending upon organics	Consumes 7.14 lbs $CaCO_3$ / lb N nitrified	Generates 3.56 lbs $CaCO_3$ / lb nitrogen denitrified

UPSET PREVENTION AND RESPONSE

- Can catch and divert wastewater if notified
- Increase in-house testing (if needed) to monitor system
- Verify operating parameters are on-target
- Utilize temporary flow reduction if possible
- Review priorities, e.g. violations vs. slowing production

UPSET PREVENTION AND RESPONSE

- Every plant is different!
- Find the conditions / settings that provide the greatest removal efficiencies for *your plant* and set your KPIs based on these values
- Develop "action levels" that provide direction to operating staff when a parameter is above/ below the target range but before it causes a large-scale problem

UPSET PREVENTION AND RESPONSE

- Communication with all upstream process units is ESSENTIAL
- Preventative vs. reactive operations
- Regular collection and generation of operating data is great, but useless if it's not used to make daily operating decisions and adjustments
- Maintain environmental conditions within the target ranges, and the biology will do the rest

KPI AND TROUBLESHOOTING TABLES

FOR MORE INFORMATION

Todd Lusk, PE
tlusk@slrconsulting.com
(859) 287-9801

CHECK YOUR UNDERSTANDING

REFERENCE FORMULA PAGE

Mass Loading Rate

Mass (lb/d) = Flow (gpm) x Concentration (mg/L) x 0.012

TSS/VSS Calculations

TSS = [Weight B (g) – Weight A (g)] x 1,000,000 / Sample Volume (mL)

VSS = [Weight B (g) – Weight C (g)] x 1,000,000 / Sample Volume (mL)

QA/QC Calculations

Percent Recovery = (Measured / Standard) x 100%

RPD = 2 x (Sample B - Sample A) / (Sample B + Sample A) x 100%

SVI Calculation

SVI (mL per g MLSS) = SSV_{30} (mL) x 1,000 / MLSS (mg/L)

Name: _______________________________ Score: ______ / 100

1. Which condition below could cause the dissolved oxygen in a Bioreactor to go **up**?
    a. High F/M
    b. Blower failure
    c. Biomass inhibition
    d. Poor sludge settling

2. Floc particles below 150 microns in diameter are classified as:
    a. Baby floc
    b. Pin floc
    c. Open floc
    d. Floc of Seagulls

3. The condition where activated sludge does not thicken properly when settling in the Clarifier, either due to filamentous bacteria or polysaccharides, is called:
    a. Bulking
    b. Sloughing
    c. Foaming
    d. Thinning

4. A white, frothy foam on the Bioreactor could be an indicator of which of the following conditions?
    a. High surfactant concentrations
    b. Cappuccino spill
    c. Low sludge age
    d. Both A and C

5. Filamentous bacteria are undesirable in activated sludge because they can:
    a. Cause settling problems
    b. Cause foaming problems
    c. Both A and B
    d. None of the above

6. Which of the following actions is appropriate when the F/M in the Aeration Basin is too low?
    a. Increase feed rate
    b. Increase aeration
    c. Increase RAS flow
    d. Increase phosphoric acid addition

7. Rotifer, ciliate, and flagellate are all types of:
    a. Bacteria
    b. Indicator organisms
    c. Algae
    d. Fish

8. What method is used during WWTP laboratory analyses to verify the repeatability of the procedure being run?
   a. Analyze a standard solution
   b. Calibrate the instrument
   c. Perform a duplicate analysis
   d. Send a sample to an external lab

9. Because they are more sensitive to environmental conditions, __________ are often the first bacteria to show inhibition during an upset.
   a. Heterotrophs
   b. Pathogens
   c. Nitrifiers
   d. Anaerobes

10. What parameter(s) can operators adjust when the F/M ratio is outside its target ranges?
    a. Feed flow rate
    b. MLSS concentration
    c. Phosphorus addition
    d. Either A or B

Use the data below, collected during a TSS analysis, for Questions 11 and 12.

Sample #	**Sample Volume, mL**	**Initial Weight (A), g**	**Post-Oven Weight (B), g**
1	100	1.3450	1.3746
2	50	1.3148	1.3282

11. What is the TSS of Sample 2?

Answer: _________ mg/L

12. If Sample 2 is a duplicate of Sample 1, what is the RPD value for this analysis? Round to the nearest whole percentage.

Answer: _________ percent

13. A mixture of 5 mL of sample with 20 mL of deionized water is equivalent to what dilution factor?
    a. 4
    b. 5
    c. 0.25
    d. 0.2

14. What analysis is used to measure the overall wastewater impacts to organisms in the environment?
    a. Biochemical Oxygen Demand
    b. pH
    c. Chemical Oxygen Demand
    d. Whole Effluent Toxicity

15. A biomass sample is tested in the settleometer and produces a 30-minute settled volume of 270 mL. This sample was analyzed for MLSS and the result was 3,000 mg/L. What is the SVI of this sample?

