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David M. Shelton
Counsel – Environmental

January 5, 2022

Via Electronic Mail and Certified Mail
Amari Farren
Office of Water Quality
Indiana Department of Environmental Management
100 North Senate Avenue
Indianapolis, IN 46204-2251
afarren@idem.in.gov

Re: U. S. Steel Midwest Plant, NPDES Permit No. 0000337
Agreed Order, Case Nos. 2019-26434-W, 2019-26665-W

Dear Ms. Farren:

Please find the attached Updated Compliance Plan for the Midwest Agreed Order for your review. The attached document is the update to the Compliance Plan submitted to IDEM on June 25, 2021 and approved by IDEM on July 9, 2021. Upon approval by IDEM, U. S. Steel is prepared to immediately commence with the tasks proposed in the Updated Compliance Plan as listed in the Implementation and Improvement Schedule in Section 10 of the Plan. U. S. Steel retained Ramboll, an engineering firm with Professional Engineers licensed in the state of Indiana to develop the Updated Compliance Plan that identifies actions U. S. Steel will take to achieve and maintain compliance with the NPDES permit.

Should you have any questions, comments, or need additional information regarding the Updated Compliance Plan, please feel free to contact me.

Best Regards,

David M. Shelton
Counsel – Environmental
United States Steel Corporation

Cc: Susanna Bingman (via e-mail)
Beth Admire (via-e-mail)
Jason House (via e-mail)
Alexis Piscitelli (via e-mail)
Tishie Woodwell (via e-mail)

United States Steel Corporation
Midwest Plant
6300 US Highway 12
Portage, IN 46368

Wastewater Compliance Plan
NPDES Permit No. IN0000337

Per Agreed Order Case Nos.
2019-26434-W, 2019-26665-W

Submitted: January 5, 2022

CONTENTS

TABLES

APPENDICES

1. EXECUTIVE SUMMARY

During investigations performed by the Indiana Department of the Environmental Management (IDEM) in recent history, several violations were found. These violations necessitated a full review of all aspects of U. S. Steel Midwest's wastewater treatment systems, operational procedures, and associated programs. These operational activities are under the purview of IDEM under several sections of 327 Indiana Administrative Code with regards to the National Pollutant Discharge Elimination System (NPDES).

Under the case numbers 2019-26434-W and 2019-26665-W, U. S. Steel entered into an Agreed Order, which requires U. S. Steel to develop and submit to IDEM a Compliance Plan that identifies actions U. S. Steel will take to achieve and maintain compliance with the NPDES permit. The Agreed Order specifies that this must include:

a. Identifying the causes of the violations cited in the Agreed Order;
b. Evaluating all contributions to the Treatment Plants, and for each source identify their characteristics, provided pretreatment, and operational needs for elimination, control, or treatment;
c. Evaluating the Pretreatment, Chrome, and Final Treatment Plants, including their process components, adequacy, equipment status, and planned improvements;
d. Developing and Implementing a Preventative Maintenance Program;
e. Developing and Implementing a Standard Operating Procedure for communications between operations personnel and treatment plant personnel; and
f. Developing an Implementation and Improvement Schedule with specific milestone dates.

This document is the update to the Compliance Plan submitted to IDEM on June 25, 2021 and approved by IDEM on July 9, 2021. Evaluations performed are attached as Appendices. The Implementation and Improvement Schedule is presented in Section 10. U. S. Steel contracted with Ramboll US Corporation (Ramboll) to perform the evaluations of the sources and treatment systems that were required to be performed by a Professional Engineer. U. S. Steel also contracted Ramboll to perform a root cause analysis of the violations and to review the Preventative Maintenance Procedure and the Standard Operating Procedure for communications.

2. BACKGROUND

U. S. Steel Corporation (U. S. Steel) owns and operates finishing facility in Portage, Indiana known as the Midwest Plant (U. S. Steel Midwest). The Midwest Plant operates as part of the U. S. Steel Gary Works. Principal processes include tin mill products, cold-rolled steel, electrical lamination, and hot-dip galvanized steels. The Midwest Plant is situated approximately 10 miles east of Gary Works on Lake Michigan.

U. S. Steel Midwest is authorized to discharge process wastewaters, non-contact cooling water, and stormwater to the Portage-Burns Waterway adjacent to the facility under National Pollutant Discharge Elimination System (NPDES) Permit IN0000377. Authorized outfalls include the following:

- Outfall 002;
- Outfall 003;
- Outfall 004;
- Outfall 104 and 204;
- Outfall 304; and
- Outfall 500.

Outfalls 002 and 003 are permitted to discharge non-contact cooling water and stormwater only. Outfall 004 is permitted to discharge process wastewater received from the internal Outfalls 104 and 204. Outfall 500 is an administrative outfall used to compile reported temperatures of intake, upstream and downstream river, and outfall effluent temperatures.

Internal Outfall 104 contains discharges from the Final Treatment Plant, while internal Outfall 204 contains discharges from the Chrome Treatment Plant. The administrative Outfall 304 is the combined total of Outfalls 104 and 204.

Permit limitations exist as qualitative or quantitative for all outfalls. Parameters with qualitative limits include visual assessments for the following:

- Color;
- Odor;
- Diminished clarity;
- Floating solids;
- Settled solids;
- Suspended solids;
- Foam;
- Oil sheen; and
- Other obvious indicators of pollution.

Parameters with quantitative limits include the following:

- Total residual chlorine (TRC);
- pH;
- Silver;
- Free cyanide;
- Cadmium;
- Copper;

- Nickel;
- Lead;
- Mercury; and
- Whole effluent toxicity (WET).

Outfalls 002 and 003 only have limits on TRC and pH; Outfall 004 is limited by all of the above parameters.

Wastewater flows to the treatment plants are separated by initial source and treated according to stream contents. The Pretreatment Plant operates to equalize and remove oil and grease for select wastewater sources prior to treatment at the Final Treatment Plant. Streams containing hexavalent chromium are routed to the Chrome Treatment Plant. Oil recovered during the treatment processes is dewatered and removed via third party contractors.

3. IDENTIFICATION OF CAUSES OF VIOLATIONS

U. S. Steel contracted Ramboll to perform a root cause analysis (section II.6.A of Agreed Order) to identify the most likely causes of the violations presented in the Findings of Facts (Section I of the Agreed Order). The Root Cause Analysis is presented in Appendix 1.

This analysis focused on violations related to effluent quality presented in the Agreed Order sections I.9, I.15, I.16, I.20, and I.21 and not those violations related to monitoring and reporting presented in sections I.10 through I.14 and I.19 of the Agreed Order. U. S. Steel adjusted monitoring and reporting practices immediately following those violations.

U. S. Steel is actively engaged in a Toxic Reduction Evaluation (TRE) as a result of the violation related to Whole Effluent Toxicity Testing presented in section I.18 of the Agreed Order. As the TRE is on-going, it was excluded from this evaluation. Any findings and/or corrective actions resulting from the TRE will be amended to the Compliance Plan as appropriate, and U. S. Steel will continue to submit quarterly updates to IDEM.

4. SOURCE SURVEY REPORT

U. S. Steel contracted with Ramboll to perform the evaluation of all contributions to the Treatment Plants and the identification of opportunities for elimination, controls, or improved treatment (Section II.6.B parts i through iv of Agreed Order). The Source Survey performed by Ramboll is presented in Appendix II.

5. ENGINEERING EVALUATION – PRETREATMENT PLANT

U. S. Steel contracted Ramboll to perform the engineering evaluation of the adequacy of the Pretreatment Plant components and operational needs (Section II.6.C parts i through v of Agreed Order). This Engineering Evaluation is presented in Appendix III.

6. ENGINEERING EVALUATION – CHROME TREATMENT PLANT

U. S. Steel contracted Ramboll to perform the engineering evaluation of the adequacy of the Chrome Treatment Plant components and operational needs (Section II.6.D parts i through v of Agreed Order). This Engineering Evaluation is presented in Appendix IV.

7. ENGINEERING EVALUATION – FINAL TREATMENT PLANT

U. S. Steel contracted Ramboll to perform the engineering evaluation of the adequacy of the Final Treatment Plant components and operational needs (Section II.6.D parts i through v of Agreed Order). This Engineering Evaluation is presented in Appendix V.

8. REVIEW OF PREVENTATIVE MAINTENANCE PROGRAM AND STANDARD OPERATING PROCEDURES FOR COMMUNICATIONS

U. S. Steel contracted Ramboll to review the Preventative Maintenance Program Plan (PMPP) for U. S. Steel Midwest (Section II.6.E of Agreed Order) and the Standard Operating Procedure (SOP) for communications between operations personnel and treatment personnel (Section II.6.F of Agreed Order). A Memorandum summarizing this review is presented in Appendix VI.

9. IMPROVEMENT PLAN

Based on all of the evaluations preformed and recommendations from Ramboll, a comprehensive Improvement Plan has been developed. U. S. Steel will perform the following:

1. Review and revise, as needed, the current operations guidance documents for the treatment systems. This will include ensuring SOPs and PMPP reflect accurate KPIs, reaffirming personnel roles and responsibilities, and reviewing tracking of non-routine maintenance
2. Conduct a bench-scale Outfall defoamer optimization study and document optimal feed rate.
3. Review effectiveness of the training program.
4. Develop alarms to indicate when key process sump pumps are operating at abnormal conditions.
5. Perform an Engineering Assessment to review the feasibility and effectiveness of utilizing the existing 1M gallon tank for diversion capability at the Final Treatment Plant.
6. Provide results of diversion capability Engineering Assessment and update Compliance Plan, as appropriate.
7. Improve reliability of Chrome Treatment Plant performance by refurbishing the continuous backwash filters and adding valving.
8. Perform an Engineering Assessment to review feasibility and effectiveness of potential reduction of flow and loading to the Final Treatment Plant from batch tanks dumps and coating oil systems.
9. Provide results of Final Treatment flow and loading Engineering Assessment and update Compliance Plan, as appropriate.
10. Upgrade the Final Treatment Plant control system to provide the ability to flow pace chemical additions, improve process control, and enhance the monitoring and alarming capabilities.
11. Upgrade the Pretreament Plant with the capability to process all pretreatment source flows through API separators and DAF units.
12. Modify Final Treatment Plant Equalization Basins to improve flow distribution and oil removal.

10. IMPLEMENTATION PLAN AND SCHEDULE

Table 10.1 below presents the timeframe for implementing the Improvement Plan identified in Section 9. For each task, an estimated duration for completion is presented. Table 10.2 below presents the tasks with specific milestone dates. All durations will commence upon approval by IDEM of this Updated Compliance Plan. As per section II.7 of the Agreed Order, U. S. Steel must demonstrate compliance with the terms and conditions of the NPDES permit for 12 consecutive months upon completion of the improvements. The Compliance Demonstration is therefore expected to begin 36 months following IDEM approval of this Updated Compliance Plan. This schedule may need to be modified due to current global supply chain issues, labor shortages, the ongoing global COVID-19 pandemic, and other *force majeure* issues that may arise pursuant to the section II.30 of the Agreed Order. U. S. Steel will provide IDEM with periodic schedule updates.

Table 10.1 Improvement Plan Tasks

Task Number	Task Name	Estimated Task Timeframe (months)
1	Review and revise, as needed, the current operations guidance documents for the treatment systems. This will include ensuring SOPs and PMPP reflect accurate KPIs, reaffirming personnel roles and responsibilities, and reviewing tracking of non-routine maintenance.	4 months
2	Conduct a bench-scale Outfall defoamer optimization study and document optimal feed rate.	6 months*
3	Review effectiveness of the training program.	7 months
4	Develop alarms to indicate when key process sump pumps are operating at abnormal conditions.	8 months
5	Perform an Engineering Assessment to review the feasibility and effectiveness of utilizing the existing 1M gallon tank for diversion capability at the Final Treatment Plant.	9 months
6	Provide results of diversion capability Engineering Assessment and update Compliance Plan, as appropriate.	11 months*
7	Improve reliability of Chrome Treatment Plant performance by refurbishing the continuous backwash filters and adding valving.	12 months
8	Perform an Engineering Assessment to review feasibility and effectiveness of potential reduction of flow and loading to the Final Treatment Plant from batch tanks dumps and coating oil systems.	12 months
9	Provide results of Final Treatment flow and loading Engineering Assessment and update Compliance Plan, as appropriate.	14 months*
10	Upgrade the Final Treatment Plant control system to provide the ability to flow pace chemical additions, improve process control, and enhance the monitoring and alarming capabilities.	24 months

Table 10.1 Improvement Plan Tasks		
Task Number	**Task Name**	**Estimated Task Timeframe (months)**
11	Upgrade the Pretreament Plant with the capability to process all pretreatment source flows through API separators and DAF units.	36 months*
12	Modify Final Treatment Plant Equalization Basins to improve flow distribution and oil removal.	36 months*
	TOTAL	**36 months**
*Timeframes for tasks 2, 6, 9, 11, and 12 are milestone dates (see table below). All other tasks are estimated timeframes that may be adjusted as needed and are not subject to stipulated penalties.		

Table 10.2 Milestones		
Task Number	**Milestone**	**Milestone Date (months)**
2	Conduct a bench-scale Outfall defoamer optimization study and document optimal feed rate.	6 months
6	Provide results of diversion capability Engineering Assessment and update Compliance Plan, as appropriate.	11 months
9	Provide results of Final Treatment flow and loading Engineering Assessment and update Compliance Plan, as appropriate.	14 months
11	Upgrade the Pretreament Plant with the capability to process all pretreatment source flows through API separators and DAF units.	36 months
12	Modify Final Treatment Plant Equalization Basins to improve flow distribution and oil removal.	36 months

APPENDIX I
ROOT CAUSE ANALYSIS

WATER

TECHNICAL MEMORANDUM

Project name **U. S. Steel Midwest Root Cause Assessment**
Project no. **1690022867**
Client **U. S. Steel Midwest**
Memo no. **01**
Version **1 – Internal Review and Comment**
From **Matt Hausmann**

Prepared by **Elizabeth Sensing**
Checked by **Matt Hausmann**
Approved by **David G Gilles, PE, PE Indiana Number 12100267**

January 4, 2022

Table of Contents

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1 Executive Summary

U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM, which requires identifying the causes for the permit exceedances listed in the Agreed Order. U. S. Steel contracted Ramboll to perform an independent assessment of the root causes for these exceedances. This memo covers the assessments of the effluent limit exceedances indicated in the Agreed Order, including the cause identified by U. S. Steel, the corrective actions taken by U. S. Steel, the most likely cause identified by Ramboll, and recommendations for additional correction actions for U. S. Steel to prevent additional similar incidents.

The exceedances listed in the Agreed Order are a combination of qualitative and numeric exceedances. The qualitative exceedances consisted of observable foam at Outfalls 003 and 004, discoloration observed at Outfall 004, and oil sheens observed at Outfall 004. For the exceedances when a sheen was observed, a specific likely root cause could be identified for only one event; other oil sheen events were most likely due to isolated instances where the treatment systems were not operated optimally. Based on visual testing at the time of observation, foaming was determined to be most likely caused by the constituents in the receiving water upstream of the outfall. Specific events that caused the outfall discoloration were identified and consisted of:

- Leaks from a roll seal at the Tin Line and failure to respond properly to an alarm;
- Dumps of rolling solution and cleaner solution occurred within a timeframe too close together; and,
- Release of pickle solution that by-passed an automatic isolation valve.

The most likely specific causes attributed to the numeric exceedances are as follows: The hexavalent chromium exceedance was caused by a combination of a plugged sample line that fed an on-line pH probe and failure of an operator to follow Standard Operating Procedures for manually checking pH readings. The free cyanide exceedance was highly-likely caused by an analytical method interference that occurs when sodium hydroxide is used to preserve samples containing hypochlorite. The copper exceedances were most likely caused by the re-use of plastic graduated cylinders in lieu of disposable digestion cups by the contract analytical laboratory.

As part of this assessment, Ramboll did not review the exceedances related to reporting of temperatures and sample holding temperatures as these were previously corrected by U. S. Steel. The exceedances related to Whole Effluent Toxicity are still currently being investigated under IDEM's Toxicity Identification Evaluation (TIE) and Toxicity Reduction Evaluation (TRE) program.

In addition to the corrective actions already taken by U. S. Steel, Ramboll developed additional recommendations as presented in Section 5.

2 Background

U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM. One of the requirements of the Agreed Order is the identification of the root causes for the permit exceedances listed in the Agreed Order. U. S. Steel contracted Ramboll to perform an independent assessment of the root causes for several of these exceedances. Ramboll was requested to assess the following exceedances that occurred between November 2018 and December 2020:

1. November 28, 2018 – Foam at Outfall 104
2. December 18, 2018 – Foam at Outfall 004
3. May 9, 2019 – Discoloration and sheen at Outfall 004
4. May 30, 2019 – Foam at Outfall 003
5. August 8, 2019 – Sheen at Outfall 004
6. August 20, 2019 – Discoloration at Outfall 004
7. August 29, 2019 – Total copper at Outfall 004
8. September 6, 2019 – Sheen at Outfall 004
9. September 18, 2019 – Sheen at Outfall 004
10. October 13, 2019 – Total copper at Outfall 004
11. October 30, 2019 – Hexavalent chromium at Outfall 304
12. October 31, 2019 – Sheen, visible oil layer at Outfall 004
13. November 21, 2019 – Discoloration and sheen at Outfall 004
14. August 2020 – Whole Effluent Toxicity (WET) at Outfall 004
15. September 2020 – WET at Outfall 004
16. November 14, 2020 – Total copper at Outfall 004
17. November 28, 2020 – Total copper at Outfall 004
18. December 20, 2020 – Free cyanide at Outfall 004

This memorandum covers the assessments of the effluent limit exceedances listed above, including:

- The root cause identified by U. S. Steel and evaluated by Ramboll;
- The corrective actions taken by U. S. Steel;
- The most likely cause identified by U. S. Steel and Ramboll; and,
- Recommendations for additional correction actions for U. S. Steel to prevent additional similar incidents.

Attachments 1.1 through 1.16 present information and evaluations for each of the exceedances listed above. The Attachments present:

- Root Cause identified by U. S. Steel;
- Corrective Actions already taken by U. S. Steel;
- Information and Contributing Factors reviewed by Ramboll; and,
- Ramboll's determination of the most likely Root Cause.

In Sections 3 (Root Cause Identification) and Section 4 (Corrective Actions) below, the qualitative exceedances related to foam are grouped together as are the exceedances related to discoloration and also oil sheens. The quantitative exceedances for hexavalent chromium, free cyanide and total copper are then discussed. Section 5 presents Ramboll's recommendations for improvements based on this Assessment.

3 Root Cause Identification

Ramboll reviewed the information provided by U. S. Steel to determine the most likely root causes for the exceedances listed above in Section 2.

3.1 Foam Exceedances

Ramboll was unable to determine a specific event or cause for the three foam exceedances that occurred on November 28, 2018, December 18, 2018, and May 30, 2019 (Attachments 1.1, 1.2, and 1.4). Ramboll concluded that these events do have the same underlying most likely root causes:

1. Constituents in the receiving water in Burns Waterway;
2. Insufficient defoamer addition; and/or
3. Entrained air, especially at Outfall 003.

3.2 Discoloration Exceedances

Ramboll agrees with U. S. Steel as to the most likely root cause identified for the three exceedances (Attachments 1.3, 1.6, and 1.10) related to discoloration at Outfall 004. All discoloration exceedances were most likely a result of atypical wastewater treatment influents.

The May 9, 2019 discoloration at Outfall 004 (Attachment 1.3) was determined to be the result of a roll seal on the Tin Line leaking cleaning solution. The cleaning solution contained 3 - 7% sulfuric acid and an elevated concentration of dissolved iron, which gave Outfall 004 discharge a reddish-brown discoloration. This was compounded by the failure for operators to properly respond to a conductivity alarm that had indicated the leak had occurred.

On August 20, 2019, cleaner solution was discharged too soon to the Final Treatment Plant after rolling oil solution was discharged to the Pretreatment Plant, causing discoloration at Outfall 004 (Attachment 1.6). The chemical combination of the oil and the significant amount of cleaner resulted in oil that could not be removed by the Final Treatment Plant.

The November 21, 2019 exceedance at Outfall 004 (Attachment 1.10) resulted from a release of pickle solution from the Pickle Line. An alarm had closed a solenoid valve to stop the pickle solution from entering the sewer; however, the pickle solution was able to flow through a by-pass valve around the closed solenoid valve.

3.3 Oil Sheen Exceedances

Of the six exceedances listed for a visible oil sheen (Attachments 1.3, 1.5, 1.7, 1.8, 1.9, and 1.10), a likely root cause determined for three of the exceedances. No specific event or activity was identified as a likely cause for the other three sheen exceedances.

The May 9, 2019 oil sheen (Attachment 1.3), observed on the same day as a discoloration exceedance, as discussed above. was determined to be the result of a roll seal on the Tin Line leaking cleaning solution.

The September 6, 2019 oil sheen (Attachment 1.7) was the result of a discharge of coating oil from the pickling line directly to the Final Treatment Plant. A plugged drain in the coating oil drip tray caused an overflow to a sump. The Final Treatment Plant was unable to capture and remove this oil prior to discharge.

The November 21, 2019 oil sheen (Attachment 1.10) also occurred when the outfall was discolored as discussed above. The same day, when the pickle solution was released from the Pickle Line, oil was able to backflow through a faulty flapper valve from the oil skimming vault and backwards into the channel skimmer at the end of final settling basins.

The August 8, 2019, September 18, 2019, and October 31, 2019 exceedances for sporadic oil sheen (Attachments 1.5, 1.8, and 1.9, respectively) were not determined to be the fault of a particular activity or equipment failure. Ramboll assumed that this oil sheen was due to suboptimal oil removal in the treatment plants.

3.4 Hexavalent Chromium Exceedance

The most likely cause of the October 30, 2019 hexavalent chromium exceedance at Outfall 304 (Attachment 1.11) was twofold. First, the line that conveys samples to the inline pH probe plugged and resulted in an incorrect pH reading, which then led to inadequate sulfuric acid addition to the treatment system. Second, the operator failed to perform the routine manual pH measurements per the Standard Operating Procedure.