Answer: _______ mL/g

16. Which of the following is **<u>not</u>** a potential cause for floating solids in the Clarifier?
    a. Low conductivity
    b. Denitrification
    c. Pin floc
    d. Nutrient deficiency

17. Which of the following is **<u>true</u>** regarding storage and calibration of the pH probe?
    a. Only one calibration standard is required
    b. The probe must be rinsed with deionized water between samples
    c. Calibration standards can be reused for up to a week
    d. The probe should be stored dry

18. In order to determine how efficiently the WWTP is operating, data should be compared against…
    a. Historical results
    b. Data from other APC facilities
    c. Key Process Indicators
    d. Production rates

19. Which two words fill in these blanks in the correct order? ___________ can be used as a settling aid to neutralize floc charge, and _____________ can be used to enhance floc size.
    a. Coagulants, flocculants
    b. Flocculants, coagulants
    c. Caustic, nutrients
    d. MicroC, defoamer

20. Routine communication with production is _________ to prevent and manage upsets.
    a. Difficult
    b. Optional
    c. Only via fax
    d. Essential

Answer Key:

1. C
2. B
3. A
4. D
5. C
6. A
7. B
8. C
9. C
10. D
11. 268 mg/L
12. 10 percent
13. B
14. D
15. 90 mL/g
16. A
17. B
18. C
19. A
20. D

APPENDIX G

WWTP DATA MANAGEMENT SYSTEM INSTRUCTIONS

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

AUSTIN POWDER COMPANY

Outfall 010 WWTP
Data Management System Instructions

Prepared for:

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

July 2021

CONTENTS

ACRONYMS AND ABBREVIATIONS

APC	Austin Powder Company
COD	Chemical Oxygen Demand
DMS	Data Management System
DO	Dissolved Oxygen
F/M_{COD}	Food to Mass Ratio (COD Basis)
ft/s	Feet per second
gpm	Gallons per minute
KPI	Key Process Indicator
lb/day	Pounds per day
mgd	Millions of gallons per day
mL/g	Milliliters per gram
mL/L	Milliliters per liter
mg/L	Milligrams per liter
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
µS/cm	Microsiemens per centimeter
NH_3-N	Ammonia Nitrogen
NO_2-N	Nitrite Nitrogen
NO_3-N	Nitrate Nitrogen
NTU	Nephelometric Turbidity Units
PO_4-P	Orthophosphate Phosphorus
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SSV	Settled Sludge Volume
SVI	Sludge Volume Index
TNT	Trinitrotoluene
TSS	Total Suspended Solids
WWTP	Wastewater Treatment Plant

1. INTRODUCTION

This instruction guide has been developed to assist operators at the APC Red Diamond facility in McArthur, Ohio for entering and evaluating monitoring data collected at the Outfall 010 WWTP. These instructions for the Data Management System (DMS) cover the following basic features of the data management spreadsheet and charts supplied to APC:

- Data entry and process calculations;
- Data quality checks and KPIs; and,
- Data trending charts.

Each section includes a series of screenshots from the data management file. The master file is stored on the APC network at the following location and it should not be copied, moved, or otherwise edited without APC management approval:

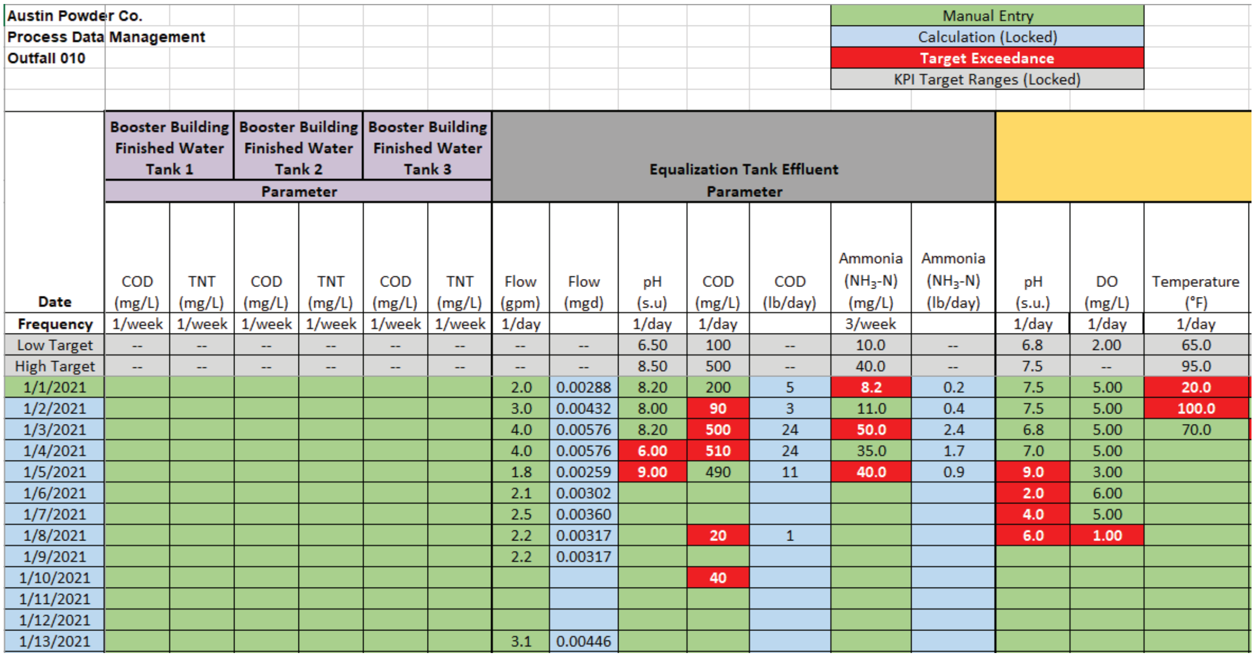
\\RDN-SERVER\EnvirLab\Environmental\Red Diamond\Water\Waste Water Treatment Plants\Outfall 010 WWTP\Data Management

This DMS has been designed to operate in Microsoft Excel. Use of other spreadsheet programs (e.g., Google Sheets) may result in a loss of functionality.