3.5 Total Copper Exceedances

While copper exceedances occurred on multiple dates, all were considered to be the result of contract laboratory error in the analysis of submitted samples. Following the 2020 exceedances from November 20 and 28 (Attachments 1.15 and 1.16), the contracted analytical lab performing the copper analyses (ALS, Inc) determined that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias in the results. As no samples were collected with copper concentrations measured to be equal to or higher than what was measured at Outfall 004, the same laboratory error is the most likely root cause of the earlier 2019 exceedances on August 29 and October 13 (Attachments 1.13 and 1.14).

3.6 Free Cyanide Exceedance

The most likely cause of the elevated free cyanide measured on December 20, 2020 (Attachment 1.12) is interference to the WAD cyanide test (Method 4500-CN-I). Using sodium hydroxide to preserve samples that contain background constituents is known to cause interference, including low levels of hypochlorite and formaldehyde. Two days prior to this sample event, U. S. Steel switched from hydrogen peroxide to hypochlorite injection ahead of Outfall 004 to control biological growth on the pipe walls.

4 Corrective Actions

This section presents corrective actions already taken by U. S. Steel as a result of these exceedances.

4.1 Foam Exceedances

A redundant defoamer system was installed after occurrence of the November 28, 2018 foaming exceedance. A second antifoam Water Treatment Additive (WTA) was approved and added with the previously used defoamer. When foam was observed after the secondary system was online, an increase in the approved dosage range was requested from IDEM, while defoamer addition rates were optimized.

After foam was observed at Outfall 003, approval to add defoamer to Outfalls 002 and 003 was requested of IDEM and given. A diluted defoamer WTA stream is currently added via a metering pump at these outfalls as needed, based on the condition of the receiving waters.

4.2 Discoloration Exceedances

As each discoloration exceedance is the result of a specific activity or equipment failure, corrective actions for these exceedances were tailored to their occurrence.

For instances where sheen was observed in addition to discoloration, booms were deployed. For instances where leaks caused atypical treatment plant influent condition, sumps were pumped down in a controlled manner.

U. S. Steel revised the SOPs for Releases, Spills, Leaks, and Dumps/Washdowns. Operators have been directed to prioritize alarm reactions to decrease response time. Additional review of alarms and their response procedures were reviewed where applicable.

4.3 Oil Sheen Exceedances

U. S. Steel revised the SOPs for Releases, Spills, Leaks, and Dumps/Washdowns. A skirted boom was installed at Outfall 004 after the August 8, 2019 incident.

Additional action items included:

- Evaluating the Final Treatment Plant by a third party;
- Investigating additional water treatment additive (WTA) options;
- Increasing Final Treatment sedimentation basin skimmer maintenance; and
- Conducting trials of different types of absorbent booms.

Reducing the operating pH in the Equalization Basins in November 2019 improved the separation and removal of oil and water at the Final Treatment Plant.

4.4 Hexavalent Chromium Exceedance

Procedural and equipment operation corrective actions were implemented as a result of the hexavalent chromium exceedance.

The continuous pH monitoring line had a clear cover installed to allow visual observation of flow over the probe. Flow monitors were installed on the sample lines to indicate if flow to the pH probes was interrupted. Operators were educated on the incident findings, and additional training procedures were implemented. Operators were temporarily instructed to conduct hourly pH tracking.

4.5 Total Copper Exceedances

The contract laboratory (ALS) modified its procedures for managing changes of analytical equipment and supplies.

4.6 Free Cyanide Exceedance

U. S. Steel worked with the commercial analytical laboratory (ALS) to determine that analyzing unpreserved samples eliminated an identified interference to the analytical method, as is allowed under permit requirements.

5 Summary of Recommendations

Based upon the review of the most likely cause for the exceedences, Ramboll developed the following recommendations.

5.1 Develop a Procedure to Document Foaming Potential in Burns Waterway

U. S. Steel indicated a significant foaming potential occasionally occurs in the receiving water in Burns Waterway. A procedure could be developed that shakes and/or aerates samples from Burns Waterway upstream and downstream of the U. S. Steel permitted outfalls. This procedure should include photographic evidence as part of the testing documentation and also indicate when this procedure needs to be performed.

5.2 Conduct a Defoamer Optimization Study

Upon review of the history of permit qualitative violations over the last two years, several relate to the observance of foam at Outfall 004. While several mitigation strategies have been implemented over the years, some improvements could potentially provide more reliable foam control. A bench-scale defoamer optimization study will provide insight into key details about the process and control options. This study should help optimize the effective dosage range and choice of defoamer.

5.3 Evaluate Installing Diversion Capability

The plant could potentially benefit from having the option to divert the final effluent in times of poor treatment that risks violations. A Lift Station could be installed to transfer effluent from Final Treatment Settling Basin to a diversion tank. This would provide time for the operator to correct conditions or for production to stop operations.

5.4 Install a High Level Alarm on the Oil Skimming Vault at Final Treatment

The Standard Operating Procedure is for the operator to pump down the Oil Skimming Vault prior to commencing skimming operations. This vault is covered, so the level cannot be verified visually. A level alarm would alert the operator not to perform skimming operations.

5.5 Evaluate Programming Alarms To Indicate When Key Process Sump Pumps are Operating Continuously or Cycling Excessively

The operating status of select sump pumps could be monitored automatically and an alarm programmed to indicate excessive operating time or an increase in operating cycle frequency. These alarms could indicate a spill from a storage tank, discharge of a non-typical wastewater, or a mechanical malfunction of the pump.

6 Attachments

ATTACHMENT 1.1: NOVEMBER 28, 2018 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Foam
Type of Violation: Narrative
Summary of Violation: Foam extended 40 yards into Burns water way.

U. S. Steel IDENTIFIED CAUSE(S)

Defoamer (Chemtreat FO-120) was constantly metered into the effluent channel prior to Outfall 104. This foaming event was most likely due to insufficient defoamer addition and was not attributed to any pollutant regulated under NPDES permit based on a grab sample at Outfall 004 and a 24-hour composite at Outfall 104[1].

In verbal discussions with U. S. Steel personnel, U. S. Steel believes entrained air/turbulence interacting with receiving water conditions contributes to foaming. U. S. Steel believes there is a foaming potential in the receiving water. This is evidenced by the need to add defoamer at non-contact cooling water Outfalls 002 and 003, which are located upstream of Outfall 004[2].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel installed a redundant defoamer system, with Polyblend mixing at Outfall 004 after the November 28th foaming incident. Later, a second IDEM-approved defoamer, Chemtreat CL-240, was added in addition to Chemtreat FO-120, based on a recommendation from Chemtreat[3].

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
Insufficient defoamer (Chemtreat FO-120) addition into the sedimentation basin effluent channel	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
1.54 inches precipitation 48 hr prior		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKLEY CAUSE

Ramboll concurs with U. S. Steel that the most likely cause of Outfall 004 foaming was insufficient defoamer addition and the foaming potential of the receiving water. Because defoamer dosage cannot be optimized in a laboratory setting, only real time dosage adjustments (within the accepted IDEM range) in response to visual observations can be made.

[1]Letter to IDEM dated December 3, 2018
[2]Completed Approval Application form for Water Treatment Additives, December 21, 2018
[3]Letter to IDEM dated December 21st, 2018

ATTACHMENT 1.2: DECEMBER 18, 2018 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Foam
Type of Violation: Narrative
Summary of Violation: Foam extended 10 - 30 feet into Burns water way, lasting approximately 30 seconds.

U. S. Steel IDENTIFIED CAUSE(S)

U. S. Steel installed a redundant defoamer system, with Polyblend mixing at Outfall 004 after the November 28th foaming incident. On December 18, 2018, the defoamer addition was insufficient and resulted in marginal foaming at Outfall 004[1].

In verbal discussions with U. S. Steel personnel, U. S. Steel believes entrained air/turbulence interacting with receiving water conditions contributes to foaming. U. S. Steel believes there is a foaming potential in the receiving water. This is evidenced by the need to add defoamer at non-contact cooling water Outfalls 002 and 003, which are located upstream of Outfall 004[2].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel increased the defoamer addition rate within the range previously approved by IDEM. U. S. Steel requested an increase to the allowable dosage range to account for variable conditions in the receiving waters. U. S. Steel continued to monitor and optimize the new defoamer addition system and dosage[3].

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
Insufficient defoamer addition into the sedimentation basin effluent channel	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
No precipitation		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

U. S. Steel began to use an additional defoamer after the foam violation in the prior month. Chemtreat CL-240 was now being used in addition to Chemtreat FO-120[4].

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll concurs with U. S. Steel that the most likely cause of Outfall 004 foaming was insufficient defoamer addition and the foaming potential of the receiving water. Because defoamer dosage cannot be optimized in a laboratory setting, only real time dosage adjustments (within the accepted IDEM range) in response to visual observations can be made.

[1]Letter to IDEM dated December 21, 2018
[2]Completed Approval Application form for Water Treatment Additives, December 21, 2018
[3]Letter to IDEM dated January 11, 2019
[4]IDEM Inspection Summary Letter dated January 3, 2019

ATTACHMENT 1.3: MAY 09, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Discoloration, Sheen
Type of Violation: Narrative
Summary of Violation: Continuous discoloration (reddish-brown), turbidity and sheen observed in discharge of final treatment plant from 7:45am to 12:30pm (2:00 p.m. according to IDEM summary) on May 9th

U. S. Steel IDENTIFIED CAUSE(S)

U. S. Steel initially believed that the reddish-brown discoloration at Outfall 004 was a result of a release of pickle liquor; however, upon further investigation, the primary cause was identified as a roll seal leak on the Tin Line. The cleaning solution, which contains 3 – 7% sulfuric acid and an elevated concentration of dissolved iron, leaked from a roll seal into the Tin Line sump that discharged to the Final Treatment Plant. A conductivity alarm in the Tin Line sump indicated the roll seal leak had occurred. The rate at which the cleaning solution was pumped to the Final Treatment Plant exceeded that system's removal capacity.

The western train of the Final Treatment Plant was offline for maintenance, and the single operating train, which can accommodate normal mill operating conditions, had a reduced margin of capacity for removing the high concentration of solids caused by the leak[1].

U. S. Steel CORRECTIVE ACTION(S)

As an instant response to the narrative violation, U. S. Steel deployed booms at Outfall 004 and pumped down the Tin Line sump in a controlled manner. U. S. Steel continued to prioritize reaction to any alarms with corrective actions[1,2].

U. S. Steel revised the Standard Operating Procedure for managing Releases, Spills, Leaks, and Dumps/ Washdowns[3]

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No reported process failure	Roll seal failure on the Tin Line	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
Pickling Line heat exchanger 1 isolation valve was replaced on 5/9/2019. Western train of the Final Treatment Plant was down for routine preventative maintenance.	No non-routine operations	A roll seal leaked a cleaning solution containing sulfuric acid and dissolved iron. Pickle liquor from the Pickling Line was released to facilitate a repair to a heat exchanger isolation valve.
WEATHER		
0.77 inches of precipitation on the day of violation. 0.23 inches 48 hours prior.		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	West settling basin down for maintenance

[1]Letter to IDEM dated May 14, 2019
[2]Additional Questions email sent to IDEM May 20, 2019
[3]Revised May 4, 2020

ADDITIONAL INFORMATION

On the day of the violation, U. S. Steel initially believed the potential cause of the discoloration was a loss of pickle liquor from a Pickle Line Heat Exchanger. The volume of pickle liquor lost was later estimated to be 30 gallons, which is unlikely to have impacted operations.

The Tin Line production was stopped at approximately 7:05 a.m. after elevated conductivity was observed at the Tin Line sump. The line was restarted and then shut down at approximately 8:00 a.m. to repair the leak on the roll seal. The line was returned to operation but was shut down again (at approximately 11:08 a.m.) after the conductivity in the Tin Line sump did not reduce below the alarm level. The Tin Line sump was slowly pumped down to allow for sufficient settling time at the Final Treatment Plant, and the Tin line was restarted at 7:00 p.m. on 5/9/2019[2].

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll concurs with U. S. Steel that the most likely cause of the reddish-brown discoloration at Outfall 004 was the Tin Line roll seal leak of cleaning solution, which contained a high concentration of dissolved iron, and a failure to properly respond to the conductivity alarm that had indicated the leak had occurred.

[1]Letter to IDEM dated May 14, 2019
[2]Additional Questions email sent to IDEM May 20, 2019
[3]Revised May 4, 2020

ATTACHMENT 1.4: MAY 30, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 003
Description of Outfall: Non-Contact cooling water

Constituent: Foam
Type of Violation: Narrative
Summary of Violation: According to June 14, 2019 IDEM inspection summary: Mild foaming at Outfall 003

U. S. Steel IDENTIFIED CAUSE(S)

No official U. S. Steel response to foaming at Outfall 003.

In verbal discussions with U. S. Steel personnel, U. S. Steel stated that they believed entrained air/turbulence interacting with receiving water conditions contributes to foaming.

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel requested IDEM approval to add defoamer ChemTreat CL250 to Outfalls 002 and 003[1]. U. S. Steel received approval from IDEM on January 15, 2019. They immediately began defoamer addition at Outfall 003 using a carboy and later setup a pump and drum in 2020 to inject a diluted feed of defoamer[2].

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No reported process failure	No reported mechanical failure	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No maintenance on Outfall 003	No non-routine operations	No reported spills or leaks
WEATHER		
No precipitation		
TREATMENT PLANTS – Outfall 003 not associated with any treatment plants.		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
N/A	N/A	N/A

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll concurs with U. S. Steel that any foaming at Outfall 003, which is non-contact water only, is most likely due to entrained air or turbulence interacting with the receiving waters.

[1]Completed Approval Application form for Water Treatment Additives, December 21, 2018
[2]E-mail from U. S. Steel, August 27, 2021

ATTACHMENT 1.5: AUGUST 08, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Sheen
Type of Violation: Narrative
Summary of Violation: During a facility inspection by IDEM, a thin sporadic oil sheen was observed in receiving stream at Outfall 004

U. S. Steel IDENTIFIED CAUSE(S)

U. S. Steel did not identify a specific source of the sporadic sheen[1].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel continued to investigate the intermittent bloom issue and installed a temporary skirted boom at Outfall 004, as well as revised dump procedures.

Additional action items included[1]:

- Evaluatingthe Final Treatment Plant by a third party,
- Investigating additional water treatment additive options,
- Increasing Final Treatment sedimentation basin skimmer maintenance, and
- Conducting trial of different types of absorbent booms.

Per verbal conversation with U. S. Steel personnel, improvement to the separation and removal of oil and water at the Final Treatment Plant was made by reducing the operating pH in the Equalization Basins in November 2019.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No reported process failures	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported plant maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
Minimal precipitation on day of and days prior to event		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
The East API skimming pipe actuator was being repaired, so the East API was shut down. The West and East API skimming systems share the same drive so the skimming system in the West API was also shut down.	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

The East API at Pretreatment was taken out of service to perform maintenance to assure continued proper operation of the treatment plant.

Immediately after discovering the skimming pipe actuator failed, Midwest initiated the repair process. The east basin was isolated and subsequently cleaned in preparation for repairs. The East Basin skimming pipe repair commenced on August 8th. The West and East Basin skimming systems share

[1]Letter to IDEM dated October 3, 2019

the same drive motor, as well as skimming pipe. Because of this, both skimming systems were shut down and locked out during the one-day repair. When the repairs were completed on August 8th, the West Basin skimming system was put back in operation. There is sufficient height above the bottom of the baffle plate to retain oil volume in the API units and not carry-over into the discharge to the Final Treatment Plant for short outages such as this[1].

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll and U. S. Steel cannot determine the specific event causing of the sporadic sheen. It is possible that oil removal systems in the treatment plants were not being operated optimally.

[1]Letter to IDEM dated October 3, 2019

ATTACHMENT 1.6: AUGUST 20, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Discoloration
Type of Violation: Narrative
Summary of Violation: Discolored effluent at Outfall 004 from 8:25 a.m. to 10:00 a.m.

U. S. Steel IDENTIFIED CAUSE(S)

A rolling oil solution tank was emptied to the Pretreatment Plant the night of August 19th. In the early morning hours of August 20th, a cleaner solution tank was discharged directly to Final Treatment Plant. U. S. Steel believes the rolling oil was not fully removed by the Pretreatment Plant and then became mixed with the cleaner solution and formed a stable dissolved solution that discharged through the Final Treatment Plant and into Outfall 004. Grab samples of 104 and 004 during the event had results well below the NPDES permit limitations[1].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel reviewed the rolling oil solution and cleaner tank draining practices, as well as the dosage of water treatment additives at the Pretreatment Plant[1]. IDEM required U. S. Steel to increase sampling frequency to daily at Outfalls 004, 104, and 204 until further notice.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
August 19th rolling oil was discharged to the Pre-treatment Plant[1] August 20th cleaner solution was discharged to the Final Treatment plant[1].	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
0.39 inches of precipitation on August 19, 2019		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll concurs with the U. S. Steel identified cause that the timing and combination of rolling oil and cleaner solution dumps resulted in some oil that could not be removed by the Final Treatment Plant.

[1]Letter to IDEM dated August 26, 2019

ATTACHMENT 1.7: SEPTEMBER 06, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Sheen
Type of Violation: Narrative
Summary of Violation: Intermittent oil layer observed at Outfall 004 starting at 11:45 a.m. until 7:00 p.m.

U. S. Steel IDENTIFIED CAUSE(S)

On September 6th, a large amount of coating oil from the pickling line discharged to Final Treatment Plant. Both treatment trains in the Final Treatment Plant were in operation, and all NPDES limits were met, but a small amount of sheen carried over to 004[1].

U. S. Steel CORRECTIVE ACTION(S)

As a corrective action, U. S. Steel evaluated improved methods of monitoring coating oil inventory[1]. In verbal discussions with U. S. Steel personnel, it was stated that these improvements included adding level sensors in the coating oil day tanks.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
Coating oil discharge to Final Treatment Plant[1]	Drain was plugged on the pickle line coating oil collection/drip tray.	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	As a result of the plugged drain in the coating oil drip tray, coating oil overflowed to a sump which automatically pumped to the Final Treatment Plant. This was estimated to be a few hundred gallons of oil.
WEATHER		
0.02 inches Rain 72 hrs prior		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll concurs with U. S. Steel that most likely cause of the sheen was a plugged drain that resulted in the discharge of coating oil to the Final Treatment Plant. The Final Treatment Plant was unable to capture all of the oil prior to discharge to Outfall 004. No alarms were in place at this time to indicate the leak had occurred.

[1]Letter to IDEM dated September 11, 2019

ATTACHMENT 1.8: SEPTEMBER 18, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Sheen
Type of Violation: Narrative
Summary of Violation: Intermittent sheen observed at Outfall 004, which did not extend beyond the booms outside of the outfall.

U. S. Steel IDENTIFIED CAUSE(S)

In verbal discussion with U. S. Steel personnel, U. S. Steel did not provide an official response to IDEM regarding a cause for the oil sheen; a specific cause for the oil sheen was not identified by U. S. Steel.

U. S. Steel CORRECTIVE ACTION(S)

Potential cleaning methods for the clarifier flights were discussed with onsite staff[1].

Per verbal conversation with U. S. Steel personnel, improvement to the separation and removal of oil and water at the Final Treatment Plant was made by reducing the operating pH in the Equalization Basins in November 2019.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No reported process failures	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
Minimal rainfall 72 hours prior		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll and U. S. Steel cannot determine the specific event causing of intermittent sheening. It is possible that oil removal systems in the treatment plants were not being operated optimally.

[1]IDEM inspection letter dated September 30, 2019

ATTACHMENT 1.9: OCTOBER 31, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Sheen, oil layer
Type of Violation: Narrative
Summary of Violation: Mild sheening observed at Outfall 004. (no timeline in IDEM inspection summary)

U. S. Steel IDENTIFIED CAUSE(S)

In verbal discussion with U. S. Steel personnel, U. S. Steel did not provide an official response to IDEM regarding a cause for the oil sheen; a specific cause for the oil sheen was not identified by U. S. Steel.

U. S. Steel CORRECTIVE ACTION(S)

Per verbal conversation with U. S. Steel personnel, improvement to the separation and removal of oil and water at the Final Treatment Plant was made by reducing the operating pH in the Equalization Basins in November 2019.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No process failures reported	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
0.4 inches and 0.71 inches of precipitation of October 30th and 31st respectively.		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
	Chrome Plant was temporarily shut down on October 30th, 31st and restarted the morning of November 1st[1].	Both trains operational

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll and U. S. Steel cannot determine the specific event causing the sheen. The chrome plant failure on October 30, 2019 likely did not contribute to the sheen. It is possible that oil removal systems in the treatment plants were not being operated optimally.

[1]Letter sent to IDEM, November 4, 2019

ATTACHMENT 1.10: NOVEMBER 21, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Discoloration
Type of Violation: Narrative
Summary of Violation: Continuous discoloration and sheen observed at Outfall 004 from 8:45 a.m. to 10 a.m. Intermittent sheen observed till noon.

U. S. Steel IDENTIFIED CAUSE(S)

A process monitoring alarm in a sump at the Pickle Line signaled an isolation valve leak on Tank #1. The leak was repaired; however, the low pH pickle solution containing high amounts of iron was released to the Final Treatment Plant[1]. In verbal discussions with U. S. Steel personnel, it was explained that a process monitoring alarm closed a solenoid valve at the Pickle Line sump, which should have stopped the discharge to the Final Treatment Plant; however, flow passed around the solenoid valve through a by-pass valve. Additionally, the east settling basin was down for routine maintenance, which reduced the typical retention time for settling[1].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel did the following[1]:

- Review isolation procedures
- Review current alarms and response procedures
- Contact employees on incident

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No process failure	Isolation valve failure at Tank #1 at the Pickle Line[1].Water passing through by-pass valve when the Pickle Line Sump discharge solenoid valve closed	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	As a result of the isolation valve failure, Tank #1 at the Pickle Line leaked to the Pickle Line Sump. Approximately 40 minutes passed from pH alarm to stopping the leak[1].
WEATHER		
There was a large rain event prior to incident according to U. S. Steel[1]. However, NOAA data shows 0.15 inches of rain on 11/20 and 0.19 inches of rain on 11/21.		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
N/A	N/A	East settling basin down for maintenance[2] Final Treatment Plant operator was notified of the leak and adjusted chemical feed rates and operation to best treat the increased loading[1].

[1]Letter to IDEM dated November 26, 2019.
[2]IDEM Inspection Summary Report, December 10, 2019
[3]E-mail from U. S. Steel to IDEM, December 19, 2019

TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
		Failure of a flapper valve between sedimentation basin and oil skimming vault[3].

ADDITIONAL INFORMATION

On November 21, 2019 a faulty flapper valve in the Final Treatment Plant oil skimming system caused oil to accumulate in the sedimentation basins, which had to be removed by a vac truck. The small amount of oil that did overflow to the outfall was not a significant contributor to the suspended solids/discoloration. The discoloration was due to solids not oil[3].

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

Ramboll agrees with U. S. Steel that the uncontrolled release of pickle solution from Tank #1 at the Pickle Line to the Final Treatment Plant contributed to the red discoloration observed at Outfall 004. The flow of water through the by-pass valve around the closed solenoid valve on the discharge from the Pickle Line Sump allowed the pickle solution to reach the Final Treatment Plant.

In addition, a faulty flapper valve combined with a full oil skimming vault at the Final Treatment plant released oil to the surface of the west settling basin. The presence of oil on the surface of the settling basin is a likely cause of the intermittent sheen observed at the outfall.

[1]Letter to IDEM dated November 26, 2019.
[2]IDEM Inspection Summary Report, December 10, 2019
[3]E-mail from U. S. Steel to IDEM, December 19, 2019

ATTACHMENT 1.11: OCTOBER 30, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 304
Description of Outfall: Calculated combined total of internal Outfall 204 (Chrome Treatment Plant) and internal Outfall 104 (Final Treatment Plant).

Constituent: hexavalent chromium
Type of Violation: Numeric
Summary of Violation: Exceeded chromium concentration and daily limit of 0.013mg/L and 0.51lbs/day with values of 0.017mg/L and 1.53lbs/day, respectively.

U. S. Steel IDENTIFIED CAUSE(S)

The continuous pH monitoring line at the Chrome Treatment Plant was blocked and led to an incorrect pH reading and inadequate dosing of sulfuric acid. In addition, the operator failed to check pH values manually as per SOPs[1].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel did the following[1]:

- Installed clear cover on the continuous pH monitoring line so flow can be observed,
- Installed flow sensors on pH monitoring lines,
- Educated employees on incident and retrain procedures,
- Instituted temporary work instruction that requires hourly pH tracking by operators, and
- Investigated and implemented alarms for pH, and ORP addressing sulfuric acid, sodium bisulfite, and caustic additions.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No reported general plant process failures	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
0.4 inches precipitation on October 30th		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
N/A	See Additional Information below	

ADDITIONAL INFORMATION

Sulfuric acid addition rate to the Chrome Treatment 'B' train decreased at approximately 4:00 a.m. on October 30th. Manual tests at 8:00 a.m. revealed a problem with the 'B' train, and it was immediately put into recycle mode, and the 'A' train was started up and began discharging at 9:00 a.m.[1]

Upon receipt of the lab results at 3:40 p.m., the Chrome Treatment Plant was shut down; however, the 'A' train was mistakenly left in automatic mode and intermittently discharged approximately 33,000 gallons the night of October 30th. The 'A' train was believed to be operating properly during this time.[1]

RAMBOLL'S DETERMINATION OF MOST LIKELY CAUSE

By reviewing the October 30th operator logs, Ramboll confirms that the Chrome Treatment Plant pH and ORP for 'B' train were out of the control range prior to being recognized by an operator at 8 a.m. This validates the assertion by U. S. Steel that the continuous pH monitoring line was blocked and that the operator did not follow procedures for sampling and monitoring.

[1]Letter to IDEM dated November 4 & 8, 2019

ATTACHMENT 1.12: DECEMBER 20, 2020 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Free Cyanide
Type of Violation: Numeric
Summary of Violation: Exceeded maximum cyanide concentration limit of 0.13mg/L with a value of 0.017mg/L.

U. S. Steel IDENTIFIED CAUSE(S)

The cyanide exceedance coincided with switching from the injection of hydrogen peroxide to the injection of hypochlorite and chlorine stabilizer ahead of Outfall 004 on December 18th, 2020[1].

Subsequent investigation determined an interference when analyzing preserved samples using the WAD Cyanide test method 4500-CN-I[2].

U. S. Steel CORRECTIVE ACTION(S)

U. S. Steel Investigated the possible interference of Chlorine with method 4500-CN-I in conjunction with ALS[1].

U. S. Steel originally thought that the interference was with the method itself; therefore, they requested approval from IDEM to use Free Cyanide method OIA-1677 Available Cyanide as a permit approved method at the Midwest facility, in addition to the existing WAD cyanide analytical method[2]. U. S. Steel received approval from IDEM on Feb. 11, 2021.

Further investigation by U. S. Steel and ALS determined that samples containing residual hypochlorite, when preserved using sodium hydroxide, generated erroneous results in both WAD Cyanide method 4500-CN-I and Free Cyanide method OIA-1677[3]. U. S. Steel has subsequently been sending unpreserved samples for analysis for Free cyanide using method OIA-1677.

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No process failure	No mechanical failure	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
No precipitation during the last 48 hours.		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**
Operating in normal condition	Operating in normal condition	Operating in normal condition

ADDITIONAL INFORMATION

On December 18, 2020, the peroxide feed ahead of Outfall 004 was stopped, and the injection of hypochlorite and a chlorine stabilizer began[1].

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

The elevated free cyanide measured on December 20, 2020, occurred immediately after switching from hydrogen peroxide to hypochlorite injection ahead of Outfall 004. Laboratory investigations determined that preserving samples with sodium hydroxide was generating erroneous results when samples contained residual hypochlorite.

[1]Letter to IDEM date December 29, 2020
[2]Emails within U. S. Steel, January 28, 2021
[3]ASTM D-7365-09a

ATTACHMENT 1.13: AUGUST 29, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Total copper
Type of Violation: Numeric
Summary of Violation: Exceeded copper concentration limit of 0.052mg/L with a value of 0.077mg/L.

U. S. Steel IDENTIFIED CAUSE(S)

Initially, no identifiable source could be correlated with the timing of the elevated copper measurements[1].

The source of copper was later believed to be from biological growth on the pipe walls between Outfall 104 and Outfall 004 and not from the Final Treatment Plant, Chrome Treatment Plant, or any upstream source[2].

Subsequently, U. S. Steel and ALS, who provided contracted lab services on the day of the violation, found that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias. This bias was large enough to exceed the permit limit[3].

U. S. Steel CORRECTIVE ACTION(S)

Since August 22, 2019, NPDES discharge limitation parameters had been collected/analyzed daily[2].

After the August 29, 2019 exceedance, U. S. Steel conducted a study to determine upstream contributors to elevated copper. The study revealed that upstream copper concentrations (Outfall 104 and Manhole MH-B11) were lower than Outfall 004. Therefore, U. S. Steel believed that the Final Treatment Plant, Chrome Treatment Plant or any upstream source was not the cause of the elevated copper in Outfall 004[1].

U. S. Steel suspected the copper source may be biological growth on the sewer walls, which sloughs off causing higher concentrations of copper[4].

In September 2020, U. S. Steel cleaned the sewers and began feeding peroxide to control future biological growth[2]. U. S. Steel later requested approval to switch to injecting Chemtreat CL15 (a chlorine stabilizer) and hypochlorite to control the biological growth[5].

U. S. Steel requested ALS to perform analyses to determine if the copper is present in a total or dissolved form[2].

ALS has modified their procedures for the analysis of copper[3].

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No process failure	No mechanical failure	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
0.32 inches precipitation on 8/26/19		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**

[1]Letter to IDEM dated September 12, 2019
[2]Letter to IDEM dated November 23, 2020
[3]ALS report to U. S. Steel dated April 1, 2021
[4]Letter to IDEM dated September 12, 2020
[5]Letter to IDEM dated December 7, 2020

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

U. S. Steel was unable to identify an upstream source of copper with a higher concentration than that measured at Outfall 004. Although the investigation by ALS into elevated readings caused by the procedure being used did not occur until much later (2021), it is likely that there was a similar error in the copper analysis performed in 2019.

[1]Letter to IDEM dated September 12, 2019
[2]Letter to IDEM dated November 23, 2020
[3]ALS report to U. S. Steel dated April 1, 2021
[4]Letter to IDEM dated September 12, 2020
[5]Letter to IDEM dated December 7, 2020

ATTACHMENT 1.14: OCTOBER 13, 2019 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Total copper
Type of Violation: Numeric
Summary of Violation: Copper concentration limit of 0.052mg/L was exceeded with a value of 0.053 mg/L

U. S. Steel IDENTIFIED CAUSE(S)

No identifiable source could be correlated with the timing of the elevated copper measurements. U. S. Steel investigated the potential presence of biological growth or other factors that may have caused the elevated copper in Outfall 004[1].

The source of copper was later believed to be from biological growth on the pipe walls between Outfall 104 and Outfall 004 and not from the Final Treatment Plant, Chrome Treatment Plant, or any upstream source[2].

Subsequently, U. S. Steel and ALS, who provided contracted lab services on the day of the violation, found that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias. This bias was large enough to exceed the permit limit[3].

U. S. Steel CORRECTIVE ACTION(S)

Since August 22, 2019, NPDES discharge limitation parameters had been collected/analyzed daily[2].

After the August 29, 2019 exceedance, U. S. Steel conducted a study to determine upstream contributors to elevated copper. The study revealed that upstream copper concentrations (Outfall 104 and Manhole MH-B11) were lower than Outfall 004. Therefore, U. S. Steel believed that the Final Treatment Plant, Chrome Treatment Plant or any upstream source was not the cause of the elevated copper in Outfall 004[4].

U. S. Steel suspected the copper source may be biological growth on the sewer walls, which sloughs off causing higher concentrations of copper[5].

In September 2020, U. S. Steel cleaned the sewers and began feeding peroxide to control future biological growth[2]. U. S. Steel later requested approval to switch to injecting Chemtreat CL15 (a chlorine stabilizer) and hypochlorite to control the biological growth[6].

U. S. Steel requested ALS to perform analyses to determine if the copper is present in a total or dissolved form[2].

ALS has modified their procedures for the analysis of copper[3].

[1]Letter to IDEM dated October 21, 2019
[2]Letter to IDEM dated November 23, 2020
[3]ALS report to U. S. Steel dated April 1, 2021
[4]Letter to IDEM dated September 12, 2019
[5]Letter to IDEM dated September 12, 2020
[6]Letter to IDEM dated December 7, 2020

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No reported process issues	No reported mechanical failures	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

U. S. Steel was unable to identify an upstream source of copper with a higher concentration than that measured at Outfall 004. Although the investigation by ALS into elevated readings caused by the procedure being used did not occur until much later (2021), it is likely that there was a similar error in the copper analysis performed in 2019.

[1]Letter to IDEM dated October 21, 2019
[2]Letter to IDEM dated November 23, 2020
[3]ALS report to U. S. Steel dated April 1, 2021
[4]Letter to IDEM dated September 12, 2019
[5]Letter to IDEM dated September 12, 2020
[6]Letter to IDEM dated December 7, 2020

ATTACHMENT 1.15: NOVEMBER 14, 2020 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Total copper
Type of Violation: Numeric
Summary of Violation: Exceeded copper concentration limit of 0.052mg/L with a value of 0.070mg/L.

U. S. Steel IDENTIFIED CAUSE(S)

No identifiable source could be correlated with the timing of the elevated copper measurements. U. S. Steel investigated the potential presence of biological growth or other factors that may have caused the elevated copper in Outfall 004[1].

Subsequently, U. S. Steel and ALS, who provided contracted lab services on the day of the violation, found that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias. This bias was large enough to exceed the permit limit[2].

U. S. Steel CORRECTIVE ACTION(S)

Since August 22, 2019, NPDES discharge limitation parameters had been collected/analyzed daily[1].

After the August 29, 2019 exceedance, U. S. Steel conducted a study to determine upstream contributors to elevated copper. The study revealed that upstream copper concentrations (Outfall 104 and Manhole MH-B11) were lower than Outfall 004. Therefore, U. S. Steel believed that the Final Treatment Plant, Chrome Treatment Plant or any upstream source was not the cause of the elevated copper in Outfall 004[3].

U. S. Steel suspected the copper source may be biological growth on the sewer walls, which sloughs off causing higher concentrations of copper[4].

In September 2020, U. S. Steel cleaned the sewers and began feeding peroxide to control future biological growth[1]. U. S. Steel later requested approval to switch to injecting Chemtreat CL15 (a chlorine stabilizer) and hypochlorite to control the biological growth[5].

U. S. Steel requested ALS to perform analyses to determine if the copper is present in a total or dissolved form[1].

ALS has modified their procedures for the analysis of copper[2].

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No process failure	No mechanical failure	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
No significant precipitation		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**

[1]Letter to IDEM dated November 23, 2020
[2]ALS report to U. S. Steel dated April 1, 2021
[3]Letter to IDEM dated September 12, 2019
[4]Letter to IDEM dated September 12, 2020
[5]Letter to IDEM dated December 7, 2020

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

U. S. Steel was unable to identify an upstream source of copper with a higher concentration than that measured at Outfall 004. Investigation by ALS in 2021 found that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias. This error bias was removed when ALS instituted procedure changes to their measurement practices.

[1] Letter to IDEM dated November 23, 2020
[2] ALS report to U. S. Steel dated April 1, 2021
[3] Letter to IDEM dated September 12, 2019
[4] Letter to IDEM dated September 12, 2020
[5] Letter to IDEM dated December 7, 2020

ATTACHMENT 1.16: NOVEMBER 28, 2020 VIOLATION - ROOT CAUSE ASSESSMENT

Permitted Location: Outfall 004
Description of Outfall: Internal Outfall 104, internal Outfall 204, stormwater, non-contact cooling area

Constituent: Total copper
Type of Violation: Numeric
Summary of Violation: Exceeded copper concentration limit of 0.052mg/L with a value of 0.071mg/L.

U. S. Steel IDENTIFIED CAUSE(S)

No identifiable source could be correlated with the timing of the elevated copper measurements. U. S. Steel investigated the potential presence of biological growth or other factors that may have caused the elevated copper in Outfall 004[1].

Subsequently, U. S. Steel and ALS, who provided contracted lab services on the day of the violation, found that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias. This bias was large enough to exceed the permit limit[2].

U. S. Steel CORRECTIVE ACTION(S)

Since August 22, 2019, NPDES discharge limitation parameters had been collected/analyzed daily[3].

After the August 29, 2019 exceedance, U. S. Steel conducted a study to determine upstream contributors to elevated copper. The study revealed that upstream copper concentrations (Outfall 104 and Manhole MH-B11) were lower than Outfall 004. Therefore, U. S. Steel believed that the Final Treatment Plant, Chrome Treatment Plant, or any upstream source was not the cause of the elevated copper in Outfall 004[4].

U. S. Steel suspected the copper source may be biological growth on the sewer walls, which sloughs off causing higher concentrations of copper[4].

In September 2020, U. S. Steel cleaned the sewers and began feeding peroxide to control future biological growth[3]. U. S. Steel later requested approval to switch to injecting Chemtreat CL15 (a chlorine stabilizer) and hypochlorite to control the biological growth[1].

U. S. Steel requested ALS to perform analyses to determine if the copper is present in a total or dissolved form[3].

ALS has modified their procedures for the analysis of copper[2].

RAMBOLL REVIEW OF CONTRIBUTING FACTORS

GENERAL/PLANT		
PROCESS	**MECHANICAL**	**ELECTRICAL/CONTROLS**
No process failure	No mechanical failure	No reported electric or instrumentation and control failures
MAINTENANCE	**NON-ROUTINE OPERATIONS**	**SPILLS/LEAKS**
No reported maintenance	No non-routine operations	No spills or leaks reported
WEATHER		
TREATMENT PLANTS		
PRE-TREATMENT	**CHROME TREATMENT**	**FINAL TREATMENT**

[1]Letter to IDEM dated December 7, 2020
[2]ALS report to U. S. Steel dated April 1, 2021
[3]Letter to IDEM dated November 23, 2020
[4]Letter to IDEM dated September 12, 2019

ADDITIONAL INFORMATION

None

RAMBOLL DETERMINATION OF MOST LIKELY CAUSE

U. S. Steel was unable to identify an upstream source of copper with a higher concentration than that measured at Outfall 004. Investigation by ALS in 2021 found that the re-use of plastic graduated cylinders in lieu of disposable digestion cups for the measurement of total copper had a positive error bias. This error bias was removed when ALS instituted procedure changes to their measurement practices.

[1]Letter to IDEM dated December 7, 2020
[2]ALS report to U. S. Steel dated April 1, 2021
[3]Letter to IDEM dated November 23, 2020
[4]Letter to IDEM dated September 12, 2019

APPENDIX II
SOURCE SURVEY

WATER

TECHNICAL MEMORANDUM

Project name **U. S. Steel Midwest Source Survey**
Project no. **1690022867**
Client **U. S. Steel Midwest**
Memo no. **02**
Version **1**
From **Matt Hausmann**

Prepared by **Elizabeth Sensing**
Checked by **Matt Hausmann**
Approved by **David G Gilles, PE, PE Indiana Number 12100267**

January 4, 2022

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Table of Contents

1 Executive Summary

U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM, which requires U. S. Steel to identify all contributions to the wastewater treatment plants at the site. The Agreed Order also stipulates that this study must be certified by a Professional Engineer. Ramboll was contracted by U. S. Steel to develop and certify the Source Survey. This memorandum presents the nature, discharge volume, discharge frequency, and pretreatment provided prior to entry to either the Chrome Treatment Plant or the Final Treatment Plant. The Agreed Order also requires that any additional source elimination, source control, or source treatment needs are identified and evaluated.

Ramboll worked with U. S. Steel to inspect each source of wastewater at the plant that discharges to the treatment plants. Based upon the observations made while developing the data presented in this memorandum, Ramboll and U. S. Steel identified opportunities for reducing flow and loading to the treatment plants.

2 Background

U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM, which requires U. S. Steel to identify all contributions to the wastewater treatment plants at the site. The Agreed Order also stipulates that this study must be certified by a Professional Engineer. Ramboll was contracted by U. S. Steel to develop and certify the Source Survey. This memorandum presents the nature, discharge volume, discharge frequency, and pre-treatment provided prior to entry to either the Chrome Treatment Plant or the Final Treatment Plant. The Agreed Order also requires that any additional needed source elimination, control, or treatment needs are identified. Ramboll followed accepted engineering practices in the development of this study for the site. These included visual observations, discussions with operators and site managers, inspection of wastewater transfer equipment, source sampling, on-line and augmented flow measurement, statistical data evaluation, review of permits and DMR data, and brainstorming with site personnel.

The overall flow path for how the wastewater sources reach the treatment systems is shown in Block Flow Diagram BFD-01. BFD-02 presents a summary of flow rates from each of the Stream Numbers shown in BFD-01. This includes average and maximum daily flow rates at each location. The instantaneous flow rate at each location is also shown as the flow at many of these locations is not continuous, such as sump pumps that cycle on and off during normal operations. The daily average and maximum flow rates for wastewater sources are based on the average and maximum operating hours for that production process line for the year 2020. The data used for the Outfall flow rates were from July 2020 to June 2021, which are continuously measured using calibrated flow meters. U. S Steel indicated that production operations during this time are representative of typical operations. It should be noted that a complete flow balance was not developed as part of this study.

The study focused on developing flow estimates from each individual source to the treatment plants. As seen in BFD-02, neither the summation of the source flows to the Chrome Treatment Plant nor to the Final Treatment Plant matches the long-term average flow rate measured at the effluents from the two Plants (Outfalls 104 and 204). This is likely a result of several factors, including the use of estimated flow rates, estimated sump pump cycle frequency, and approximated duration of production operations. The error in these estimates is likely compounding to increase in the inaccuracy of the total flow. Also, miscellaneous water uses are directly at the treatment plants and not directly from a production source and are not included in the source survey, such as service water and chemicals that also contribute the flow imbalance.

Several different evaluation methods were used to generate the data and used to calculate the instantaneous flow rates. For many of the sumps, the rate at which the sump filled was measured and multiplied by the cross-sectional area of the sump. For some sumps where the rise rate could not be measured, the rated flow rate of the pump was used in conjunction with run time determined by reviewing historical and current PLC data. For some locations, flow was estimated based on information on P&IDs or design drawings. Some sources have installed flow meters; however, several sources that generate larger quantities of wastewater were identified that did not have installed flow meters. U. S. Steel was able to use a clamp-on, ultrasonic type flow meter to obtain close approximations for these flow rates, as well.

Section 3 below lists the major wastewater sources, while Section 4 presents Ramboll's recommendations for site improvements.

3 Influent Streams

Detailed information for each of the influent streams is presented in the attached Tables 2.1 to 2.29. Each table corresponds to one or two of the stream numbers shown on BFD-01. Each table contains a detailed list of sources of water for that stream. The stream numbers from BFD-01 are also used in the descriptions below. For each of these influent streams, the following information is presented:

- The stream 'does or does not' go the Pretreatment Plant
- The nature of the stream:
  - Typical pH (Acidic, Neutral, Basic)
  - Typical contaminants present (Oil, Solids, None)
- Flow information for the stream:
  - Daily volume of flows (average and maximum)
  - Frequency of discharges
- Indication of any installed monitoring and controls:
  - Online Monitoring
  - Alarms
  - Automatic Controls (e.g. pump interlocks, automatic isolation valves)

3.1 Pretreatment Plant

The Pretreatment Plant receives wastewater from the oily waste pad (Stream 29), the 80" cold mill (CRS5)(Stream 24), the 52" cold mill (CRT5)(Stream 25), double cold reduction mill (DCRM)(Stream 22), and tin mill temper mill (TMTM)(Stream 23) lines. These lines primarily contribute flow through basement sumps, which typically contain rolling oil solutions, rinse waters, and/or non-contact cooling water.