2. DATA ENTRY SCREEN

2.1 LAYOUT

The screenshot below shows the data entry page for the DMS, with example data included:



Austin Powder Co.
Process Data Management
Outfall 010

Manual Entry
Calculation (Locked)
Target Exceedance
KPI Target Ranges (Locked)

	Booster Building Finished Water Tank 1		**Booster Building Finished Water Tank 2**		**Booster Building Finished Water Tank 3**		**Equalization Tank Effluent**										
	Parameter						**Parameter**									
Date	COD (mg/L)	TNT (mg/L)	COD (mg/L)	TNT (mg/L)	COD (mg/L)	TNT (mg/L)	Flow (gpm)	Flow (mgd)	pH (s.u)	COD (mg/L)	COD (lb/day)	Ammonia (NH_3-N) (mg/L)	Ammonia (NH_3-N) (lb/day)	pH (s.u.)	DO (mg/L)	Temperature (°F)
Frequency	1/week	1/week	1/week	1/week	1/week	1/week	1/day		1/day	1/day		3/week		1/day	1/day	1/day
Low Target	--	--	--	--	--	--	--	--	6.50	100	--	10.0	--	6.8	2.00	65.0
High Target	--	--	--	--	--	--	--	--	8.50	500	--	40.0	--	7.5	--	95.0
1/1/2021							2.0	0.00288	8.20	200	5	**8.2**	0.2	7.5	5.00	**20.0**
1/2/2021							3.0	0.00432	8.00	**90**	3	11.0	0.4	7.5	5.00	**100.0**
1/3/2021							4.0	0.00576	8.20	**500**	24	**50.0**	2.4	6.8	5.00	70.0
1/4/2021							4.0	0.00576	**6.00**	**510**	24	35.0	1.7	7.0	5.00	
1/5/2021							1.8	0.00259	**9.00**	490	11	**40.0**	0.9	**9.0**	3.00	
1/6/2021							2.1	0.00302						**2.0**	6.00	
1/7/2021							2.5	0.00360						**4.0**	5.00	
1/8/2021							2.2	0.00317		**20**	1			**6.0**	**1.00**	
1/9/2021							2.2	0.00317								
1/10/2021										**40**						
1/11/2021																
1/12/2021																
1/13/2021							3.1	0.00446								

The colors in the data entry section are used to represent the following:

- Gray cells are the KPIs for each parameter, where applicable. These values are locked and should only be adjusted by supervisory personnel.
- Green cells indicate locations for WWTP operators to input meter readings and analytical results.
- Blue cells indicate values that are calculated automatically by the spreadsheet.
- **Red cells** indicate that an entered value falls outside the KPI range for that parameter.

2.2 DATA ENTRY

WWTP operators should follow the instructions below when entering new data into the spreadsheet. Data should be entered into the spreadsheet **every day they are collected** in order to provide the fastest identification and response to abnormal conditions.

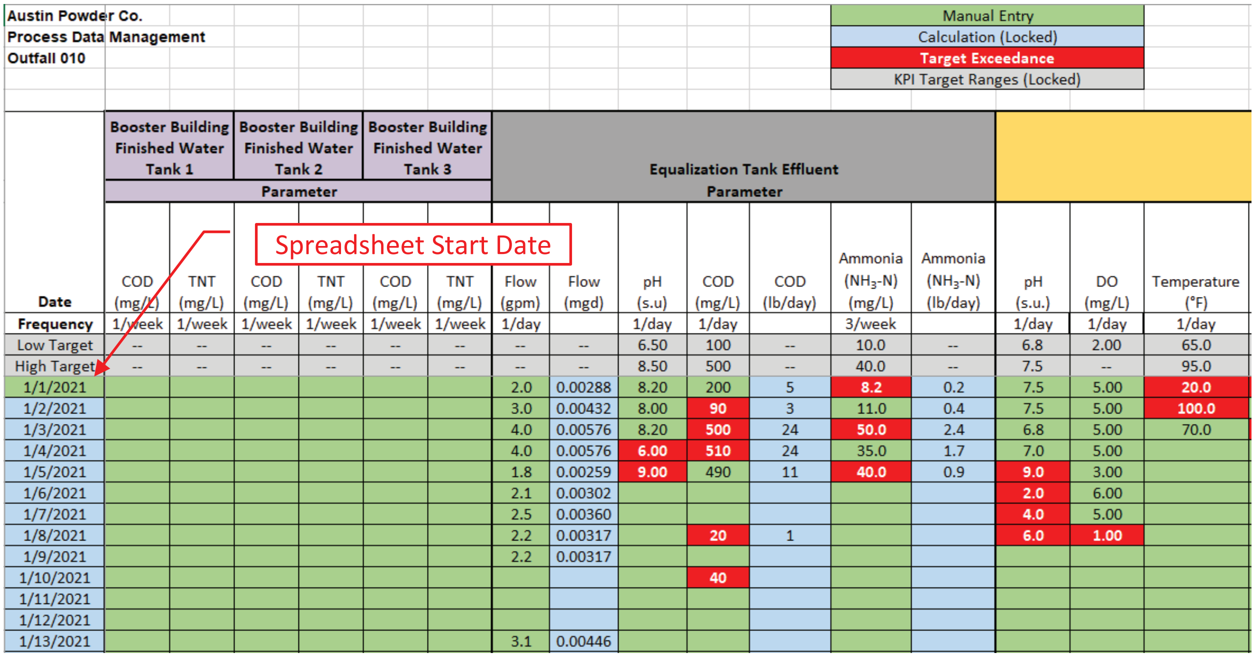
1. Open the data file from its assigned location on the APC network.
2. Select the ‘Process Control Data’ tab.
3. Scroll down to the row showing the current date.
4. Input all of the meter readings and analytical results for the current date.