Monitoring capabilities and online process control are not available for any of these lines. Flows were recorded via field measurement.

These streams are routed to the Pretreatment Plant for oil treatment. All flows are first collected in a 75,000-gallon holding tank and then flow by gravity to the North Oil Interceptor Building. The effluent from the North Oil Interceptor Building is pumped to the South Oil Interceptor Building for additional treatment. A small portion of the North Interceptor Building effluent, however, overflows into the discharge pipeline and is not pumped to the South Oil Interceptor Building. This overflow combines with the effluent from the South Oil Interceptor Building and flows to the Pretreatment Lift Station in the

Final Treatment Plant. The pipeline that conveys the effluent from the Pretreatment Plant also conveys water from:

- Portside Energy – East Manhole (Stream 27);
- Portside Energy – West Manhole (Steam 28);
- Sludge Dewatering Filtrate (Stream 29); and,
- Lake Pump House Strainer Backwash (Stream 30).

3.2 Chrome Treatment Plant

The Chrome Treatment Plant treats a portion of the wastewater from the electrolytic chrome line (ETCM) (Stream 31), a portion of the wastewater from the electrolytic tin line (ETLM)(Stream 32), the Greenbelt 2 Landfill leachate (Stream 33), and the acid piping trench (Stream 34). The portion of the wastewater from the ETCM being treated at the Chrome Treatment Plant consists of non-contact cooling water, process water, rinse solutions, dilute acid solutions, and condensates. The portion of wastewater from the ETLM being treated at the Chrome Treatment Plant consists of non-contact cooling water, process water rinse solutions, the quench tank planned drains, and the fume exhaust system effluent. The Greenbelt 2 Landfill leachate does not receive any pretreatment prior to the Chrome Treatment Plant; the leachate combines with the other wastewaters prior to sand filtration. The acid piping trench primarily conveys stormwater and may contain acids if a leak occurs from the nearby mill piping and/or storage areas, which include the PKLM, ETLM, ETCM and hydrochloric and sulfuric acid storage tanks.

The pipelines to the Chrome Treatment Plant from the ETCM and ETLM are equipped with conductivity monitoring with automatic controls to close a discharge valve when a high alarm level is detected.

3.3 Final Treatment Plant

The Equalization Basins at the Final Treatment Plant receive wastewater from three main sewers:

- The Pretreatment Lift Station;
- The North dirty industrial wastewater (DIW) sewer; and,
- The South DIW sewer.

The sources of wastewater that enter the Pretreatment Lift Station are discussed above in Section 3.1. The wastewater from the following production lines is conveyed to the Final Treatment Plant via either the North or South DIW sewers:

- Continuous annealing line (ANCA) (Streams 17 and 18);
- Cleaner line (CLNM) (Stream 10);
- 72" galvanizing line (GACT) (Stream 1);
- #3 galvanizing line (GAL3) (Stream 5);
- Pickle line (PKLM) (Streams 6 and 7);
- Electrolytic tine line (ETLM) (sources not containing hexavalent chromium)(Streams 14 and 15);
- Electrolytic chrome line (ETCM) (sources not containing hexavalent chromium) (Streams 12 and 13);
- 48" galvanizing line (48" GALV) (Stream 2);
- Combo line (RCCM) (Stream 4);
- #1 recoil line (RCL1) (Stream 20);
- #2 recoil line (RCL2) (Stream 21);
- Roll shop (Streams 11 and 16); and,
- Sheet temper line (TMSM) (Stream 3).

The ANCA wastewater contains non-contact cooling water, cleaner rinse solutions, overflows, drains, and dirty water. The CLNM wastewater contains non-contact cooling waters and cleaner and rinse solutions. No online monitoring or automatic flow controls are present on these lines.

The GACT wastewater includes stormwater, loading dock oils, non-contact cooling waters, cleaner and cleaner rinses, drains. This line has online conductivity monitoring with alarms but no automatic flow controls.

GAL3 wastewater includes non-contact cooling water from a variety of hydraulic systems and the rectifier, quench process discharge, cleaner rinse, and wringer roll sprays. This line has online conductivity monitoring with alarms but no automatic flow controls. The pickle line, ETLM and ETCM wastewater is comprised of contact and non-contact cooling waters, rinse solutions, condensate, dilute and undiluted acid, and basic solutions. Online pH monitoring is available at the sumps that receive the acid solutions at the pickle line, while online conductivity monitoring is available at various sumps in the ETLM AND ETCM lines.

The 48" galvanizing line wastewater is comprised of water from floor drains and fugitive oils from the mill level resulting from spills or leaks. The RCCM wastewater contains non-contact cooling water, cleaner rinse solution overflow, drains, and process oil used to oil the steel strip. Online monitoring or controls are not present on these lines. The wastewater from #1 and #2 recoil lines contains non-contact cooling water from hydraulic systems, mill level floor drains, and process oil used to oil the steel strip. The roll shop wastewater is made up of roll grinding solution and metal fines. The sheet temper line wastewater is comprised of non-contact cooling waters and dilute oil solutions. No online monitoring or controls are present on these lines.

4 Evaluation and Recommendations

All sources to the Chrome Treatment Plant and Final Treatment Plant were identified. Each source was verified to be discharging to the correct locations based on its characteristics. Sources were noted that enter the Pretreatment Plant, which are then further treated at the Final Treatment Plant. No sources were identified where additional pretreatment would be beneficial. Ramboll and U. S. Steel identified opportunities for reducing flow and loading to the treatment plants.

4.1 Reduce Waste Loading

Ramboll and U. S. Steel identified locations where large quantities of wastewater could potentially discharge in a short amount of time, causing surge loadings to the treatment systems. Locations were also identified where oil could potentially be released to the North and South DIW. Based on these observations Ramboll recommends:

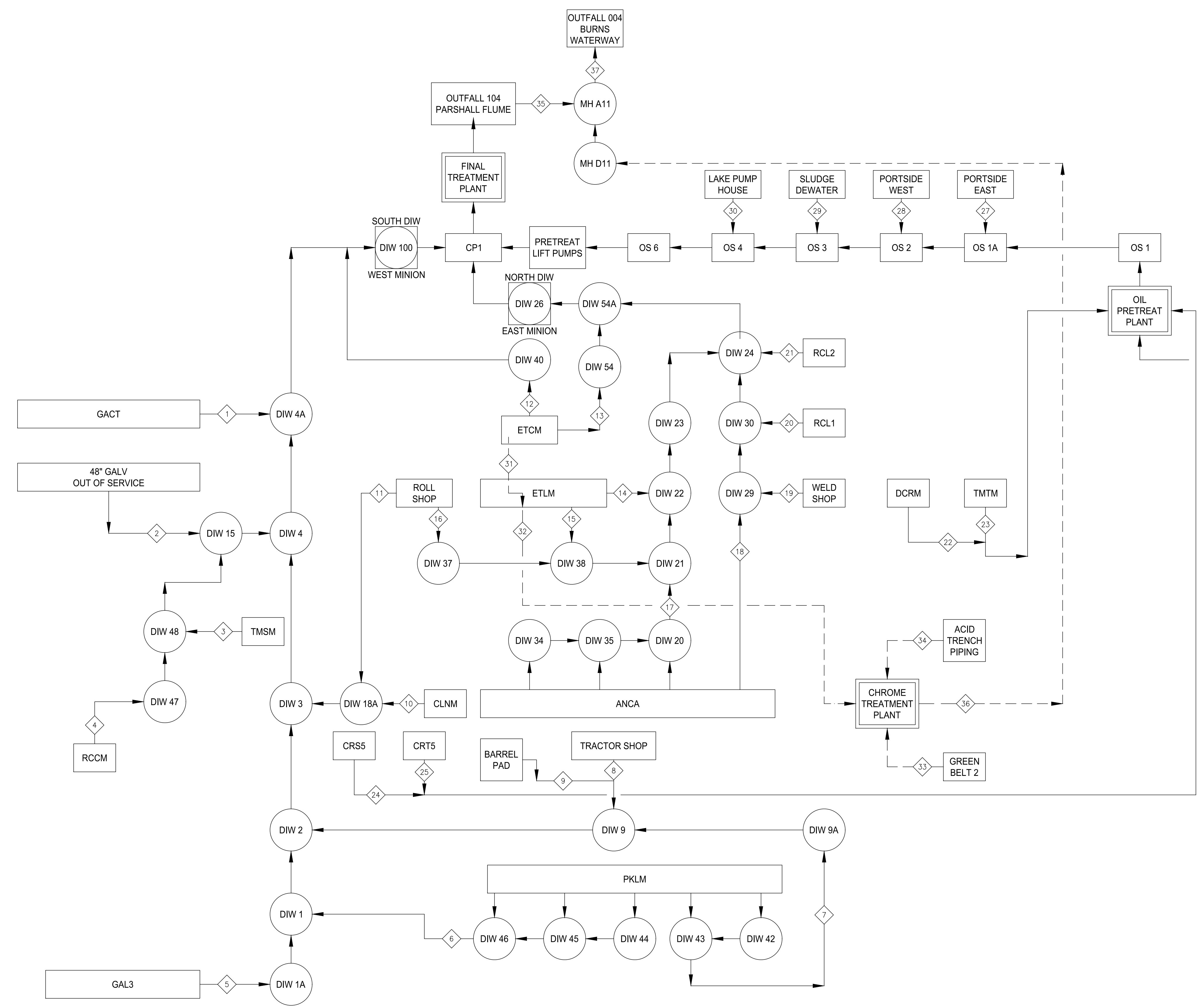
- Limiting the flow from tanks that are periodically batch dumped to avoid surge loads to the EQ Tanks.
- Investigating improvements to containment around strip oiling systems to reduce potential of oil entering the DIW.
- Evaluating the potential to segregate non-contact cooling water discharges away from areas where there is the potential for the water to convey the oil to a sump that discharges to the DIW.

4.2 Reduce Hydraulic Loading

Ramboll and U. S. Steel observed several rinse and quench systems that do not stop during production delays and shutdowns. Ramboll recommends automatic shutdown to stop these flows during these periods.

5 Attachments

- Block Flow Diagram Source Study (BFD-01 & BFD-02)
- Wastewater Data Tables (Table 2.1 to 2.29)



ABBREVIATIONS:

ANCA	=	CONTINUOUS ANNEALING
CLNM	=	CLEANER LINE
CP1	=	CONTROL POINT 1
CRS5	=	80" COLD MILL
CRT5	=	52" COLD MILL
CTP	=	CHROME TREATMENT PLANT
DCRM	=	DOUBLE COLD REDUCTION
DIW	=	DIRTY INDUSTRIAL WATER
ETCM	=	ELECTROLYTIC CHROME LINE
ETLM	=	ELECTROLYTIC TIN LINE
GACT	=	72" GALVANIZING LINE
GAL3	=	#3 GALVANIZING LINE
GPD	=	GALLONS PER DAY
INT	=	INTERMITTENT
MGD	=	MILLION GALLONS PER DAY
NF	=	NO FLOW
NO	=	NOT OPERATING
OS	=	OILY SEWER
PKLM	=	PICKLE LINE
RCCM	=	COMBO LINE
RCL1	=	#1 RE-COIL LINE
RCL2	=	#2 RE-COIL LINE
TMSM	=	SHEET TEMPER
TMTM	=	TIN MILL TEMPER MILL
48" GALV	=	48" GALVANIZING LINE

LEGEND:

- XX (circle): MANHOLE / VAULT
- XX (double box): TREATMENT PLANT
- XX (box): WASTEWATER SOURCE
- Dashed line: FLOWS THROUGH CHROME TREATMENT PLANT
- Solid line: FLOW THROUGH FINAL TREATMENT PLANT
- # (diamond): STREAM IDENTIFIER

BLOCK FLOW DIAGRAM
SOURCE STUDY

US STEEL MIDWEST

BFD-01

RAMBOLL US CONSULTING, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: 1690022867 DATED: 04OCT2021 DESIGNER: LENGLE

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PROJECT: 1690022867 DATED: 04OCT2021 DESIGNER: LENGLE

FINAL TREATMENT PLANT SOURCES

		INSTANTANEOUS FLOW (GPM)	TOTAL FLOW (GPD)	
SOUTH DIW SOURCES				
STREAM		RANGE	AVG.	MAX.
1	GACT	653 - 807	783,873	1,051,200
2	48" GALV	NO	NO	NO
3	TMSM	27 - 33	110	480
4	RCCM	117 - 143	88,645	131,040
5	GAL3	548 - 662	497,203	641,032
6	PKLM	403 - 487	472,956	566,967
7	PKLM	27 - 33	31,813	38,137
8	TRACTOR SHOP	NF	NF	NF
9	BARREL PAD	630 - 770	732	15,025
10	CLNM	125 - 174	121,509	152,238
11	ROLL SHOP	0 - 40	INT	INT
12	ETCM	226 - 274	266,422	308,400
TOTAL		2756 - 3423	2,263,263	2,904,519
NORTH DIW SOURCES				
STREAM		RANGE	AVG.	MAX.
13	ETCM	44 - 54	30,151	34,901
14	ETLM	98 - 112	99,262	128,911
15	ETLM	783 - 954	726,655	943,704
16	ROLL SHOP	0 - 20	INT	INT
17	ANCA	338 - 442	312,353	410,474
18	ANCA	18 - 22	23,947	26,752
19	WELD SHOP	NF	NF	NF
20	RCL1	18 - 22	7,300	11,799
21	RCL2	18 - 22	23,826	28,160
TOTAL		1317 - 1648	1,223,493	1,584,701
PRETREATMENT LIFT PUMPS SOURCES				
STREAM		RANGE	AVG.	MAX.
22	DCRM	110 - 140	11,076	21,900
23	TMTM	30 - 34	14,157	16,455
24	CRS5	1318 - 1622	1,125,195	1,267,135
25	CRT5	100 - 126	42,583	47,046
26	OILY WASTEPAD	80 - 95	6,188	19,110
27	PORTSIDE EAST	500 - 609	797,760	876,960
28	PORTSIDE WEST	NF	NF	NF
29	SLUDGE DEWATER	42 - 56	17,500	20,000
30	LAKE PUMPHOUSE	1670 - 3740	656,914	656,914
TOTAL		3850 - 6422	2,671,374	2,925,520

FLOWS ARE A CLOSE APPROXIMATION FOR NORMAL CONDITIONS

CHROME TREATMENT PLANT SOURCES

		INSTANTANEOUS FLOW (GPM)	TOTAL FLOW (GPD)	
MILL SOURCES				
STREAM		RANGE	AVG.	MAX.
31	ETCM	27 - 33	31,971	37,008
32	ETLM	117 - 143	123,484	160,368
TOTAL		144 - 176	155,454	197,376
OTHER SOURCES				
STREAM		RANGE	AVG.	MAX.
33	GREENBELT 2	200 - 250	4,608	14,912
34	ACID PIPING TRENCH	70 - 80	INT	INT
TOTAL		270 - 330	INT	INT

OUTFALL FLOWS

	INSTANTANEOUS FLOW (GPM)	TOTAL FLOW (MGD)	
OUTFALL 104 - FINAL TREATMENT PLANT EFFLUENT			
STREAM	RANGE	AVG.	MAX.
35	2806 - 8465	9.8	12.2
OUTFALL 204 - CHROME TREATMENT PLANT			
STREAM	RANGE	AVG.	MAX.
36	19 - 207	0.2	0.3
OUTFALL 004 - BURNS WATERWAY			
STREAM	RANGE	AVG.	MAX.
37	6604 - 11418	13.1	16.4

ABBREVIATIONS:

ANCA = CONTINUOUS ANNEALING
CLNM = CLEANER LINE
CP1 = CONTROL POINT 1
CRS5 = 80" COLD MILL
CRT5 = 52" COLD MILL
CTP = CHROME TREATMENT PLANT
DCRM = DOUBLE COLD REDUCTION
DIW = DIRTY INDUSTRIAL WATER
ETCM = ELECTROLYTIC CHROME LINE
ETLM = ELECTROLYTIC TIN LINE
GACT = 72" GALVANIZING LINE
GAL3 = #3 GALVANIZING LINE
GPD = GALLONS PER DAY
INT = INTERMITTENT
MGD = MILLION GALLONS PER DAY
NF = NO FLOW
NO = NOT OPERATING
OS = OILY SEWER
PKLM = PICKLE LINE
RCCM = COMBO LINE
RCL1 = #1 RE-COIL LINE
RCL2 = #2 RE-COIL LINE
TMSM = SHEET TEMPER
TMTM = TIN MILL TEMPER MILL
48" GALV = 48" GALVANIZING LINE

BLOCK FLOW DIAGRAM
SOURCE STUDY

US STEEL MIDWEST

BFD-02

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TABLE 2.1- STREAM 1 -72" GALVANIZING LINE (GACT) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	*AVERAGE OPERATING TIME (%)*	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	*MAXIMUM OPERATING TIME (%)*	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	*OPERATING TIME FOR YEAR 2020 (%)*	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Collection Header Discharge		N	Basic	Oil/Solids	653 - 807	Continuous	74.6	783,873	100	1,051,200	74.6	287,012,640		Conductivity	Y	None
	Stormwater & oils at loading dock															
	Non-contact cooling water from delivery hydraulic system				18 - 22								Visual Estimation			
	Non-contact cooling water from steering system				18 - 22								Visual Estimation			
	Cleaner and Cleaner Rinse				590 - 730								Field measurement			
	Non-contact cooling water from chem-treat coating system				18 - 22								Visual Estimation			
	Control room AC drain & sinks				9 - 11								Visual Estimation			
Discharge Total					653 - 807			783,873		1,051,200		287,012,640				

TABLE 2.2 - STREAM 2 - 48" GALVANIZING LINE - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (%)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	PERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
#1 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
	Floor drains Oil from mill level															
#2 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
	Floor drains Oil from mill level															
#3 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
	Floor drains Oil from mill level															
#4 Basement Sump	Floor drains	N	Neutral	None	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
#5 Basement Sump	Floor drains	N	Neutral	None	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
#6 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
	Floor drains Oil from mill level															
#7 Basement Sump		N	Neutral	None	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
#8 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation			
	Floor drains Oil from mill level															
#9 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
	Floor drains Oil from mill level															
#10 Basement Sump		N	Neutral	Oil	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
	Floor drains Oil from mill level															
#11 Basement Sump	Floor drains	N	Neutral	None	0 - 10	*Not operating*	0.0	0	0.0	0	0.0	0	Visual Estimation	None	N	None
Discharge Total					0 - 110			0		0		0				

TABLE 2.3 - STREAM 3 -SHEET TEMPER MILL (TMSM) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Coil Delivery Basement Sump		N	Neutral	Oil	27 - 33	Continuous	0.3	110	1.1	480	0.3	40,320		None	N	None
	Non-contact cooling water from hydraulic systems				18 - 22								Visual Estimation			
	Dilute oil solution from fume exhaust control system				9 - 11								Visual Estimation			
Discharge Total					27 - 33			110		480		40,320				

TABLE 2.4 - STREAM 4 - COMBO LINE (RCCM) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Entry Area Shear, Welder, Tension Leveler Discharge	Non-contact cooling water from hydraulic systems	N	Neutral	None	45 - 55	Continuous	47.4	34,094	70.0	50,400	47.3	12,472,800		None	N	None
Cleaner Rinse Basin	Cleaner rinse solution overflow	N	Basic	Oil/Solids	11-Sep	Continuous	47.4	6,819	70.0	10,080	47.3	2,494,560	Overflow estimation	None	N	None
Entry Basement Sump Pump	Non-contact cooling water from hydraulic systems	N	Neutral	None	18 - 22	Continuous	47.4	13,638	70.0	20,160	47.3	4,989,120	Visual estimation	None	N	None
Tunnel Basement Sump Pump	Water drain point	N	Neutral	None	9 - 11	Continuous	47.4	6,819	70.0	10,080	47.3	2,494,560	Visual estimation	None	N	None
Electrical Basement Sump Pump	Floor drains	N	Neutral	None	9 - 11	Continuous	47.4	6,819	70.0	10,080	47.3	2,494,560	Visual estimation	None	N	None
Delivery Basement Sump Pump	Excess coating oil from process	N	No water	Oil	9 - 11	Continuous	47.4	6,819	70.0	10,080	47.3	2,494,560	Visual esimation	None	N	None
Delivery Area Shear Discharge	Non-contact cooling water from hydraulic systems	N	Neutral	None	18 - 22	Continuous	47.4	13,638	70.0	20,160	47.3	4,989,120	Visual estimation	None	N	None
Discharge Total					117 - 143			88,645		131,040		32,429,280				

TABLE 2.5 - STREAM 5 - #3 GALVANIZING LINE (3GAL) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Collection Header discharge		N	Basic	Oil/Solids	548 - 662	Continuous	57.5	497,203	74.2	641,032	57.7	182,419,200		Conductivity	Y	None
	Non-contact cooling water from entry hydraulic system				18 - 22								Visual estimation			
	Non-contact cooling water from hydraulic steering system				18 - 22								Visual estimation			
	Non-contact cooling water from hydraulic tension leveler				18 - 22								Visual estimation			
	Non-contact cooling water from rectifier				18 - 22								Visual estimation			
	Non-contact cooling water from delivery hydraulic system				18 - 22								Visual estimation			
	Non-contact cooling water from delivery hydraulic steering				18 - 22								Visual estimation			
	Quench process discharge				320 - 390								Design document			
	Cleaner Rinse and wringer roll sprays				120 - 140								Design document			
Discharge Total					548 - 662			497,203		641,032		182,419,200				

TABLE 2.6 - STREAM 6 & 7 - PICKLE LINE (PKLM) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Entry Basement Sump Pump	Non-contact cooling water from entry hydraulic system	N	Neutral	Oil	27 - 33	Continuous	73.6	31,813	88.3	38,137	73.6	11,643,840	Field measurement	None	N	None
Total to DIW 9A					27 - 33			31,813		38,137		11,643,840				
Weak Acid Sump		N	Acidic	Solids	337 - 403	Continuous	73.6	392,362	88.3	470,354	73.6	143,607,360		pH	Y	Close sump pump discharge valve
	Pickle (hydrochloric acid) rinse solution				180 - 220								Field measurement			
	Non-contact cooling water form entry heat exchanger bridle drive				27 - 33								Field measurement			
	Dilute pickle (hydrochloric acid) solution from fume exhaust control system				130 - 150								Field measurement			
Air Compressors		N	Neutral	None	48 - 62	Continuous	73.6	59,385	88.3	71,189	73.6	21,735,168		None	N	None
	Air compressor #5 cooling water				18 - 22								Drawings			
	Air compressor #6 cooling water				30 - 40								Drawings			
Delivery Basement Sump Pump	Non-contact cooling water from hydraulic system; leaks from oil pumping system	N	Neutral	Oil	18 - 22	Continuous	73.6	21,209	88.3	25,425	73.6	7,762,560	Visual estimation	None	N	None
Total to DIW 1					403 - 487			472,956		566,967		173,105,088				
Discharge Total					430 - 520			536,582		643,240		196,392,768				

TABLE 2.7 - STREAM 8 - TRACTORSHOP WASH PAD DISCHARGE - WASTEWATER DATA

		NATURE												MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Drain Area	Rinse water with dilute cleaning chemicals	N	Basic	Solids	No flow	-	-	No flow	-	No flow	-	No flow		None	N	None
Discharge Total																

TABLE 2.8 - STREAM 9 - BARREL PAD - WASTEWATER DATA

		NATURE													MONITORING & CONTROL		
SUB-SOURCES	DESCRIPTION	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	CROSS-SECTIONAL AREA (FT^2)	AVERAGE PRECIPITATION FOR YEAR 2020 (FT/DAY)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM PRECIPITATION FOR YEAR 2020 (FT/DAY)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	TOTAL PRECIPITATION FOR YEAR 2020 (FT)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Drains	Stormwater	N	Neutral	Oil	630 - 770	Intermittent	12,620	0.01	732	0.16	15,025	2.83	267,145	Drawing & precipitaton data	None	N	None
Discharge Total					630 - 770				732		15,025		267,145				

TABLE 2.9 - STREAM 10 - CLEANER MILL (CLNM) - WASTEWATER DATA

		NATURE			REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	DESCRIPTION	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Entry Area Shear & Welder	Non-contact cooling water from hydraulic system	N	Neutral	None	18 - 22	Continuous	56	16,255	73	20,996	57	5,961,600	Visual estimation	None	N	None
Cleaner Solution Basement Sump Pump		N	Basic	Oil	18 - 22	Continuous	56	16,255	57	16,289	57	5,961,600		None	N	None
	Cleaner solution from overflow												Field measurement			
	Non-contact cooling water from entry hydraulic system				18 - 22								Visual estimation			
Rinse Area Basement Sump Pump		N	Basic	Oil/Soilds	62 - 97	Continuous	56	64,615	73	83,460	57	23,697,360	Field measurement	None	N	None
	Cleaner rinse solution				56 - 84											
	Cleaner final rinse solution				6 - 13											
Fume Exhaust Discharge	Dilute cleaner solution from fume exhaust control system	N	Basic	None	9 - 11	Continuous	56	8,128	73	10,498	57	2,980,800	Visual estimation	None	N	None
Delivery Area Sump Pump	Non-contact cooling water from hydraulic system	N	Neutral	Oil	18 - 22	Continuous	56	16,255	73	20,996	57	5,961,600	Visual estimation	None	N	None
Discharge Total					125 - 174			121,509		152,238		44,562,960				

TABLE 2.10 - STREAM 11 & 16 - ROLL SHOP - WASTEWATER DATA

		NATURE			WHILE MILL IS OPERATING									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Roll Grind 101		N		Solids	0 - 20	intermittent				NOT APPLICABLE				None	N	None
	Grinding solution				0 - 10											
	Rolling solution				0 - 10											
Discharge to DIW 37					0 - 20	intermittent				NOT APPLICABLE						
Roll Grinding System		N		Solids	0 - 40	intermittent				NOT APPLICABLE				None	N	None
	Roll grinding solution				0 - 10											
	Non-contact cooling water from hydraulic systems				0 - 20											
	Metal fines from Hoffman separator				0 - 10											
Discharge to DIW 18A					0 - 40	intermittent				NOT APPLICABLE						
Discharge Total					0 - 60	intermittent				NOT APPLICABLE						

TABLE 2.11 - STREAMS 12 & 13 - ELECTROLYTIC CHROME LINE (ECTM) TO FINAL TREATMENT PLANT- WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Entry Basement Sump Pump	Non-contact cooling water from hydraulic system	N	Neutral	Oil	26 - 32	Pump cycles every 20 - 25 minutes	74.0	8,837	85.7	10,229	74.0	3,232,344	Field measurement	None	N	None
Entry Looping Tower Sump Pump	Process water containing dilute solids	N	Neutral	Solids	18 - 22		74.0	21,314	85.7	24,672	74.0	7,796,160	Visual estimation	None	N	None
Total to DIW 54					44 - 54		148	30,151		34,901		11,028,504				
Cleaner Pump		N	Basic	Oil/Solids	119 - 141	Continuous	74.0	138,539	85.7	160,368	74.0	50,675,040		Conductivity	Y	Close sump discharge valve
	Cleaner rinse solution				110 - 130								Field measurement			
	Dilute cleaner solution from fume exhaust control system				9 - 11								Visual estimation			
Pickle Mote Pump		N	Acidic	Soilds	89 - 111	Continuous	74.0	106,569	85.7	123,360	74.0	38,980,800		Conductivity	y	Close sump discharge valve
	Pickle (sulfuric acid) rinse solution				80 - 100								Field measurement			
	Dilute pickle (sulfuric acid) solution from fume exhaust control system				9 - 11							649,680	Visual estimation			
Delivery Basement Sump Pump	Non-contact cooling water from hydraulic system	N	Neutral	Oil	18 - 22	Continuous	74.0	21,314	85.7	24,672	74.0	7,796,160	Visual estimation	None	N	None
Total to DIW 40					226 - 274		74.0	266,422		308,400		97,452,000				
Discharge Total					270 - 328			296,572		343,301		108,480,504				

TABLE 2.12 - STREAMS 14 & 15 - ELECTROLYTIC TIN LINE (ETLM) TO FINAL TREATMENT PLANT - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Entry Area Discha	Non-contact cooling water from tension leveler, side trimmer, etc	N	Neutral	Oil	80 - 90	Continuous	66.0	80,265	85.7	104,239	66.0	29,401,944	Design documents	None	N	None
Entry Basement Sump Pump	Non-contact cooling water for entry hydraulic system	N	Neutral	Oil	18 - 22	Continuous	66.0	18,998	85.7	24,672	66.0	6,959,040	Visual Estimation	None	N	None
Total to DIW 22					98 - 112			99,262		128,911		36,360,984				
Cleaner Mote Pump		N	Basic	Oil/Solids	189 - 221	Continuous	66.0	194,725	85.7	252,888	66.0	71,330,160		Conductivity	Y	Close sump discharge valve
	Cleaner rinse solution				180 - 210								Field measurement			
	Dilute cleaner solution from fume exhaust control system				9 - 11								Visual Estimation			
Pickle Mote Pump		N	Acidic	Soilds	318 - 399	Continuous	66.0	341,955	85.7	444,096	66.0	125,262,720		Conductivity	Y	Close sump discharge valve
	Pickle (sulfuric acid) rinse solution				150 - 190								Field measurement			
	Dilute pickle (sulfuric acid) solution from fume exhaust control system				9 - 11								Visual Estimation			
	MSA plater rinse solution from plater sump discharge				150 - 187								Field measurement			
	Dilute plater solution from fume exhaust control system				9 - 11								Visual Estimation			
Temperature Control System Discharge		N	Neutral	None	160 - 200	Continuous	66.0	170,978	85.7	222,048	66.0	62,631,360		None	N	None
	Hot softened water from heating/cooling coils				-											
	Service water from heating/cooling coils				-											
	Reflow Quench				160 - 200								Field measurement			
Delivery Basement Sump Pump	Non-contact cooling from delivery hydraulic system	N	Neutral	Oil	18 - 22	Continuous	66.0	18,998	85.7	24,672	66.0	6,959,040	Visual Estimation	None	N	None
Total to DIW 38					685 - 842			726,655		943,704		266,183,280				
Discharge total					783 - 954			825,917		1,072,615		302,544,264				

TABLE 2.13 - STREAMS 17 & 18 - CONTINUOUS ANNEALING (ANCA) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Entry hydraulic system	Non-contact cooling from heat exchanger	N	Neutral	Oil	18 - 22	Continuous	83.1	23,947	92.9	26,752	83.2	23,955	Visual Estimation			
Total to DIW 29					18 - 22			23,947		26,752		8,767,680				
Cleaner Rinse Trough Discharge	Cleaner rinse solution	N	Basic	Oil/Solids	55 - 95	Continuous	83.1	89,800	92.9	100,320	83.2	32,878,800	Field measurement	None	N	None
Quench Tank Trough Discharge	Quench tower overflow	N	Basic	None	50 - 62	Continuous	83.1	67,051	92.9	74,906	83.2	24,549,504	Field measurement	None	N	None
Fume Exhaust Discharge	Dilute cleaner solution from fume exhaust control system	N	Basic	None	9 - 11	Continuous	83.1	11,973	92.9	74,906	83.2	4,383,840	Visual Estimation	None	N	None
#2 Basement Sump Pump	Basement floor drains	N	Neutral	None	9 - 11	Continuous	83.1	11,973	92.9	13,376	83.2	4,383,840	Visual Estimation	None	N	None
#3 Basement Sump Pump	Mill level drain	N	Neutral	None	18 - 22	Infrequent	83.1	11,973	92.9	13,376	83.2	4,383,840	Visual Estimation	None	N	None
#4 Basement Sump Pump		N	Basic	Oil	63 - 77	Pump cycles every 2 - 3 minutes	83.1	14,934	92.9	16,684	83.2	5,467,844		None	N	None
	Cleaner rinse solution Mill level drain												Field Measurement			
#5 Basement Sump Pump	Mill level drain	N	Neutral	None	45 - 55	Continuous	83.1	59,867	92.9	66,880	83.2	21,919,200	Visual Estimation	None	N	None
#6 Basement Sump Pump	Clean water from pyrometer and other instruments	N	Neutral	None	45 - 55	Pump cycles every 5 - 7 minutes	83.1	4,590	92.9	5,127	83.2	1,680,472	Visual Estimation	None	N	None
#7 Basement Sump Pump	Electrical basement floor drains	N	Neutral	None	9 - 11	Infrequent	83.1	11,973	92.9	13,376	83.2	4,383,840	Visual Estimation	None	N	None
#9 Basement Sump Pump	Non-contact cooling water from delivery hydraulic system	N	Neutral	None	17 - 21	Pump cycles every 7 - 8 minutes	83.1	4,271	92.9	4,771	83.2	1,563,762	Field measurement	None	N	None
#10 Basement Sump Pump	Dirty water	N	Neutral	None	9 - 11	Infrequent	83.1	11,973	92.9	13,376	83.2	4,383,840	Visual Estimation	None	N	None
#11 Looping Tower Basement Sump Pump	Dirty water	N	Neutral	None	9 - 11	Infrequent	83.1	11,973	92.9	13,376	83.2	4,383,840	Visual Estimation	None	N	None
Total to DIW 21					338 - 442			312,353		410,474		114,362,622				
Discharge Total					356 - 464			336,300		437,226		123,130,302				

TABLE 2.14 - STREAM 19 - WELD SHOP- WASTEWATER DATA

		NATURE			REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
No flow									Not Applicable							
Discharge Total																

TABLE 2.15 - STREAM 20 -RE-COIL #1 (RCL1) - WASTEWATER DATA

		NATURE			REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Basement Sump Pump		N	Neutral	Oil	18 - 22	Continuous	25.3	7,300	41	11,799	25	2,676,480		None	N	None
	Non-contact cooling water from hydraulic systems Mill level floor drains				18 - 22								Visual estimation			
Discharge Total					18 - 22			7,300		11,799		2,676,480				

TABLE 2.16 - STREAM 21 -RE-COIL #2 (RCL2) - WASTEWATER DATA

		NATURE			REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY (MIN.)	AVERAGE OPERATING TIME (%)	AVERAGE VOLUME TO TREATMENT PLANT (GPD)	MAXIMUM OPERATING TIME (%)	MAXIMUM VOLUME TO TREATMENT PLANT (GPD)	OPERATING TIME FOR YEAR 2020 (%)	VOLUME TO TREATMENT PLANT FOR YEAR 2020 (GAL)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Basement Sump Pump		N	Neutral	Oil	18 - 22	Continuous	82.7	23,826	97.8	28,160	82.7	8,716,800		None	N	None
	Non-contact cooling water from hydraulic systems Mill level floor drains				18 - 22								Visual estimation			
Discharge Total					18 - 22			23,826		28,160		8,716,800				

TABLE 2.17 - STREAM 22 - DOUBLE COLD REDUCTION MILL (DCRM) - WASTEWATER DATA

		NATURE			REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Northeast Basement Sump Pump		Y	Neutral	Oil	110 - 140	Pump cycles every 2 - 3 minutes	22.6	11,076	44.7	21,900	22.6	4,056,376	Field Measurement	None	N	None
	Non-contact cooling water from MG lube set Rolling oil rinse water from Stand 2															
Discharge Total					110 - 140			11,076		21,900		4,056,376				

TABLE 2.18 - STREAM 23 - TIN MILL TEMPER MILL (TMTM) - WASTEWATER DATA

		NATURE			REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM(Y/N)	AUTOMATIC CONTROLS
Northeast Basement Sump Pump	Non-contact cooling water	Y	Neutral	Oil	30 - 34	Pump cycles every 7 - 8 minutes	68.1	14,157	79.1	16,455	68.1	5,184,053	Field Measurement	None	N	None
Discharge Total					30 - 34			14,157		16,455		5,184,053				

TABLE 2.19 - STREAM 24 - 80" 5 STAND (CRS5) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
20,000 Gallon Tank		Y	Neutral	Oil	1018 - 1222	Continuous	64.9	1,034,137	73.8	1,176,077	64.9	378,434,592		None	N	None
	Non-contact cooling water from motor-generator, screw gauge control and other hydraulic systems				18 - 22								Visua estimatoin			
	#5 stand rinse water				500 - 600								Field Measurement			
	#1 stand rinse water				500 - 600								Field Measurement			
Lower Level Basement Sump		Y	Neutral	Oil	300 - 400	Pump cycles every 4 - 5 minutes	64.9	91,058	73.8	91,058		33,321,964	Field Measurement	None	N	None
	Oily solution from fog tunnel sump															
	Non-contact cooling water from north collection trench in basement upper level															
Discharge Total					1318 - 1622			1,125,195		1,267,135		411,756,556				

TABLE 2.20 - STREAM 25 - 52" 5 STAND (CRT5) - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Main Basement Sump Pump		Y	Neutral	Oil	100 - 126	Pump cycles every 3 - 4 minutes	74.3	42,583	82.0	47,046	74.4	15,606,777	Field Measurement	None	N	None
	Non-contact cooling water from hydraulic roll bending system															
	Dilute vapor solution from fog tunnel sump discharge															
Discharge Total					100 - 126			42,583		47,046		15,606,777				

TABLE 2.21 - STREAM 26 - OILY WASTE PAD - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)										MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	DISCHARGE VOLUME (GAL/CYCLE)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (CYCLES/DAY)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (CYCLES/DAY)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (cycles/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Decanted Supernatant		Y	Neutral	Oil	80 - 95	910	Pump can cycle up to 21 times in a day	6.8	6,188	21.0	19,110	2,489	2,264,990	PLC Data	None	N	None
	Stormwater																
	Various oils from transportation shop																
	Service water from transportation shop																
Discharge Total					80 - 95				6,188		19,110		2,264,990				

TABLE 2.22 - STREAMS 27 & 28 - PORTSIDE ENERGY - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
OS 1A		N	Neutral	Solids	500 - 609	Continuous	100	797,760	100	876,960	100	291,980,160	Difference between water intake & usage in October 2021	Conductivity	Y	
	Cooler sample drains Steam condensates Cation regeneration waste solution Anion regeneration waste solution Backwash of media filters Backwash of softeners															
OS 2					No Flow					Not applicable						
	Overflow of softened water Overflow of demineralized water															
Discharge Total					500 - 609			797,760		876,960		291,980,160				

TABLE 2.23 - STREAM 29 - SLUDGE DEWATERING - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Process Overflow		N	Neutral	Solids	41.7 - 55.5	Continuous	25	17,500	25	20,000	71.4	4,546,511	Conversation with plant operator	None	N	None
	Thickener overflow Filter press overflow															
Discharge Total					42 - 56			17,500		20,000		4,546,511				

TABLE 2.24 - STREAM 30 - LAKE PUMP HOUSE - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Strainer #1 Backwash	Lake water	N	Neutral	Solids	2070 - 2530	Each backwash occurs every 18 - 22 minutes	100	157,714	100	157,714	100	57,723,429	Flow meter and field measurement	None	N	None
Strainer #2 Backwash	Lake water	N	Neutral	Solids	1670 - 2035	Each backwash occurs every 18 - 22 minutes	100	126,857	100	126,857	100	46,429,714	Flow meter and field measurement	None	N	None
Strainer #3 Backwash	Lake water	N	Neutral	Solids	1830 - 2233	Each backwash occurs every 18 - 22 minutes	100	139,200	100	139,200	100	50,947,200	Flow meter and field measurement	None	N	None
Strainer #4 Backwash	Lake water	N	Neutral	Solids	3060 - 3740	Each backwash occurs every 18 - 22 minutes	100	233,143	100	233,143	100	85,330,286	Flow meter and field measurement	None	N	None
Discharge Total					1670 - 3740			656,914		656,914		240,430,629				

TABLE 2.25 - STREAN 31 - ELECTROLYTIC CHROME LINE (ECTM) TO CHROME TREATMENT PLANT - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Plater Sump Pump		N	Acidic	None	27 - 33	Continuous	74.0	31,971	85.7	37,008	74.0	11,694,240		Conductivity	Y	Close sump pump discharge valve
	Plater rinse solution Plater solution evaporator condensate Steam condensate Water from delivery looping tower sump				27 - 33								Field measurement			
Discharge Total					27 - 33			31,971		37,008		11,694,240				

TABLE 2.26 - STREAM 32 - ELECTROLYTIC TIN LINE (ETLM) TO CHROME TREATMENT PLANT - WASTEWATER DATA

			NATURE		REGULAR (WHILE MILL IS OPERATING)									MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Chem-treat Sump Pump		N	Acidic	None	117 - 143	Continuous	66.0	123,484	85.7	160,368	66.0	45,233,760		Conductivity	Y	Close sump pump discharge valve
	Chem-treat (sodium bi/di chromate) rinse solution				90 - 110								Field measurement			
	Re-flow quench tank drain															
	Dilute chem-treat solution from fume exhaust control system				9 - 11								Visual estimation			
	Non-contact cooling water from delivery looping tower				18 - 22								Visual estimation			
Discharge Total					117 - 143			123,484		160,368		45,233,760				

TABLE 2.27 - STREAM 33 - GREEN BELT 2 - WASTEWATER DATA

			NATURE											MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	API/DAFT PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Landfill Water Collection System	Landfill leachate	N	Neutral	None	200 - 250	-	Intermittent	4,608	Intermittent	14,912	Intermittent	1,686,528	PLC Data	None	N	None
Discharge Total					200 - 250			4,608		14,912		1,686,528				

TABLE 2.28 - STREAM 34 - ACID PIPING TRENCH - WASTEWATER DATA

			NATURE											MONITORING & CONTROL		
SUB-SOURCES	COMPONENTS	OILY PRE-TREATMENT Y/N	TYPICAL PH	CONTAMINANTS (OIL/SOLIDS/NONE)	DISCHARGE FLOW RANGE (GPM)	OPERATING FREQUENCY	AVERAGE OPERATING TIME (%/day)	AVERAGE DISCHARGE VOLUME (GPD)	MAXIMUM OPERATING TIME (%/day)	MAXIMUM DISCHARGE VOLUME (GPD)	TOTAL OPERATING TIME FOR YEAR 2020 (%/year)	TOTAL DISCHARGE VOLUME FOR YEAR 2020 (GPY)	METHOD OF FLOW DATA ACQUISITION	ONLINE MONITORING	ALARM (Y/N)	AUTOMATIC CONTROLS
Stormwater	Stormwater	N	Neutral	None	70 - 80	Intermittent				Not applicable			Pump drawdown	None	N	None
Discharge Total					70 - 80	Intermittent				Not applicable						

APPENDIX III
ENGINEERING EVALUATION – PRETREATMENT PLANT

Intended for
United States Steel Corporation

Document type
Evaluation Report

Date
January 2022

PRETREATMENT PLANT EVALUATION
U. S. STEEL MIDWEST PORTAGE, INDIANA

RAMBOLL Bright ideas. Sustainable change.

PRETREATMENT PLANT EVALUATION
U. S. STEEL MIDWEST PORTAGE, INDIANA

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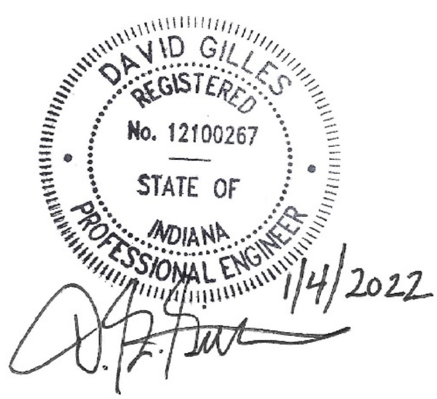

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APPENDICES

1. EXECUTIVE SUMMARY

United States Steel (U. S. Steel) Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with Indiana Department of Environmental Management (IDEM), which requires U. S. Steel to evaluate the adequacy of the existing Pretreatment Plant (PTP) components and operations. The Agreed Order also stipulates that this evaluation must be certified by a Licensed Professional Engineer. Ramboll was contracted by U. S. Steel to develop and certify the Pretreatment Plant evaluation.