5. Blue cells containing formulas should be locked and inaccessible. If data are accidentally entered in a blue cell containing a formula, press Ctrl + Z to undo the entry or click the undo button ↶ on the quick access toolbar next to the save icon.
6. Cells where the entered result is outside the KPI range for that parameter will automatically **turn red.** If any cells turn red, proceed to Section 3 and follow the instructions for performing data quality checks and troubleshooting.
7. Once all of the day's data have been entered, save the file by pressing Ctrl + S or clicking the Save Icon 💾 at the top left of the Excel window.

2.3 FILE ARCHIVING AND UPDATES

The DMS spreadsheet has been designed to accommodate four years of WWTP monitoring data. At the end of each four-year period, the WWTP supervisor should complete the following steps:

1. Save the active DMS file with a new file name to represent its status as archived data and store it in a separate directory.
2. Clear all monitoring data from the green cells in the active DMS spreadsheet.
3. Change the starting date on the DMS spreadsheet to January 1 of the coming year. The new date should be entered in the cell indicated below.



Austin Powder Co.
Process Data Management
Outfall 010

🟩 Manual Entry
🟦 Calculation (Locked)
🟥 **Target Exceedance**
▨ KPI Target Ranges (Locked)

	Booster Building Finished Water Tank 1		**Booster Building Finished Water Tank 2**		**Booster Building Finished Water Tank 3**		**Equalization Tank Effluent Parameter**									
	Parameter															
Date	COD (mg/L)	TNT (mg/L)	COD (mg/L)	TNT (mg/L)	COD (mg/L)	TNT (mg/L)	Flow (gpm)	Flow (mgd)	pH (s.u)	COD (mg/L)	COD (lb/day)	Ammonia (NH_3-N) (mg/L)	Ammonia (NH_3-N) (lb/day)	pH (s.u.)	DO (mg/L)	Temperature (°F)
Frequency	1/week	1/week	1/week	1/week	1/week	1/week	1/day		1/day	1/day		3/week		1/day	1/day	1/day
Low Target	--	--	--	--	--	--	--	--	6.50	100	--	10.0	--	6.8	2.00	65.0
High Target	--	--	--	--	--	--	--	--	8.50	500	--	40.0	--	7.5	--	95.0
1/1/2021							2.0	0.00288	8.20	200	5	**8.2**	0.2	7.5	5.00	**20.0**
1/2/2021							3.0	0.00432	8.00	**90**	3	11.0	0.4	7.5	5.00	**100.0**
1/3/2021							4.0	0.00576	8.20	**500**	24	**50.0**	2.4	6.8	5.00	70.0
1/4/2021							4.0	0.00576	**6.00**	**510**	24	35.0	1.7	7.0	5.00	
1/5/2021							1.8	0.00259	**9.00**	490	11	**40.0**	0.9	**9.0**	3.00	
1/6/2021							2.1	0.00302						**2.0**	6.00	
1/7/2021							2.5	0.00360						**4.0**	5.00	
1/8/2021							2.2	0.00317		**20**	1			**6.0**	**1.00**	
1/9/2021							2.2	0.00317								
1/10/2021										**40**						
1/11/2021																
1/12/2021																
1/13/2021							3.1	0.00446								

Spreadsheet Start Date

3. DATA QUALITY CHECKS AND KPIS

If any data cells turn red during the daily data entry, WWTP operators should follow the checklist of instructions below.

1. Confirm that the correct number was copied from the handwritten results into the spreadsheet. Transcription errors, such as missing a decimal point or accidentally adding an additional digit, are common in data entry.
2. If the result is for an analytical test (e.g., COD on the Hach spectrophotometer), verify that the value is accurate by performing standard QA/QC checks as instructed in the laboratory SOPs:
   a. Run a standard analysis to verify the instrument is operating properly (recovery between 90 and 110 percent).
   b. Run a duplicate analysis and confirm that the method is being followed consistently (RPD value of < 20).
3. If the value has been confirmed to be accurate after Steps 1 and 2 above, the parameter is outside the target KPI range. Operators should refer to the 010 WWTP Troubleshooting Guides for instructions on how to analyze and correct the condition. An example troubleshooting exercise is given below.

Example: The KPI range for COD at the Feed Well/Equalization Tank is 100 to 500 mg/L. Today's measurement has been confirmed at 800 mg/L. High influent COD can lead to an upset of the WWTP bioreactor due to high F/M_{COD} ratio and/or low DO. The Troubleshooting Guides indicate the following potential causes and corrective actions for high COD at the Feed Well/Equalization Tank:

Possible Root Cause	Corrective Action
High COD from Booster Buildings	Check COD at Booster Building Raw Water Tanks and Finished Water Tanks, determine if activated carbon in pretreatment system is exhausted and replace as necessary.
Upstream spill or washdown	Contact Operations and inquire if any upsets have occurred or any abnormal streams have been sent to the sewer.
General corrective action (all potential causes)	Reduce forward flow if possible to maintain F/M_{COD} within acceptable levels.

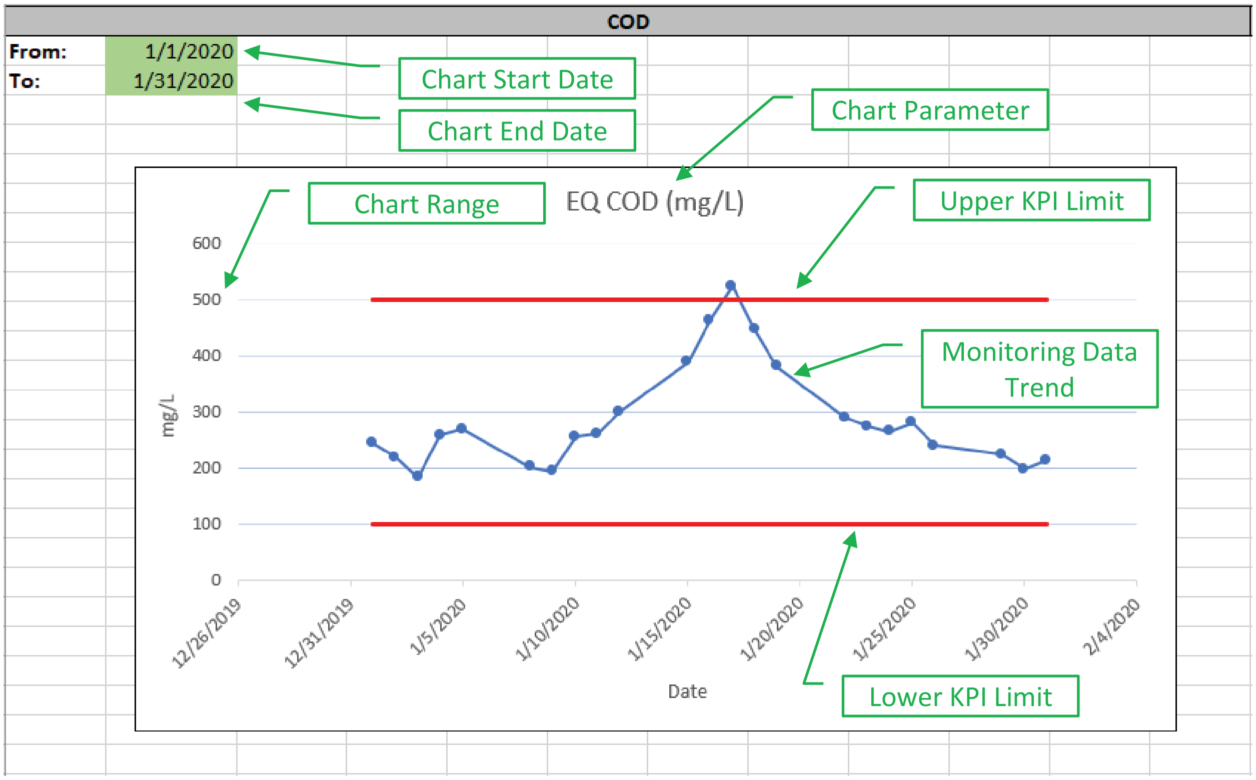
4. DATA TRENDING CHARTS

Chronological charts are a useful data analysis and troubleshooting tool for managing operations at the WWTP. The DMS includes dynamic charts that allow the operators to review high-priority operating parameters over any time range. The two most common types of charts are:

- 30-day charts – operation over the past month to check for trends in WWTP performance that may not be obvious from day-to-day data review.
- 12-month charts – operation over the past year to determine if any variations in WWTP performance can be associated with seasonal effects.

4.1 EXAMPLE CHARTS

The example charts below show influent COD over a 30-day period and effluent NH_3-N over a 12-month period. Key components of each chart are also identified on the 30-day chart.