This report presents the details of the evaluation, which include a description of the treatment process, process unit sizes, equipment age and condition, operational, monitoring and control activities, plant maintenance and reliability, and recommendations. Overall, based on Ramboll's performance evaluation, the Pretreatment Plant is operating well. The sampling data provided by U. S. Steel indicated the Pretreatment Plant is removing greater than 90% of the oil & grease (O&G).

Ramboll worked alongside U. S. Steel to inspect all relevant equipment, components, and operations in the Pretreatment Plant's current state. Ramboll recommendations are presented in Section 9 of this report.

2. INTRODUCTION AND GENERAL OVERVIEW

2.1 Background Information

U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM, which requires U. S. Steel to evaluate existing pretreatment components that treat any discharges entering the Final Treatment or Chrome Treatment plants at the site. The Agreed Order also stipulates that this study must be certified by a Professional Engineer. Ramboll was contracted by U. S. Steel to develop and certify the evaluation of these pretreatment components, which is the oily pretreatment plant.

2.2 Purpose of Treatment Plant

The Pretreatment Plant was designed to facilitate the separation and removal of light and heavy oils, from the cold rolling mills and oily waste pad discharge. The mill discharges are comprised of the 80" and 52" five stand, which combine into one discharge pipeline and the Double Cold Reduction Mill (DCRM) and Tin Mill Temper Mill (TMTM), which combine into a separate pipeline. The effluent from the Pretreatment Plant is conveyed via the Oily Sewer to the Pretreatment Lift Station at the Final Treatment Plant. Table 2.1 presents the source, nature, and approximate daily volumes to the Pretreatment Plant.

Table 2.1 Pretreatment Influent Sources			
Nature		**Total Flow (gallons/day)**	
Typical pH (Acidic, Neutral, Basic)	Typical Contaminants (Oil, Solids, None)	Average	Maximum
52" and 80" Five Stand Discharge			
Neutral	Oil	1,167,778	1,314,181
Double Cold Reduction Mill and Tin Mill Temper Mill Discharge			
Neutral	Oil	25,233	38,355
Oily Waste Pad			
Neutral	Oil	6,188	19,110
Note: Volumes are approximations.			

2.3 Agreed Order Evaluation Requirements

The purpose of this evaluation is to assess the adequacy of the existing pretreatment components and operations and address needs and will include: (Agreed Order II.6.D)

- Identify existing pretreatment treatment components, including those designed and/or utilized for oil and grease removal ahead of the Final Treatment Plant and for each component, determine its capacity, age, current condition, and treatment capability, including removal efficiency, and characterize the wastewater (source, nature, and volume) that it receives.
- Describe the current pretreatment operations, including with the description detailed diagrams that depict flows to, through and from the pretreatment components to the Treatment Plants.
- Evaluate the adequacy of pretreatment equipment and operations and determine needs. The determination of equipment needs shall encompass equipment repair, replacement, and addition.
- Develop a plan and schedule for addressing pretreatment needs.
- Submit the information required above, certified by a Licensed Professional Engineer.

3. TREATMENT SYSTEM DESCRIPTION AND SIZING

3.1 Treatment Plant History

The year 2003 marked the acquisition of the Midwest facility by U. S. Steel, along with the pretreatment plant. At the time, the Pretreatment Plant consisted of an equalization tank, two parallel API oil separators and oil storage tanks, and other auxiliary equipment. Oil removed from the wastewater was trucked off-site, while the treated wastewater was discharged to the Oily Sewer at what is now referred to as manhole OS 1.

In 2008, design work replaced the pretreatment plant (referred to as the North Interceptor Building) with a new facility, with its commissioning and start-up occurring in 2011. This new facility (referred to as the South Interceptor Building) consists of an API separator followed by two parallel dissolved air flotation (DAF) units, with the effluent eventually flowing into manhole OS 1. The existing equalization tank continued to receive the mill and oily waste pad discharges, along with recycle streams from the treatment process. During the start-up and initial operation of the new equipment in the South Interceptor Building, several operating challenges occurred, which required continued use of treatment equipment located at the North Interceptor Building, along with the new equipment located in the South Interceptor Building.

3.2 Process Description

Oily wastewater from the cold rolling mills and the oil waste pad discharge into the Equalization Tank (T-26). For the effluent of two of the cold rolling mills, a coagulant is injected prior to it entering the equalization tank to promote separation early in the process. The wastewater from T-26 then flows by gravity into the North Interceptor Building, where it flows into the Pretreatment Mix Tank. A coagulant and an emulsion breaker are then added. The wastewater then gravity flows into the West API Separator. Oil is skimmed using flights and collected in a C-channel, which discharges into the East API Separator. The East API Separator was once used as an oil interceptor but is currently being used as an oil decant tank. The wastewater from the West API then overflows weirs and into the OWS Effluent Sump. Submersible pumps transfer the wastewater from the sump to Mix Tank T-7001 located in the South Interceptor Building. Occasionally, the submersible pumps are unable to keep up with the flow leaving the West API, and water overflows a weir to the Oily Sewer and bypasses the DAF units. From the Mix Tank in the South Interceptor Building, the wastewater continues to flow by gravity into the DAF units. Currently, the South API separator is out of service and is by-passed. The effluent from the DAF units flow into the Oily Sewer. PFD-02 is a process flow diagram depicting the current configuration of the Pretreatment Plant.

A year’s worth of flow data was used to determine approximate average and peak flow rates. The North Interceptor API receives an average flow rate of 1,270 gpm and peak flow rate of 1,440 gpm. The DAF units were initially designed for an average and design flow rate of 600 and 900 gpm, respectively. However, it receives an average flow rate of 850 gpm and peak flow rate of 1,015 gpm.

3.3 Equipment, Instrumentation, and Controls

The following sections detail the process equipment, instrumentation, and controls of each component in the FTP treatment system.

3.3.1 Initial Chemical Injection

In November of 2020, U. S. Steel instituted the injection of a coagulant at the combined discharge of the 52” and 80” 5 stand rolling mills. This chemical is injected into the discharge from a sump pump underneath each of the mills to improve separation of the oil and water. The coagulant metering pump operates only when the sump sumps are running.

3.3.2 Equalization Tank T-26

Equalization Tank T-26 receives wastewater from the cold rolling mills and the oily waste pad. The wastewater flows by gravity from the bottom of the tank to the Pretreatment Mix Tank in the North Interceptor Building. An automated control valve modulates this flow to maintain a target level of 80%. Operators can initiate a skimming cycle in the Human Machine Interface (HMI), during which the control valve partially closes, and the contents of the tank are allowed to rise until floating materials overflow the skimming weir on the side of the tank. The skimmed materials flow by gravity into the Decant Tank (East API Separator) to allow the oil and water to separate. Skimming of oil from the top of the Equalization Tank T-26 reduces the oil loading on the West API separator and the DAF units.

Equalization Tank T-26 is a 26-foot diameter steel tank with a maximum water depth of 18 feet. At a target operating depth of 14 feet, the average operating volume is approximately 66,900 gallons. At the current average flow rate, the tank provides a hydraulic retention time of 52 minutes.

3.3.3 Pretreatment Mix Tank

The Pretreatment Mix Tank receives the wastewater from the Equalization Tank T-26. The Pretreatment Mix Tank is agitated with air lances to mix the coagulant and emulsion breaker into the wastewater. The coagulant is added at an average flow rate of 8 liters/hour, while the emulsion breaker is added at 5 gallons/day. Water then flows into the West API Separator.

The Pretreatment Mix Tank is a concrete tank that is 5.4 feet long, 10.8 feet wide with a maximum water depth of 11.2 feet. At a target operating depth of 9.4 feet, the average operating volume is approximately 4,100 gallons. At the current average flow rate, the tank provides a hydraulic retention time of 3.2 minutes.

3.3.4 West API Separator

Wastewater flows from the Mix Tank into the West API Separator, where light and heavy oils have the residence time to separate. The light oils that float to the surface are directed by chain and flight skimmers into a C-channel pipe, which drains into the East API Separator. At one time, a second set of flights removed settled material from the bottom of the West API Separator, but this system is presently not in service. Currently, settled materials removal is manually performed using vacuum trucks. The treated wastewater overflows weir boxes and enters the OWS Effluent Sump.

The West API Separator is a rectangular concrete tank that is 94 feet long, 15.8 feet wide with a water depth of 8.8 feet. The average operating volume is approximately 98,100 gallons and has a surface area of 1,500 square feet. At the current average flow rate, the tank provides a hydraulic loading rate of 9.1 gpm/square foot.

3.3.5 OWS Effluent Sump

The OWS Effluent Sump is a concrete chamber that collects the effluent from the West API Separator. Additionally, the Decant Tank (former East API Separator) will overflow into this sump if the tank is over filled. Submersible pumps with variable frequency drives located in the OWS Effluent Sump are controlled by a level sensor and transfer the wastewater to Mix Tank T-7001 located inside the South Interceptor Building. A service water make-up process is in place, with the purpose of adding service water to the sump to keep the sump pumps running continuously.

The OWS Effluent Sump is an irregular shape consisting of two main sections: the rectangular sump where the submersible pumps are located and the collection trough between the effluent weir boxes of the West API Separator. The OWS Effluent Sump has an approximate volume just under 2,500 gallons. The speed of the submersible pumps is varied to maintain a target level of 2 feet, which corresponds to approximately 2,000 gallons.

3.3.6 Decant Tank (East API Separator)

The Decant Tank receives skimmed oils from the West API Separator and from the equalization tank. Steam is injected into this tank to help enhance oil separation. Based on visual observation, operators pump floating oily material from the surface of the Decant Tank to Oil Storage Tanks TK-7011A/B and pump water from the bottom of the Decant Tank to the front of the West API Separator.

The Decant Tank (East API Separator) is a rectangular concrete tank that is 94 feet long, 15.8 feet wide with a water depth of 8.8 feet. The maximum operating volume is approximately 98,100 gallons.

3.3.7 Mix Tank TK–7001

The effluent from the West API Separator is pumped to Mix Tank TK-7001 by the submersible pumps in the OWS Effluent Sump. The tank is mixed by an overhead mechanical mixer. While equipment is in place to add acid, caustic, and an emulsion breaker, chemicals are not currently being added into this tank. A pH probe is also installed but is currently out of service. The overflow from the tank is currently routed to the DAF units but could also be routed to the South API Separator.

Mix Tank TK-7001 is a 9-foot diameter fiberglass tank, a maximum water depth of 11.5 feet, and an operating volume of approximately 5,500 gallons. At the current average flow rate, the tank provides a hydraulic retention time of 6.4 minutes.

3.3.8 South API Separator U-7001 (Out of Service)

The South API Separator is currently out of service. The South API Separator has a flight skimming mechanism that can collect floating oils and direct it into sump TK-7003. It has a bottom screw conveyor to remove settled material from the bottom of the tank. As the separator is out of service, the effluent from Mix Tank TK-7001 currently by-passes the South API Separator and flows to the DAF units.

The South API Separator is an elevated, rectangular steel tank that is 53.3 feet long, 10 feet wide with a water depth of 4 feet. The average operating volume is approximately 16,000 gallons with a surface area of approximately 530 square feet. At the current average flow rate, the tank would provide a hydraulic loading rate of 21.3 gpm/square foot if put back into service.

3.3.9 Dissolved Air Flotation Units U-7002A/B

The DAF units U-7002A/B are two parallel treatment systems that can receive the effluent from either Mix Tank TK-7001 or the South API Separator U-7001. Each DAF unit has a flash mix tank and a flocculation mix tank intended for the mixing of chemicals, such as coagulants and flocculants into the wastewater. However, at this time, chemical injections are not made into either of the mix tanks. Each DAF unit has a recycle stream collected after the effluent weir. The recycled water is combined with pressurized air and injected into the influent side of the unit. Light oils are skimmed by flight skimmers from the surface of the DAF units and directed to sump TK-7009, along with the discharge of a bottom augur that collects heavy sludge material. The contents of TK-7009 can be pumped into either the Oil Storage Tanks TK-7011A/B or the Equalization Tank T-26.

The Flash Mix Tanks are each 1,200 gallons and at the average flow provide a hydraulic retention time of 2.9 minutes when both units are operating. The Flocculation Mix Tanks are each 1,200 gallons and at the average flow provide a hydraulic retention time of 2.9 minutes.

The DAF unit is a rectangular steel tank that is 35 feet long and 10 feet wide with a water depth of 6.5 feet. The average operating volume is approximately 17,000 gallons with a surface area of approximately 350 square feet. At the current average flow rate, the tank provides a surface loading rate of 1.21 gpm/square foot, when both units are operating.

3.3.10 Oil Holding Tanks U-7011A/B

The Oil Holding Tanks U-7011A/B are used for additional separation of water and oil. The tanks primarily receive oily material from the surface of the Decant Tank (East API Separator) but can also receive oily material from the DAF units. These tanks also have heat added via steam jackets to help enhance the oil separation, as well as the piping to transfer decant back to Equalization Tank T-26. The water from the bottom of the tanks is pumped back to Equalization Tank T-26. The oily material is further processed by an on-site contractor, Metal Working Lubricants.

The Oil Holding Tanks are vertical steel tanks that are 12 feet in diameter with a maximum liquid depth of 35 feet, or 29,400 gallons.

3.3.11 Oily Material Processing

Metal Working Lubricants, a contracted company, uses heat and centrifugation to remove additional water from the oily materials prior to hauling off-site for additional processing and recycling of the oil. The oily material is transferred from the Oil Holding Tanks U-7011A/B to a steam-heated frac tank to heat the oil material and improve the separation of oil and water. The oily material is then pumped in batches to fill the 5,000-gallon storage tank (TK-7004). The oily material from TK-7004 is circulated through a centrifuge to remove water. The oil material is returned to TK-7004 until the volume is reduced to 1,000 gallons. This concentrated oil material is then pumped to a tanker truck, transferred off-site to a facility operated by Metal Working

Lubricants, then recycled. Water from the centrifuge drains to Sump TK-7003, which is then pumped to Equalization Tank T-26.

4. EQUIPMENT AGE AND CONDITION

Table 4.1 below summarizes the age and condition of the Pretreatment Plant's major equipment. The South Interceptor Building equipment and instrumentation, installed as part of the 2011 treatment system upgrade, are approximately 10 years in age. The condition of the equipment and instruments that follow is based on the following criteria:

- GOOD – Equipment is functional and well-maintained.
- SATISFACTORY – Equipment is functional as designed and may require minor maintenance.
- UNSATISFACTORY – Equipment is functional, but not as designed and may require frequent maintenance.
- POOR – Equipment requires immediate maintenance to continue functioning or is non-functional.

Table 4.1 Pretreatment Plant Major Process and Chemical Equipment – Age and Condition

Name	Age (yrs.)	Condition
Equalization Tank	~60	SATISFACTORY
North Interceptor Building - Mix Tank	~60	GOOD
North Interceptor Building - West API Separator	~60	UNSATISFACTORY
Decant Tank (East API Separator)	~60	UNSATISFACTORY
OWS Effluent Sump	~60	SATISFACTORY
OWS Effluent Sump Pumps	~10	UNSATISFACTORY
Mix Tank	~10	SATISFACTORY
Oil API Separator	~10	OUT OF SERVICE
Dissolved Air Flotation Units	~10	SATISFACTORY
Oil Holding Tanks	~10	SATISFACTORY
Frac. Tank	< 5	SATISFACTORY
Oil Storage Tank	~10	SATISFACTORY
Decant Tank Oil Transfer Pump	< 5	SATISFACTORY
Decant Tank Decant Transfer Pump	< 5	SATISFACTORY
Oil Holding Tank Transfer Pump	< 5	SATISFACTORY
Frac. Tank Transfer Pump	< 5	SATISFACTORY
Coagulant Day Tanks	< 5	GOOD
DAF Recycle Pumps	~10	GOOD

As the West API Separator does not have a continuous solids removal system, the separator needs to be being manually cleaned to remove solids. Also, the concrete is in need of inspection and potential repair. As the East API Separator is being used as a decant tank, it is not available to be immediately used as an oil water separator. Therefore, if there is an issue with the West API Separator, no online separator is available for treatment. The OWS Effluent Sump Pumps are not reliably transferring all the effluent from the API West Separator to the DAF units for treatment.

5. PERFORMANCE EVALUATION

5.1 Literature Review

The two primary process units for evaluation are the API oil water separator and the DAFs. The oil and grease removal efficiency of these systems rely heavily on several design and operating parameters. Industry practices and relevant literature were referenced to determine the most appropriate design and operating standards. The referenced literature include:

Monographs on Refinery Environmental Control Management of Water Discharges: Design and Operation of Oil-Water Separators, First ed., API Publication 421, 1991.

Wang, Lawrence K., et al. “Dissolved Air Flotation.” *Flotation Technology*, Humana Press, New York, 2010, pp. 20–26, 85-119.

Gurnham, C. Fred. “Aqueous Wastes from Petroleum and Petrochemical Plants, Milton R. Beychok, John Wiley & Sons, Inc., New York (1967). 370 Pages.” *AIChE Journal*, vol. 14, no. 1, 1968, https://doi.org/10.1002/aic.690140102.

Manual on Disposal of Refinery Wastes, American Petroleum Institute (API), First ed., Sept. 1980

Manual on Disposal of Refinery Wastes. American Petroleum Institute (API), New York, NY

Al-Shamrani, A.A., et al. “Destabilisation of Oil–Water Emulsions and Separation by Dissolved Air Flotation.” *Water Research*, vol. 36, no. 6, 2002, pp. 1503–1512., https://doi.org/10.1016/s0043-1354(01)00347-5.

5.2 Major Process Equipment

5.2.1 API Oil Water Separators

The following are the recommended design and operating parameters for API oil water separators:

<u>Design Parameters</u>

- Depth: 3 to 8 feet (API Publication 421, 4-9)
- Width: 6 to 20 feet (API Publication 421, 4-9)
- Depth to width ratio: 0.3 to 0.5 (API Publication 421, 4-9)
- Length to width ratio: at least five feet (API Publication 421, 4-9)

<u>Operating Parameters</u>

- Horizontal velocity: three feet per minute or 15 times the rise rate of oil droplets, if that is smaller (API Publication 421, 4-9)
- Effluent concentration: 50 – 75 mg/L (Human Press, pg. 89

5.2.2 DAF Units

The literature for the recommended design parameters for DAFs varies by wastes being treated. Table 5.1 provides recommended design and operating parameters.

Table 5.1 DAF Design and Operating Standards		
Parameters	**Units**	**Air Flotation for Separation of Oily Wastes**
Air pressure	psig	50 – 65 (API Institute, 6-2)
Depth	Feet	6 – 8 (Human Press, pg. 26)
Air to solids ratio	-	-
Rapid mix time	Minute	2 (Human Press, pg. 26)
Flocculation mix time	Minutes	15 – 20 (API Institute, 6-2)
Pressurization tank retention time	Minutes	1 – 2 (Human Press, pg. 26)
Retention time	Minutes	10 – 40 (Human Press, pg. 26)
Air supply requirement	SCF/100gal of feed	1.0 (API Institute, 6-2)
Hydraulic loading	Gal/min/ft^2	1.5 – 2.0 (API Institute, 6-2)
Recycle ratio	% of feed	30 – 100 (API Institute, 6-2)

5.3 Operating Review

5.3.1 General Operating Data Review

To verify the system performance, U. S. Steel conducted a short sampling program in November 2021, measuring oil and grease (O&G) at various points in the plant. While samples were collected, the West API Separator and both DAF units were operating. The measured percent removal is provided in Table 5.2.

Table 5.2 Pretreatment Plant Approximate Overall O&G Percent Removal (%)	
Date	**Percent Removal**
11/3/2020	90
11/5/2021	95
11/8/2021	94
11/10/2021	92
11/12/2021	95
11/15/2021	74
Notes: O&G result for the DAF effluent on the morning of Nov. 3, 2021 was considered an outlier. O&G result for the DAF and API effluent on the morning of Nov. 12, 2021 was considered an outlier.	

The measured data showed an average influent loading of approximately 2,300 lbs/day of O&G to the plant, with a removal efficiency of 90%. An average West API Separator effluent O&G concentration of 55 mg/L and a DAF effluent concentration of 15 mg/L were measured. The November 15th O&G results showed relatively poor removal performance of the API, which subsequently resulted in poor performance of the DAFs. However, the other days show relatively high performance and is more typical of the current API performance. Excluding the November 15th data, a removal performance of 93% is produced, with a DAF effluent O&G of 9 mg/L and West API Separator effluent of 42 mg/L. These values are in line with expectations. A portion of the influent occasionally by-passes the DAFs during periods of high flow. Using a year's flow data, Ramboll estimated that approximately 33% of the API effluent by-passes DAF treatment during periods of high flow. With this amount of by-pass flow at the average API Separator effluent of 42 mg/L O&G and a DAF effluent of 9 mg/L, the combined O&G effluent from the Pretreatment Plant is increased by 120% to almost 20 mg/L. Refining the OWS effluent sump operation and control to direct all flow to the DAF will significantly improve Pretreatment Plant effluent quality.

5.3.2 Major Process Equipment Operating Review

5.3.2.1 API Oil Water Separators

A comparison of the design and operational parameters of the West API Separator (North Interceptor) and the U-7001 Monroe API Separator (South Interceptor) to industrial standards is provided in Table 5.3. Although the Monroe is out of service at this time, the calculation is based on receiving the average and peak flow rates of 850 gpm and 1,015 gpm, respectively, currently going to the DAFs.

Table 5.3 Comparison of West API Separator and South API Separator with Design and Operating Standards

Parameter	Units	Standard	West API Separator at Current Average Flow (at Peak Flow)	South API Separator at Current Average Flow (at Peak Flow)
Depth	Feet	3 to 8	8.8	4.0
Width	Feet	6 to 20	16	10
Depth to width ratio	-	0.3 to 0.5	0.55	0.4
Length to width ratio	-	Greater than or equal to 5	6	5.3
Horizontal velocity	Feet/min	Less than or equal to 3	1.22 (1.38)	2.84 (3.39)

The West API Separator meets industry guidelines with respect to design and operating parameters, both at the average and peak flow rates. However, the South API Separator is nearly at the maximum limit for horizontal velocity at the average flow rate and exceeds it at the peak flow rate. Moreover, if the OWS Effluent Sump is improved and the DAF by-pass eliminated, the average and peak flow of 1,270 gpm and 1,440 gpm would be processed through the South API separator. At these higher flow rates, the separator would further exceed the horizontal velocity guideline limit, with values of 4.24 and 4.81 ft/min at the average and peak flow rates, respectively. This exceeds the design standard, and poor O&G removal performance would be expected.