COD

From: 1/1/2020

To: 1/31/2020

Chart Start Date

Chart End Date

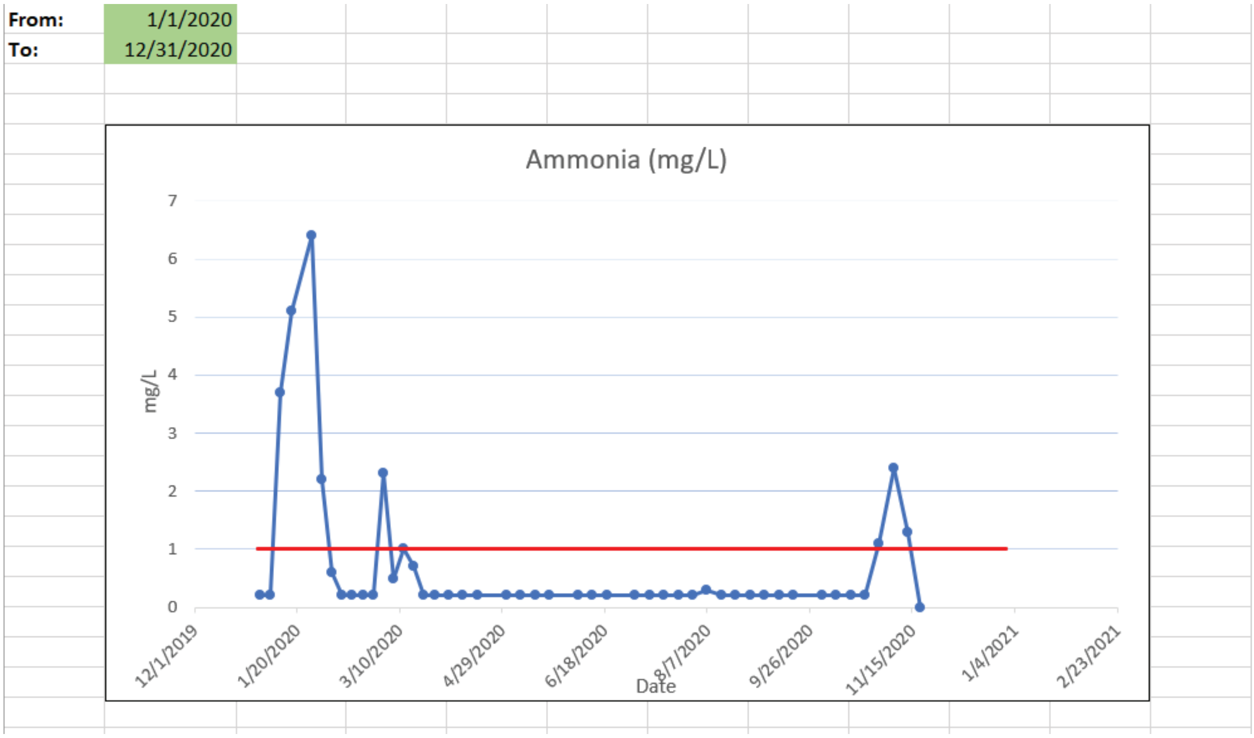
Chart Parameter

Chart Range

Upper KPI Limit

Monitoring Data Trend

Lower KPI Limit

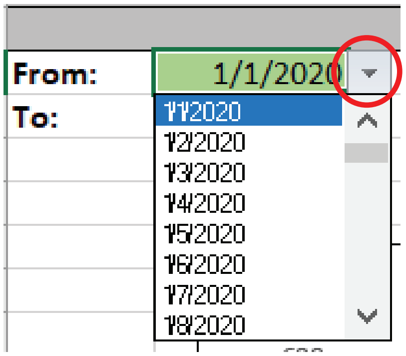


From: 1/1/2020
To: 12/31/2020

The example 30-day chart shows a mid-month peak in influent COD that gradually rises and then falls back with the allowable KPI range. The example 12-month chart shows elevated concentrations of NH_3-N during the winter and late autumn months, indicating a possible correlation between poor ammonia removal and cold weather operations.

4.2 SELECTING CHART RANGES

When updating charts to review, WWTP operators must input the start and end dates for the horizontal axis. Each chart includes a pair of input boxes to accomplish this. Date Ranges on each chart are updated as follows:



From: 1/1/2020
To:

1. For the chart to be updated, click on the green cell to the right of the “From:” label to select it.
2. A drop-down arrow ▼ will appear to the right of the selected cell, as shown in the image to the right.
3. Click on the arrow and a drop-down menu will appear.
4. Scroll to the desired start date for the chart and click on it.
5. Repeat Steps 1-4 for the green cell to the right of the “To:” label to set the desired end date.

APPENDIX H

KEY PROCESS INDICATORS AND TROUBLESHOOTING GUIDES

Operations Manual – Outfall 010 WWTP

Austin Powder Company
Red Diamond Facility
McArthur, Ohio

APPENDIX H. KEY PROCESS INDICATORS AND TROUBLESHOOTING GUIDES FOR OUTFALL 010 WWTP

FEED WELL/EQUALIZATION TANK

PARAMETER	TARGET RANGE	DEVIATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
pH	**6.5-8.5 s.u.**	High	1) Bioreactor upset 2) Effluent violation	a) High upstream pH	i) Contact Operations to identify any potential releases of basic (alkaline) material ii) Monitor downstream pH at Aeration Tank iii) Add acid if necessary to control pH
		Low	1) Bioreactor upset 2) Effluent violation	b) Low upstream pH	i) Contact Operations to identify any potential releases of acidic material ii) Monitor downstream pH at Aeration Tank iii) Add caustic if necessary to control pH
COD	**100-500 mg/L**	High	1) Increased Bioreactor F/M(COD) 2) Reduced Bioreactor DO 3) Bioreactor upset/poor effluent quality	a) High COD from Booster Buildings b) Upstream spill or washdown	i) Check Booster Building pretreatment units for carbon exhaustion ii) Adjust forward flow if necessary to maintain F/M iii) Contact Operations and inquire if any upsets
		Low	1) Reduced Bioreactor F/M(COD) 2) Poor effluent quality (biomass digestion, elevated TSS)	a) Low influent COD b) Prolonged production downtime	i) Adjust forward flow if necessary to maintain F/M ii) Increase MicroC addition rate if necessary to maintain F/M
NH_3-N	**10-40 mg/L**	High	1) Increased Bioreactor F/M(TKN) 2) Potential Bioreactor nitrification upset	a) Upstream spill or washdown	i) Notify Environmental if NH_3-N **> 50 mg/L** ii) Adjust flow out of Equalization Tank if possible to maintain F/M(TKN)
		Low	1) Loss of nitrification 2) Potential nutrient deficiency/sludge bulking	a) Prolonged production downtime	i) Adjust flow out of Equalization Tank if possible to maintain F/M(TKN) i) Consider supplemental nitrogen source for prolonged outages

APPENDIX H. KEY PROCESS INDICATORS AND TROUBLESHOOTING GUIDES FOR OUTFALL 010 WWTP

AERATION TANK

PARAMETER	TARGET RANGE	DEVIATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
pH	**6.8-7.5 s.u.**	High	1) Nitrification inhibition due to free NH_3-N 2) Elevated effluent NH_3-N	a) High influent pH b) pH meter malfunction c) Loss of nitrification	i) Check upstream pH ii) Clean, calibrate, and test pH probe iii) Check F/M for NH_3-N, check dosing chamber for high effluent NH_3-N
		Low	1) Nitrification inhibition due to free HNO_2 2) Elevated effluent NH_3-N	a) High NH_3-N loading / high alkalinity demand b) Low influent pH c) pH meter malfunction	i) Provide temporary pH adjustment (soda ash addition) ii) Check upstream pH iii) Clean, calibrate, and test pH probe
DO	**> 2.0 mg/L**	High	1) Excess energy expenditure from over-aeration	a) Low organic (COD) loading b) Excessive aeration c) Loss / inhibition of bioactivity	i) Increase MicroC feed rate or reduce MLSS if F/M is low ii) Reduce blower air flow iii) Perform SOUR test to determine if biomass is viable or inhibited – investigate potential causes of toxicity
		Low	1) Reduced nitrification, high effluent NH_3-N 2) Increased filamentous bacteria 3) Reduced COD removal, high effluent COD	a) High organic (COD) loading b) Insufficient aeration	i) Increase aeration rate if available ii) Reduce feed flow from MicroC Feed Pump
Temperature	**60-90 °F**	High	1) Loss of nitrification 2) Elevated effluent NH_3-N 3) Loss of COD treatment 4) Effluent noncompliance	a) High organic loading b) High ambient temperature c) Excessive foaming	i) Notify Environmental if temperature > **92 °F** ii) Confirm appropriate F/M, adjust feed rate or MLSS if out of range iii) Increase aeration rate iv) Troubleshoot high foaming, add defoamer
		Low	1) Reduced nitrification rate 2) Reduced COD removal rate 3) Elevated effluent NH_3-N and/or COD	a) Low ambient temperature b) Low COD loading c) Excessive aeration d) Malfunction of steam addition	i) Notify Environmental if temperature < **63 °F** ii) Reduce aeration if possible while maintaining DO > 2 mg/L iii) Monitor COD loading and adjust forward flow or MicroC addition if possible to maintain F/M iv) Check influent temperature, troubleshoot influent heater
Conductivity	**< 1,000 µS**	High	1) Deflocculation / high effluent TSS 2) Potential biological inhibition	a) Discharge of high-salt waste stream	i) Contact Operations to investigate possible discharges of high salinity
		Low	1) No negative consequences		i) No action required
MLSS	**2,000-4,000 mg/L**	High	1) Low F/M ratios 2) Hindered settling in Clarifier/high effluent TSS	a) Insufficient sludge wastage b) Recovery from a high-COD loading event	i) Increase sludge wastage while maintaining F/M ratios within target ranges
		Low	1) High F/M ratios 2) Discrete settling in Clarifier/high effluent TSS	a) Excessive sludge wastage b) High TSS carryover from Clarifier c) Recovery from process upset	i) Reduce sludge wastage while maintaining F/M ratios within target ranges ii) Check Clarifiers for proper operation
MLVSS/MLSS	**75-90%**	High	1) No negative consequences		i) No action required
		Low	1) High MLSS required to maintain F/M ratios 2) Hindered settling in Clarifier/high effluent TSS	a) High load of inert influent TSS b) Insufficient sludge wastage	i) Check Equalization Tank for high TSS and identify potential sources ii) Increase sludge wastage while maintaining F/M ratios within target ranges

APPENDIX H. KEY PROCESS INDICATORS AND TROUBLESHOOTING GUIDES FOR OUTFALL 010 WWTP

AERATION TANK (CONT.)					
PARAMETER	**TARGET RANGE**	**DEVIATION**	**POTENTIAL CONSEQUENCES**	**POSSIBLE ROOT CAUSES**	**INVESTIGATIVE OR CORRECTIVE ACTION**
F/M (COD)	**0.15-0.25 d^{-1}**	High	1) Reduced COD removal efficiency 2) High effluent COD, possible TNT 3) Dispersed growth bacteria (high effluent TSS) 4) Excessive foaming 5) Low DO and associated consequences	a) High influent COD b) High forward flow rate c) Low MLVSS	i) Reduce forward flow from Equalization Tank if possible ii) Reduce feed of MicroC iii) Reduce wastage to increase MLSS/MLVSS iv) Increase antifoam addition if foam is excessive v) Increase aeration rate if DO is low
		Low	1) Pin floc (high effluent TSS) 2) Poor Clarifier settling (open floc due to filamentous bacteria)	a) Low influent COD b) Low forward flow rate c) High MLVSS	i) Increase forward flow from Equalization Tank if possible ii) Increase feed of MicroC iii) Increase wastage to reduce MLSS/MLVSS iv) Increase return sludge flow if settling is poor
Surface Foam	**< 75% coverage**	High	1) High effluent TSS (foam carryover to Clarifiers) 2) Foam spillover to ground 3) Development of filamentous bacteria in foam layer	a) Nutrient deficiency (low N and/or P) b) Upset recovery c) Rapid increase in F/M (COD)	i) Check residual phosphorus, add supplemental phosphorus if necessary ii) Provide temporary antifoam addition iii) Initiate chlorine (bleach) addition for filamentous bacteria control if antifoam is not effective
		Low/None	1) No negative consequences		i) No action required
SVI	**< 100 mL/g**	High	1) High effluent TSS (solids carryover) 2) Sand filter plugging	a) Filamentous sludge bulking b) Viscous bulking (nutrient deficiency)	i) Conduct microscope exam, check for filament content and elevated EPS
		Low	1) No negative consequences		i) No action required