Several samples were collected from the effluent of the West API Separator for the purpose of quantifying its treatment performance. The measurement results are presented in Table 5.4.

Table 5.4 West API Separator Approximate Percent O&G Removal		
Date	**Effluent Average O&G (mg/L)**	**O&G Removal (%)**
11/3/2020	35	77
11/5/2021	43	87
11/8/2021	46	83
11/10/2021	49	77
11/12/2021	36	85
11/15/2021	120	27
Note: O&G result for the API effluent on the morning of Nov. 12, 2021 was considered an outlier		

The data showed an average API effluent concentration of 55 mg/L and percent removal of 72%. Excluding November 15th data results in an effluent concentration of 42 mg/L and percent removal of 82%. Both sets of values meet the industry driven expectations. Considering the design and operating parameters are within guidelines, this is to be expected. To maintain this level of performance, contributing factors, such as coagulant and emulsion breaker dosage rates, chemical mixing, and equalization tank top skimming, should be continued and regularly monitored.

5.3.2.2 DAF Units

Table 5.5 compares the DAF design and operating parameters to industrial standards. The calculations shown are based on both DAF units operating. The calculations are also performed for two different flow conditions. The first is at the average and peak flow rates of 850 gpm and 1,015 gpm, respectively, which is the current flow to the DAF units. The second is at the average and peak flow of 1,270gpm and 1,440 gpm, respectively, which is the current flow through the West API Separator. These higher flow rates would be treated by the DAF units if the OWS Effluent Sump is improved, and the DAF by-pass is eliminated.

Table 5.5 Comparison of DAF Design and Operating Parameter with Industry Standards				
Parameter	**Units**	**Guideline**	**At Current Average Flow (at Peak Flow) to the DAF Units**	**At Current Average Flow (at Peak Flow) to the West API Separator**
Depth	Feet	6 to 8	6.5	6.5
Rapid mix time	Minutes	>=2	2.9 (2.4)	1.9 (1.7)
Flocculation mix time	Minutes	5 to 10	2.9 (2.4)	1.9 (1.7)
Hydraulic retention time	Minutes	10 to 40	40 (34)	27 (24)
Hydraulic loading	gpm/ft^2	1.5 to 2.5	1.21 (1.45)	1.81 (2.05)
Recycle ratio	%	30 to 100	59 (49)	39 (35)

Except for the flocculation mix time, the design and operating parameters meet the industry guidelines at the current and peak flow rates. Except for the rapid and flocculation mix times, the parameters also meet the industry guidelines if the DAF units were to treat the entire West API Separator flow. Since chemicals are not being added at the mix tanks, the residence times are not impacting performance at this time. However, the retention time is an important factor when chemicals are injected.

An important consideration is the ability of the DAF system to adequately treat the wastewater during a maintenance outage. If one of the DAF units is out of service, the parameters of the operating unit are significantly affected. Table 5.6 depicts relevant parameters with a single DAF Unit in operation.

Table 5.6 Comparison of DAF Design and Operating Parameter with Industry Standards (One DAF Unit Operating)

Parameter	Units	Guideline	At Current Average Flow (at Peak Flow) to the DAF Units	At Current Average Flow (at Peak Flow) to the West API Separator
Rapid mix time	Minutes	2	1.4 (1.2)	1.0 (0.8)
Flocculation mix time	Minutes	15 to 20	1.4 (1.2)	1.0 (0.8)
Hydraulic retention time	Minutes	10 to 40	20 (17)	13 (12)
Hydraulic loading	gpm/ft2	1.50 – 2.50	2.42 (2.89)	3.62 (4.10)
Recycle ratio	%	30 to 100	29 (25)	20 (17)

During a single DAF Unit operation, several industry guidelines are not met, both at the current flow rates and at the West API Separator flow rates. The rapid and flocculation mix times are not for at least two minutes. Instituting chemical addition can lead to poor mixing of chemicals and consequently to poorer destabilization of oil emulsions. The hydraulic loading rates are important in ensuring sufficient time and surface area are provided to mitigate effluent O&G carryover. During a single unit operation, this parameter is at or exceeding guidelines. As a result, taking a unit out of service must be conducted at a time and with a duration that will least impact performance.

Several samples were collected from the combined effluent of the DAF Units for the purpose of quantifying its treatment performance. The measurement results are presented in Table 5.7.

Table 5.7 DAF Units Approximate Percent O&G Removal		
Date	**Average Effluent O&G (mg/L)**	**O&G Removal (%)**
11/3/2020	8	78
11/5/2021	10	77
11/8/2021	16	65
11/10/2021	7	85
11/12/2021	4	89
11/15/2021	43	64
Note: O&G result for the DAF effluent on the morning of Nov. 3 and 12 2021 were considered outliers		

The data in Table 5.7 show an average removal efficiency of 76% with an effluent O&G concentration of 15 mg/L. Excluding November 15th data produces 79% and 9 mg/L for the removal percent and effluent concentration, respectively. These are in line with performance expectations. Instituting the use of coagulant and flocculant is advised to help improve and maintain O&G removal. Moreover, contributing factors, such as recycle flow, air tank pressure, and flight skimmer operation should be monitored regularly to ensure reliable performance.

6. OPERATIONS, MONITORING, AND CONTROLS EVALUATION

6.1 Operator Daily Activities

The operator daily activities currently include the following:

- Complete the Pretreat API Oily Wastewater Interceptor Log Sheet (Form 7093-10).
- Initiate and complete Equalization Tank (T-26) skims based on visual observations of oil levels at the top of the equalization tank.
- Pump oily supernatant from the Decant Tank (East API Separator) to the Oil Holding Tanks (TK-7011A/B) based on visual observation.
- Pump the decant from the bottom of the Decant Tank (East API Separator) to the West API Separator.
- Rotate the West API Separator C-channel skimmer to transfer oily waste to the Decant Tank (East API Separator).

An evaluation of Form 7093-10 produced several additions to consider, including:

- T-26 equalization tank
  - level
- North interceptor building
  - Mixing tank
    - Air lance mixer status
  - West oil water separator
    - Chain and flights operating status
  - Decant tank
    - Level
- OWS effluent sump
  - Free oil present (Y/N)
- TK-7011A/B oil holding tanks
  - Level
  - Steam On (Y/N)
- TK-7001 south interceptor building mix tank
  - Level
  - Mixer operating (Y/N)
- U-7002A/B DAF
  - Whitewater present (Y/N)
  - Chain and flights operating status
  - Chain and flight speed
  - Rapid mix and floc. Mix tanks
    - Mixers operating (Y/N)
  - TK 7010A/B pressurized tank
    - Water level
    - Air rate
  - Influent pH
  - Effluent turbidity

6.2 Online Monitoring

Several instruments are monitored at the SCADA system and are detailed below in Table 6.1.

Table 6.1 Pretreatment Plant Online Monitoring

Equipment	Variable	Units
Equalization Tank (T-26)	Level	%
API By-pass Flow	Flow	gpm
OWS Effluent Sump Discharge	Flow	gpm
OWS Effluent Sump	Level	%
Oil Holding Tank (TK-7011A/B)	Level	%

6.3 Critical Alarms

Critical alarms indicate highly detrimental situations in the treatment process that can significantly affect the treated effluent. They may or may not include equipment shutdowns. The critical alarms identified at the pretreatment plant include:

- High level alarm on the Decant Tank (East API Separator)
- Low level alarm on DAF effluent chambers used for the effluent recycle pumps & the air injection systems

6.4 Operator Troubleshooting Activities

Document NSCS-M-P-7093-02-46 provides details on addressing a deviation from the acceptable range of various control variables. It specifically highlights the process name, control system, method of control, required frequency of observation, possible sources for problems, possible strategies for addressing deviations along with reference SOP documents.

7. MAINTENANCE AND RELIABILITY EVALUATION

Ramboll inspected the equipment during a site walkthrough and had conversations with U. S. Steel Maintenance personnel. U. S. Steel also provided Ramboll with records of the routine maintenance performed on the equipment.

7.1 Key Preventative Maintenance Activities

Several maintenance activities are regularly completed to ensure reliable operation, including:

- Cleaning of the API effluent pump screens.
- Steaming the OWS API effluent pump based on the observation of a lower discharge flow rate
- Conducting general inspection and equipment lubrication approximately every one to four months.
- Inspecting the equalization tank approximately every five months.
- Inspecting the north interceptor building API area approximately every six months.
- Inspecting the north interceptor building decant tank approximately every five months.
- Visually inspecting the oil holding tanks approximately every six months.
- Inspecting the DAF systems approximately every six months.
- Visually inspecting south interceptor building API approximately every six months.

7.2 Reliability Concerns

Based on Ramboll observations and conversations with operations personnel, potential reliability concerns were identified. U. S. Steel is aware of the items listed in the table below and is actively monitoring/addressing these issues.

Table 7.1 Pretreatment Plant Equipment Reliability Concerns

Component	Concern	Potential Impact on Treatment Process
North Interceptor Building - Decant Tank (East API Separator)		
Decant tank transfer pump	Internal parts overheating	Unable to decant
Oil Processing Equipment		
Oil holding tank to Frac. Tank Transfer Pump	Internal parts overheating	Unable to process separated oils
Frac. Tank to TK-7004 Transfer Pump	Internal parts overheating	Unable to process separated oils

7.3 Planned Maintenance Activities

Maintenance activities are performed at irregular intervals and are scheduled in advance, including:

- Removal of solids form the bottom of the West API Separator

8. EVALUATION SUMMARY

Overall treatment performance of the Pretreatment Plant is good, with over 90% of O&G removed by the system. The West API Separator is appropriately sized for the current volume of being treated both at the average and peak rates. The DAF Units are appropriately sized if both units are operating. However, if only DAF unit is in operation, flow through the Pretreatment Plant should be limited until maintenance activities are completed, and the second DAF unit is returned to service.

The West API Separator periodically needs to be taken out of service for solids removal and be inspected for potential concrete repair. Currently, an online spare API separator is not available due to the East API Separator being used as an oil decant tank. The internal parts on the decant transfer, oil holding tank transfer, and frac tank transfer pumps are prone to overheating, and U. S. Steel has begun trials to identify more reliable pumps.

The current configuration and operation of the API effluent sump is not transferring all the effluent to the DAF units for treatment. This potentially increases the total O&G effluent from the Pretreatment Plant. In addition, chemical addition at the DAF Units would help improve and maintain O&G removal.

9. RECOMMENDATIONS

9.1 Operating Philosophy Improvements

Several improvements pertaining primarily to the administration activities are recommended to be implemented, including:

- Review and revise Key Performance Indicators (KPIs).
- Revise log sheets and data collection to improve tracking of KPIs.
- Reaffirm personnel roles and responsibilities associated with treatment plant operations.
- Review and update Operating Manuals and Procedures to ensure consistent operating objectives and current process configurations.
- Review and update Preventative Maintenance Program Plan (PMPP) and improve tracking work orders in Oracle for non-routine maintenance
- Review effectiveness of the personnel training program to identify potential improvements.

9.2 PTP Improvements

The following are PTP specific recommendations:

- Perform Engineering Assessment for processing all North API effluent through DAF Units.
- Optimize DAF chemical addition.
- Return East API Separator into Operation processing Wastewater.
- Perform Engineering Assessment for Properly Managing Oil Skimmings from Pretreatment.

APPENDIX 1
OPERATING PARAMETERS AND UNIT PROCESS SIZES – PRETREATMENT PLANT

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
INFLUENT PARAMETERS						
DCR & TMTM flow	gal/day	240,000	360,000	25,233	38,355	Current values from source study survey
52" & 80" 5 stand flow	gal/day	600,000	900,000	1,167,778	1,314,181	Current values from source study survey
Oily waste pad flow	gal/day	24,000	36,000	6,188	19,110	Current values from source study survey
Total flow	gal/day	864,000	1,296,000	1,199,199	1,371,646	The current flow determined from source survey is not used in the calculations. The effluent flow obtained from flow meter data is used
Oil concentration	ppm	900	1400	225	309	Design values from NA Water Technical specification document Current values from November 2021 sampling study
	lb/day	6,480	15,120	2,249	3,532	
pH	--	8 - 9		NA	NA	NA Water Technical specification document NA - not available
TSS	ppm	300	600	NA	NA	NA Water Technical specification document
Average density	S.G.			NA	NA	NA - not available
Temperature	Deg. F	95	95	NA	NA	NA Water Technical specification document NA - not available
CHEMICAL ADDITION TO COLD MILL DISCHARGE						
P8905L flow to cold mill combined discharge	gal/day	6	6	6	6	Values from ChemTreat
P8905L dosage	ppm	12	8	6	5	Using source survey values
T-26 EQUALIZATION TANK						
Diameter	ft	25.9	25.9	25.9	25.9	Drawing No. F744-0251 Inner diameter
Maximum operating level	ft	18.0	18.0	18.0	18.0	Drawing No. F744-0273 & F744-0251 From bottom of cylinder to centerline of overflow
Target operating level	ft	NA	NA	15.5	15.5	NA - not available
Height of conical tank bottom	ft	4.0	4.0	4.0	4.0	
Radius of conical tank bottom	ft	13.0	13.0	13.0	13.0	
Nominal volume	ft^3	10,223	10,223	10,223	10,223	
	gal	76,470	76,470	76,470	76,470	Volume of 75,000 gal according to "20210415 v9-DMS_Midwest_O_M_Plan"
Target operating volume	ft^3	NA	NA	8,902	8,902	NA - not available
	gal	NA	NA	66,587	66,587	NA - not available
Hydraulic retention time (HRT)	hours	2.12	1.42	0.87	0.77	

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
PRETREATMENT MIX TANK						
Length	ft	5.4	5.4	5.4	5.4	Drawing No. F744-0165
Width	ft	10.8	10.8	10.8	10.8	Drawing No. F744-0165
Height	ft	11.2	11.2	11.2	11.2	Drawing No. F744-0165
Working depth	ft	9.4	9.4	9.4	9.4	Drawing No. F744-0165
Nominal Volume	ft^3	651	651	651	651	
	gal	4,868	4,868	4,868	4,868	
Working volume	ft^3	548	548	548	548	
	gal	4,097	4,097	4,097	4,097	
Hydraulic retention time (HRT)	minutes	6.8	4.6	3.2	2.8	
Mixing provided	--	Mixer	Mixer	Air mixing	Air mixing	
	hp	10	10	-	-	Drawing No. F744-0165
Turnover	hp/1000gal	2.4	2.4	-	-	
CHEMICAL ADDITIONS TO PRETREATMENT MIX TANK						
P841L flow to north interceptor building mix tank	gal/day	5	5	5	5	Values from ChemTreat
P841L dosage	ppm	6	4	3	2	Using effluent flow data
Neat P841L Tank Capacity	gal	1,700	1,700	1,700	1,700	
P8905L flow to north interceptor building mix tank	gal/day	50.8	50.8	50.8	50.8	Values from ChemTreat
P8905L dosage	ppm	71	47	33	29	Using effluent flow data
Neat P8905L Tank Capacity	gal	5200	5200	5200	5200	
WEST API OIL WATER SEPARATOR						
Length	ft	94.0	94.0	94.0	94.0	Drawing No. F744-0165 Includes weir boxes
Width	ft	15.8	15.8	15.8	15.8	Drawing No. F744-0165
Depth	ft	8.8	8.8	8.8	8.8	Drawing No. F744-0165 Based on max water level
Length to width ratio	--	6.0	6.0	6.0	6.0	
Width to depth ratio	--	1.8	1.8	1.8	1.8	
Surface area	ft^2	1,484	1,484	1,484	1,484	
Working volume	ft^3	13,107	13,107	13,107	13,107	
	gal	98,043	98,043	98,043	98,043	Volume of 111,000 gal according to document "20210415 v9-DMS_Midwest_O_M_Plan"
Horizontal velocity	ft/min	0.58	0.86	1.22	1.38	
Hydraulic loading rate	gpm/ft^2	4.3	6.5	9.1	10.3	
Hydraulic retention time (HRT)	hours	2.72	1.82	1.29	1.13	
Effluent Parameters						
O+G	mg/L	NA	NA	42	48	Current values from November 2021 sampling study NA - Not available
	lb/d	NA	NA	640	829	Using effluent flow data NA - Not available
TSS	mg/L	NA	NA	NA	NA	NA - Not available
	lbs/day	NA	NA	NA	NA	NA - Not available

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
DECANT TANK (FORMER EAST API OIL WATER SEPARATOR)						
Length	ft	94.0	94.0	94.0	94.0	Drawing No. F744-0165 Includes weir boxes
Width	ft	15.8	15.8	15.8	15.8	Drawing No. F744-0165
Maximum height	ft	8.8	8.8	8.8	8.8	Drawing No. F744-0165 Based on max water level
Nominal volume	ft^3	13,107	13,107	13,107	13,107	
	gal	98,043	98,043	98,043	98,043	
OWS EFFLUENT SUMP						
Length of discharge channel	ft	36.8	36.8	36.8	36.8	Drawing No. A744-0165
Width of discharge channel	ft	3.0	3.0	3.0	3.0	Drawing No. A744-0165
Depth of discharge channel	ft	2.0	2.0	2.0	2.0	Drawing No. A. 744-0165 Using ruler. From floor bottom to weir
Length of oil interceptor pit	ft	5.0	5.0	5.0	5.0	Drawing No. A744-0330
Width of oil interceptor pit	ft	5.5	5.5	5.5	5.5	Drawing No. A744-0165 Using ruler
Depth of oil interceptor pit	ft	4.0	4.0	4.0	4.0	
Target operating level in oil interceptor pit	ft	NA	NA	2.0	2.0	NA - Not available
Nominal volume	ft^3	331	331	331	331	
	gal	2,472	2,472	2,472	2,472	
Target operating volume	ft^3	NA	NA	276	276	NA - Not available
	gal	NA	NA	2,061	2,061	NA - Not available
TK-7001 MIX TANK						
Diameter	ft	9.0	9.0	9.0	9.0	Drawing No. A744-0821 Inner diameter
Height	ft	11.5	11.5	11.5	11.5	Drawing No. A744-0821 From floor to centerline of 12" flanged outlet
Working volume	ft^3	732	732	732	732	
	gal	5,472	5,472	5,472	5,472	Volume of 5,980 gal according to tank name plate
Hydraulic retention time (HRT)	minutes	9.1	6.1	6.4	5.4	
Mixing Provided	--	Mixer	Mixer	Mixer	Mixer	
Horsepower	hp	2	2	2	2	
Turnover	hp/1000gal	0.37	0.37	0.37	0.37	

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
U-7001 API SEPARATOR (OUT OF SERVICE)						
Length	ft	53.3	53.3	53.3	53.3	Drawing No. A744-0741 inner wall to wall distance
Width	ft	10.0	10.0	10.0	10.0	Drawing No. A744-0741 inner wall to wall distance
Height	ft	5.0	5.0	5.0	5.0	Drawing No. A744-0741
Depth	ft	4.0	4.0	4.0	4.0	Drawing No. A744-0337
Length to width ratio	--	5.3	5.3	5.3	5.3	
Width to depth	--	2.5	2.5	2.5	2.5	
Surface area	ft^2	533	533	533	533	
Nominal volume	ft^3	2,665	2,665	2,665	2,665	
	gal	19,934	19,934	19,934	19,934	
Working Volume	ft^3	2,132	2,132	2,132	2,132	Volume of 16,000 gal according to O&M document "20210415 v9-DMS_Midwest_O_M_Plan" Note if dimensions of 54'x11.42'x4' are used based on drawing no. A744-0337, the volume comes out to 18,445 gal
	gal	15,947	15,947	15,947	15,947	
Horizontal velocity	ft/min	2.01	3.01	2.84	3.39	
Hydraulic loading rate	gpm/ft^2	15.0	22.5	21.3	25.4	
Hydraulic retention time (HRT)	minutes	27	18	19	16	
U-7002A/B DISSOLVED AIR FLOTATION (DAF) UNIT						
7002A1/B1 FLASH MIX TANK A/B						
Length	ft	5.0	5.0	5.0	5.0	Assuming both mix chambers have the same cross-sectional area. This is based on using the outer lengths and widths. 5+(8.5/12)
Width	ft	5.0	5.0	5.0	5.0	Assuming both mix chambers have the same cross-sectional area. This is based on using the outer lengths and widths. ((10+(0.75/12))/2)
Depth	ft	6.5	6.5	6.5	6.5	
Working volume	ft^3	163	163	163	163	Volume of 1,200 gal according to Drawing No. A7440338
	gal	1,223	1,223	1,223	1,223	
Hydraulic retention time (HRT) with both DAFs operating	minutes	4.1	2.7	2.9	2.4	
Hydraulic retention time (HRT) with one DAF operating	minutes	2.0	1.4	1.4	1.2	
Mixing Provided	--	Mixer	Mixer	Mixer	Mixer	
Horsepower	hp	2	2	2	2	
Turnover	hp/1000 gal	1.64	1.64	1.64	1.64	

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
7002A2/B2 FLOCCULATION MIX TANK A/B						
Length	ft	5.0	5.0	5.0	5.0	Assuming both mix chambers have the same cross-sectional area. This is based on using the outer lengths and widths. 5+(8.5/12)
Width	ft	5.0	5.0	5.0	5.0	Assuming both mix chambers have the same cross-sectional area. This is based on using the outer lengths and widths. ((10+(0.75/12))/2)
Depth	ft	6.5	6.5	6.5	6.5	
Working volume	ft^3	163	163	163	163	
	gal	1223	1223	1223	1223	Volume of 1,200 gal according to Drawing No. A7440338
Hydraulic retention time (HRT) with both DAFs operating	minutes	4.1	2.7	2.9	2.4	
Hydraulic retention time (HRT) with one DAF operating	minutes	2.0	1.4	1.4	1.2	
Mixing Provided	--	Mixer	Mixer	Mixer	Mixer	
Horsepower	hp	1.5	1.5	1.5	1.5	
Turnover	hp/1000 gal	1.23	1.23	1.23	1.23	