APPENDIX H. KEY PROCESS INDICATORS AND TROUBLESHOOTING GUIDES FOR OUTFALL 010 WWTP

DOSING CHAMBER

PARAMETER	TARGET RANGE	DEVIATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
Turbidity	**< 50 NTU**	High	1) Rapid blinding of sand filters 2) Poor UV disinfection potential 3) Effluent noncompliance (*E. coli,* TSS)	a) Pin floc b) Dispersed growth c) High loading of inert influent TSS d) Denitrification (floating sludge) e) Poor scum removal	i) Increase wastage to lower sludge age while maintaining F/M within target range ii) Reduce wastage to increase sludge age while maintaining F/M within target range iii) Check Equalization Tank for high influent TSS iv) Reduce Clarifier retention time (increase RAS rate), check for high COD in effluent v) Inspect scum removal system for proper operation
		Low	1) No negative consequences		i) No action required
TSS	**< 30 mg/L**	High	1) Rapid blinding of sand filters 2) Poor UV disinfection potential 3) Effluent noncompliance (*E. coli,* TSS)	a) Pin floc b) Dispersed growth c) High loading of inert influent TSS d) Denitrification (floating sludge) e) Poor scum removal	i) Increase wastage to lower sludge age while maintaining F/M within target range ii) Reduce wastage to increase sludge age while maintaining F/M within target range iii) Check Equalization Tank for high influent TSS iv) Reduce Clarifier retention time (increase RAS rate), check for high COD in effluent v) Inspect scum removal system for proper operation
		Low	1) No negative consequences		i) No action required

UV FEED WELL

PARAMETER	TARGET RANGE	DEVIATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
NH_3-N	**< 1.0 mg/L**	High	1) Effluent noncompliance	a) High influent NH_3-N b) Nitrification upset	i) Reduce forward flow from Equalization Tank if possible ii) Reduce wastage to increase MLSS/MLVSS iii) Add supplemental nitrifiers if elevated effluent NH_3-N is observed iv) Increase alkalinity (supplemental soda ash addition)
		Low	1) No negative consequences		i) No action required
PO_4-P	**> 1.0 mg/L**	High	1) High effluent TSS (algae growth)	a) Excess phosphorus in feed	i) Check phosphorus at Equalization Tank ii) Check production/break areas for possible sources of high phosphorus (e.g., cleaners)
		Low	1) Poor sludge settling (viscous bulking) 2) High foam at Bioreactor 3) Reduced Bioreactor performance	a) Low phosphorus in feed	i) Add supplemental phosphorus (sodium phosphate solution)
NO_3-N + NO_2-N	**0-20 mg/L**	High	1) Denitrification in clarifiers leading to high effluent turbidity/TSS 2) Effluent noncompliance (*E. coli*, TSS, and/ or NH_3-N)	a) High influent NH_3-N b) Nitrification upset (free nitrous acid toxicity)	i) Reduce forward flow from Equalization Tank if possible ii) Reduce wastage to increase MLSS/MLVSS iii) Add supplemental nitrifiers if elevated effluent NH_3-N is observed iv) Increase alkalinity (supplemental soda ash addition)
		Low	1) No negative consequences		i) No action required
COD	**< 80 mg/L**	High	1) Potential effluent noncompliance (BOD)	a) Low DO in Aeration Tank b) High F/M in Aeration Tank c) Aeration Tank inhibition/toxicity	i) Refer to troubleshooting guides for low DO in Aeration Tank ii) Refer to troubleshooting guide for high F/M in Aeration Tank iii) Check COD removal performance data for potential inhibition
		Low	1) No negative consequences		i) No action required
TSS	**< 10 mg/L**	High	1) Poor UV disinfection potential 2) Effluent noncompliance (*E. coli*, TSS)	a) Channeling in sand filter bed b) High solids load to sand filters c) Dispersed growth in Aeration Tank	i) Switch to standby sand filter ii) Inspect filter bed and replace media if needed iii) Refer to troubleshooting guides for high TSS at Dosing Chamber
		Low	1) No negative consequences		i) No action required

APPENDIX H. KEY PROCESS INDICATORS AND TROUBLESHOOTING GUIDES FOR OUTFALL 010 WWTP

UV DISINFECTION SYSTEM

PARAMETER	TARGET RANGE	DEVIATION	POTENTIAL CONSEQUENCES	POSSIBLE ROOT CAUSES	INVESTIGATIVE OR CORRECTIVE ACTION
UV Transmittance	**> 75%**	High	1) No negative consequences		i) No action required
		Low	1) Effluent noncompliance (*E. coli*)	a) High effluent turbidity b) Dirty UV bulb/sheath (scale or fouling) c) UV bulb near end of life	i) Refer to troubleshooting guide for high turbidity at Dosing Chamber ii) Inspect and clean UV bulb/sheath iii) Replace UV bulb