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
U-7002A/B DISSOLVED AIR FLOTATION UNIT A/B						
Length	ft	35.1	35.1	35.1	35.1	
Width	ft	10.0	10.0	10.0	10.0	
Depth	ft	6.5	6.5	6.5	6.5	
Length to width ratio	--	3.5	3.5	3.5	3.5	
Depth to width ratio	--	0.7	0.7	0.7	0.7	
Surface area	ft^2	351	351	351	351	
Working volume	ft^3	2,282	2,282	2,282	2,282	
	gal	17,066	17,066	17,066	17,066	Volume of 18,000gal according to "20210415 v9-DMS_Midwest_O_M_Plan"
Horizontal velocity with both DAFs operating	ft/min	0.6170	0.9255	0.8741	1.0438	
Surface loading rate with both DAFs operating	gpm/ft^2	0.85	1.28	1.21	1.45	
Surface loading rate with one unit operating	gpm/ft^2	1.71	2.56	2.42	2.89	DAF manual has 3 and 4 gpm/ft^2 as design and peak
Air injection rate	scfm	6	6	U	U	From DAF manual U - unknown
Hydraulic retention time (HRT) with both DAFs operating	minutes	57	38	40	34	
Hydraulic retention time (HRT) with one DAF operating	minutes	28	19	20	17	
Recycle per DAF	gpm	300	300	250	250	
	%	100%	67%	59%	49%	Ratio when both DAFs are operating
	%	50%	33%	29%	25%	Ratio when one DAF are operating
Recycle O+G per DAF	mg/L	50.0	50.0	9.0	15.0	DAF manual indicates effluent O&G <50mg/L Current values are from November 2021 sample study. The sampling study measured combined DAF eflfuent. Each DAF's effluent is assumed to have the combined effluent concentration
	lbs/day	180	180	27	45	
Recycle TSS	mg/L	NA	NA	NA	NA	NA - Not available
	lbs/day	NA	NA	NA	NA	NA - Not available
Net TSS	mg/L	NA	NA	NA	NA	NA - Not available
	lbs/day	NA	NA	NA	NA	NA - Not available
O+G loading per DAF (including recycle)	mg/L	75.0	560.0	29.8	37.1	The plant influent flow is split between both DAFs
	lbs/day	540	5,040	241	337	
Solids Loading Rate	$lb/hr/ft^2$	NA	NA	NA	NA	NA - Not available

OPERATING PARAMETERS AND UNIT PROCESS SIZES - PRETREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
Influent per DAF						Design values from DAF manual
O+G	mg/L	100.0	900.0	42.0	48.0	Current values from November 2021 sample study
	lbs/day	360	4,860	214	292	When the flow is split to both DAF units
Effluent per DAF						DAF manual indicates effluent O&G <50mg/L
O+G	mg/L	50.0	50.0	9.0	15.0	Current values from November 2021 sample study
	lbs/day	180	270	46	91	
TSS	mg/L	NA	NA	NA	NA	NA - not available
	lbs/day	NA	NA	NA	NA	NA - not available
TK-7011A NORTH/SOUTH HOLDING TANK						
Diameter	ft	12.0	12.0	12.0	12.0	Drawing No. A744-0783/4 Inner diameter
Height	ft	36.0	36.0	36.0	36.0	Drawing No. A744-0345 The sloped bottom is not subtracted out From grade to center of overflow
Depth	ft	34.8	34.8	34.8	34.8	Drawing No. A744-0783/4 The sloped bottom is not subtracted out From grade to center of overflow
Nominal volume	ft^3	4,072	4,072	4,072	4,072	
	gal	30,455	30,455	30,455	30,455	
Working volume	ft^3	3,930	3,930	3,930	3,930	
	gal	29,397	29,397	29,397	29,397	Volume of 30,000 gal according to "20210415 v9-DMS_Midwest_O_M_Plan"
EFFLUENT PARAMETERS						
North building interceptor weir overflow	gal/day	0	0	604,800	612,000	Design was to have all flow directed to south interceptor building
Flow to south interceptor building	gal/day	864,000	1,296,000	1,224,000	1,461,600	Design values from North Interceptor Building design documents/drawings Currernt flow values are based on averages of flow meter readings >= 1000gpm through North interceptor API and flow of >=630 to the DAFs
Total effluent flow to pre-treat lift station	gal/day	864,000	1,296,000	1,828,800	2,073,600	

APPENDIX 2
PRETREATMENT PLANT PROCESS FLOW DIAGRAM

SAVED: 11/30/21 11:19 AM

T-26 FLOW EQUALIZATION TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		75,000
DETENTION TIME, min	AVG FLOW	52.2
	PEAK FLOW	46.2

PRETREATMENT MIX TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		4,900
DETENTION TIME, min	AVG FLOW	3.2
	PEAK FLOW	2.8

WEST API OIL WATER SEPARATOR		
NUMBER OF UNITS		1
SURFACE AREA ft^2		1,480
HYDRAULIC LOADING RATE gpm/ft^2	AVG FLOW	9.1
	PEAK FLOW	10.3

OWS EFFLUENT SUMP		
NUMBER OF UNITS		1
CAPACITY, gal ea.		2,500
DETENTION TIME, sec	AVG FLOW	VARIES
	PEAK FLOW	VARIES

U-7001 API SEPARATOR (OUT OF SERVICE)		
NUMBER OF UNITS		1
SURFACE AREA ft^2		533
HYDRAULIC LOADING RATE gpm/ft^2	AVG FLOW	N/A
	PEAK FLOW	N/A

FLASH MIX TANK A		
NUMBER OF UNITS		1
CAPACITY, gal ea.		1,200
DETENTION TIME, sec	AVG FLOW	174
	PEAK FLOW	144

FLOCCULATION MIX TANK A		
NUMBER OF UNITS		1
CAPACITY, gal ea.		1,200
DETENTION TIME, sec	AVG FLOW	174
	PEAK FLOW	144

U-7002A DAF UNIT A		
NUMBER OF UNITS		1
SURFACE AREA ft^2		350
HYDRAULIC LOADING RATE gpm/ft^2	AVG FLOW	1.2
	PEAK FLOW	1.5

TK-7011A NORTH HOLDING TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		30,000
DETENTION TIME, min	AVG FLOW	VARIES
	PEAK FLOW	VARIES

DECANT TANK (FORMER EAST API OIL WATER SEPARATOR)		
NUMBER OF UNITS		1
CAPACITY, gal ea.		98,000
DETENTION TIME sec	AVG FLOW	VARIES
	PEAK FLOW	VARIES

TK-7001 MIX TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		5,500
DETENTION TIME, sec	AVG FLOW	384
	PEAK FLOW	324

FLASH MIX TANK B		
NUMBER OF UNITS		1
CAPACITY, gal ea.		1,200
DETENTION TIME, sec	AVG FLOW	174
	PEAK FLOW	144

FLOCCULATION MIX TANK B		
NUMBER OF UNITS		1
CAPACITY, gal ea.		1,200
DETENTION TIME, sec	AVG FLOW	174
	PEAK FLOW	144

U-7002B DAF UNIT B		
NUMBER OF UNITS		1
SURFACE AREA ft^2		350
HYDRAULIC LOADING RATE gpm/ft^2	AVG FLOW	1.2
	PEAK FLOW	1.5

TK-7011B SOUTH HOLDING TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		30,000
DETENTION TIME, min	AVG FLOW	VARIES
	PEAK FLOW	VARIES

TK-7004 USED OIL TANK (FORMER API SLUDGE TANK)		
NUMBER OF UNITS		1
CAPACITY, gal ea.		5,000
DETENTION TIME, min	AVG FLOW	VARIES
	PEAK FLOW	VARIES

CLIENT							
UNITED STATES STEEL CORPORATION	1	04JAN22	FINAL	LTE	DESIGNER / PROFESSIONAL ENGINEER RESPONSIBLE	RAMBOLL US CONSULTING, INC.	PROJECT MIDWEST WASTEWATER TREATMENT EVALUATION
	NO.	DATE	REVISION	INT.	DESIGNED BY TJP; PROJECT NO. 1690022867; CHECKED BY TJP; DATE 04JAN22; DRAWN BY W.JARRELL	RAMBOLL	ADDRESS 6290 US-12, PORTAGE, IN 46368

SHEET DESCRIPTION
PRETREATMENT PLANT PROCESS FLOW DIAGRAM
DRAWING LOCATION

PFD-02

L:\ACTIVE PROJECTS\US STEEL\MIDWEST\2021 ENGINEERING EVALS\PRETREATMENT EVALUATION\CAD\USS MIDWEST CTP PFD.DWG

APPENDIX IV
ENGINEERING EVALUATION – CHROME TREATMENT PLANT

Intended for
United States Steel Corporation

Document type
Evaluation Report

Date
January 2022

CHROME TREATMENT PLANT EVALUATION
U. S. STEEL MIDWEST PORTAGE, INDIANA

RAMBOLL Bright ideas. Sustainable change.

CHROME TREATMENT PLANT EVALUATION
U. S. STEEL MIDWEST PORTAGE, INDIANA

Project name	**U. S. Steel Midwest Engineering Evaluations**
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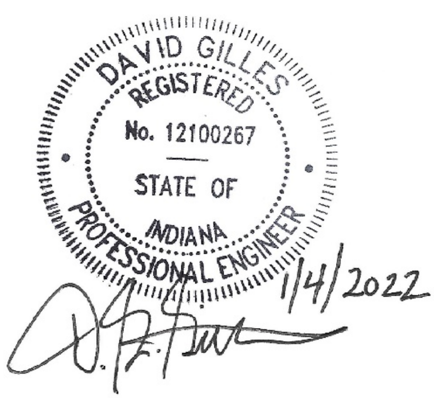

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APPENDICES

1. EXECUTIVE SUMMARY

United States Steel (U. S. Steel) Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with Indiana Department of Environmental Management (IDEM), which requires U. S. Steel to evaluate the adequacy of the existing Chrome Treatment Plant (CTP) components and operations. The Agreed Order also stipulates that this evaluation must be certified by a Licensed Professional Engineer (Reference Agreed Order II.6.D). Ramboll was contracted by U. S. Steel to develop and certify the Chrome Treatment Evaluation.

This report presents the details of the evaluation, which includes a description of the treatment process, process unit sizes, equipment age and condition, operational, monitoring and control activities, plant maintenance and reliability, and recommendations to implement. Overall, based on Ramboll's performance evaluation, the CTP is operating well. The sampling data provided by U. S. Steel indicated the CTP is removing greater than 98% of the total chrome.

Ramboll worked alongside U. S. Steel to inspect all relevant equipment, components, and operations in the CTP's current state. Ramboll recommends are presented in Section 9 of this report.

2. INTRODUCTION AND GENERAL OVERVIEW

2.1 Background Information

The U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM, which requires U. S. Steel to evaluate the adequacy of the existing CTP. Ramboll was contracted by U. S. Steel to develop and certify the CTP Evaluation. Ramboll followed accepted engineering practices in the development of this evaluation for the site. These practices included visual observations, discussions with operators and site managers, inspection of wastewater treatment equipment, source sampling, on-line and augmented flow measurement, statistical data evaluation, review of permits and DMR data, and brainstorming with site personnel.

Figure PFD-01 provides a process flow diagram of the CTP, as well as the critical process design parameters of all major treatment plant equipment and tanks. A Process Design Table is included in Appendix 1.

2.2 Purpose of Treatment Plant

The purpose of the CTP is to treat hexavalent chrome-bearing wastewaters via a reduction process using sulfuric acid, sodium bisulfite, and sodium hydroxide. The CTP receives wastewater from the following influent sources:

- Greenbelt II Landfill leachate and stormwater (Greenbelt II per PFD-01)
- Hexavalent chrome-bearing wastewaters from the Tin Free Steel Line (ETCM) and Electrolytic Tinning Lines (ETLM) (ETLM and ETCM per PFD-01)
- Stormwater from the outside trench (Stormwater Sump/Trench per PFD-01)

Treated effluent from the CTP is discharged via internal Outfall 204. Outfall 204 discharges to the Portage-Burns Waterway via Outfall 304 (administrative compliance point for internal Outfalls 104 and 204), which discharges via Outfall 004.

2.3 Agreed Order Evaluation Requirements

The purpose of this evaluation is to assess the adequacy of the existing CTP and operations per Agreed Order II.6.D and address needs to include:

- Identify existing treatment components, and for each component, determine its capacity, age, current condition, and treatment capability, including removal efficiency, and characterize the wastewater (source, nature, and volume) that it receives;
- Describe the current treatment operations, including detailed diagrams that depict flows to and through the CTP;
- Evaluate the adequacy of treatment equipment and operations and determine needs. The determination of equipment needs shall encompass equipment repair, replacement, and addition;
- Develop a plan and schedule for addressing treatment needs; and,
- Submit the information required above, certified by a Licensed Professional Engineer.

3. TREATMENT SYSTEM DESCRIPTION AND SIZING

3.1 Treatment Plant History

U. S. Steel's existing CTP was constructed following the results of a Phase 2 evaluation completed by N.A. Water Systems (N.A.W.S.) in October 2008. N.A.W.S. was retained by U. S. Steel to evaluate options for upgrading wastewater treatment facilities at the Midwest Plant; the findings and recommendations are detailed in N.A.W.S.'s *Used Oil, Waste Minimization, and Wastewater Modernization Phase 2 Report* ("Phase 2 Report"). U. S. Steel's preexisting CTP was replaced with an entirely new plant, consistent with N.A.W.S.'s Conventional Chrome Treatment System upgrade (Option 2), outlined in Section 3.1.2 of the Phase 2 Report. The new treatment system includes chromium precipitation, solids precipitation, and solids dewatering and was put into service on September 4, 2011.

3.2 Process Description

As stated in Section 2.2, the main objective of the CTP treatment system is to treat hexavalent chrome-bearing wastewaters via a reduction process using sulfuric acid, sodium bisulfite, and sodium hydroxide to allow for discharge to the permitted outfall. The treatment processes include:

- Chrome Equalization Tank (TK-2001);
- Chrome Reduction Tanks (TK-2002A and TK-2002B);
- pH Adjustment Tanks (TK-2003A and TK-2003B);
- Lamella Clarifiers (CF-2001A and CF-2001B);
- Sludge Handling – Sludge Holding Tank (TK-2005) and Filter Press (FP-2001);
- Continuous Backwash Filters (F-2001A and F-2001B); and,
- Former Final pH Adjustment Tank (TK-2004).

PFD-01 provides a process flow diagram of the CTP, as well as the critical process design parameters of all major treatment plant equipment and tanks.

Tables 3.1 and 3.2, which follow, summarize the CTP Major Equipment and Instruments, as well as the CTP Chemical Equipment.

The CTP system was initially designed for an average flow of 250[1] gpm and a design peak flow of 450[2] gpm. The CTP consists of two parallel trains, each sized to treat these flow rates. Between July 2020 and June 2021, the average daily effluent flow to Outfall 204 for the CTP was 108 gpm with the maximum daily flow of 207 gpm. The Chrome Equalization tank receives and stores influent wastewater prior to treatment. From the equalization tank, wastewater is transferred to one of two trains, Treatment Train A and B. Each train consists of a chrome reduction tank, pH adjustment tank, Lamella clarifier, and continuous backwash filter. Treated effluent from each train is discharged to the Final pH adjustment tank before discharging through Internal Outfall 204 which then flows to Outfall 004.

For additional details on specific equipment details, see section 3.3 Equipment, Instruments, and Controls.

[1] Design Average Flow is based on manufacturer's design average flow for Dynasand Filter (Continuous Backwash Filter).
[2] Design Peak Flow is based on manufacturer's peak flow for the Lamella Clarifier.

Table 3.1 CTP Major Equipment and Instruments[1]

Name	Tag(s)	Purpose	Design Criteria
CTP Building Sump	TK-2008	Receives wastewater from the Filter Press, Continuous Backwash Filter A and B, Truck Fill Pad A, and Chrome Equalization Tank containment	1,615 gal
CTP Building Sump Pump A	P-2008A	Transfers wastewater from the CTP Building Sump to the Chrome Equalization Tank	200 gpm @ 50' TDH ea.
CTP Building Sump Pump B	P-2008B		
Chrome Equalization Tank	TK-2001	Stores CTP influent wastewater	60,000 gal HRT = 4 hrs.
Equalization Tank Transfer Pump A	P-2001A	Transfers wastewater from the Chrome Equalization Tank to the Chrome Reduction Tanks	500 gpm @ 30' TDH ea.
Equalization Tank Transfer Pump B	P-2001B		
Outside Stormwater / Acid Sump	N/A	Stores stormwater from the Stormwater Acid Trench	N/A
Chrome Reduction Tank A	TK-2002A	Lowers wastewater pH and speeds up reaction through acid addition and reduces chromium to Cr^{+3} through addition of reducing agent; mixing is provided	11,090 gal ea. pH ~ 2.5 ORP ~ 250 mV HRT = 44 min
Chrome Reduction Tank B	TK-2002B		
pH Adjustment Tank A	TK-2003A	Neutralizes wastewater and precipitates chromium hydroxide through Caustic addition; mixing is provided	5,430 gal ea. 7.8 < pH < 8.5 HRT = 22 min
pH Adjustment Tank B	TK-2003B		
Flash Mix Tank A	N/A	Provides rapid mixing to disperse Coagulant evenly (to ensure a complete chemical reaction) and form flocs	140 gal ea. HRT = 34 sec
Flash Mix Tank B	N/A		
Flocculation Tank A	N/A	Provides slow mixing and Polymer to enhance floc growth and to facilitate Lamella Clarifier gravity settling	900 gal ea. HRT = 3.6 min
Flocculation Tank B	N/A		
Lamella Clarifier A	CF-2001A	Settles out influent solids (chromium hydroxide) by gravity	1,135 ft^2 ea. 0.18 gpm/ft^2 ea. Peak Flow ≤ 450 gpm ea. TSS ≤ 300 mg/L
Lamella Clarifier B	CF-2001B		
Continuous Backwash Filter A	F-2001A	Filters Lamella Clarifier effluent with continuous backwashing	92 ft^2 ea. 2.72 gpm/ft^2 HLR ea. Effluent TSS ≤ 10 mg/L Design Flow = 250 gpm
Continuous Backwash Filter B	F-2001B		
Former Final pH Adjustment Tank	TK-2004	Stores and discharges final treated effluent and provides pH adjustment, if necessary	1,640 gal HRT = 7 min
Sludge Holding Tank	TK-2005	Stores Lamella Clarifier sludge effluent; mixing is provided	5,500 gal
Filter Press	FP-2001	Provides efficient separation of solids from liquids for fast, simple removal of filter cakes for off-site landfill disposal	612 ft^2 6 gpm/ft^2 HLR

Table 3.1 CTP Major Equipment and Instruments[1]			
Name	**Tag(s)**	**Purpose**	**Design Criteria**
Filter Press Feed Pump A	P-2003A	Transfers sludge from sludge holding tank to filter press	100 gpm @ 231 TDH ea. (existing)
Filter Press Feed Pump B	P-2003B	Transfers sludge from sludge holding tank to filter press	250.9 gpm @ 700 rpm Max discharge pressure = 175 psi (replacement pump)

Notes:

[1]Reference Process Design Table in Appendix 1.
(gal): Gallons
(gpm): Gallons per minute
(HLR): Hydraulic Loading Rate
(HRT): Hydraulic Retention Time
(ORP): Oxidation Reduction Potential
(TDH): Total Dynamic Head
(TSS): Total Suspended Solids
(mg/L): Milligrams per liter

Table 3.2 CTP Chemical Equipment[1]			
Name	**Tag(s)**	**Purpose**	**Design Criteria**
Sulfuric Acid Dosing System			
Sulfuric Acid Mill Source Tank	N/A	Stores and feeds Sulfuric Acid to lower the influent pH and speed up the reduction reaction	N/A
Sulfuric Acid Dosing Pump A	P-2009A		34 GPH A 69' TDH ea.
Sulfuric Acid Dosing Pump B	P-2009B		
Sodium Bisulfite Feed System			
Sodium Bisulfite Storage Tank A	TK-2007A	Stores and feeds Sodium Bisulfite (reducing agent) to reduce Cr^{+6} to Cr^{+3}	7,040 gal. ea.
Sodium Bisulfite Storage Tank B	TK-2007B		
Sodium Bisulfite Feed Pump A	P-2005A		73 GPH @ 231' TDH ea.
Sodium Bisulfite Feed Pump B	P-2005B		
Caustic Feed System			
Caustic Storage Tank	TK-2006	Stores and feeds Caustic (NAOH) to neutralize influent and precipitate Cr^{+3} as insoluble chromium hydroxide ($Cr(OH)_3$)	7,000 gal.
Caustic Feed Pump A	P-2004A		34 GPH @ 69' TDH ea.
Caustic Feed Pump B	P-2004B		
Coagulant Dosing System			
Coagulant Storage Tank	TK-2014	Stores and feeds Coagulant to bring non-settling particles together into larger, heavier masses of solids (flocs)	1,100 gal.
Coagulant Dosing Pump A	P-2015A		7 GPH @ 69' TDH ea.
Coagulant Dosing Pump B	P-2015B		
Polymer Feed System			
Polymer Day Tank	TK-2011B	Stores and feeds Polymer to enhance floc growth and facilitate Lamella gravity settling	1,175 gal.
Polymer Metering Pump A	P-2011A		74 GPH 100 PSI
Polymer Metering Pump B	P-2011B		

Notes:

[1]Reference Process Design Table in Appendix 1.
(dia.): Diameter
(GPH): Gallons Per Hour
(TDH): Total Dynamic Head
(PSI): Pounds Per Square Inch

3.3 Equipment, Instrumentation, and Controls

The following sections detail the function of each component of the CTP treatment system.

3.3.1 Chrome Equalization Tank (TK-2001)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

As stated in Section 2.2, the Chrome Equalization Tank (TK-2001) receives wastewater from three influent sources: Greenbelt II (Landfill), ETLM and ETCM, and stormwater from the outside sump/trench. The CTP Building Sump (TK-2008) receives backwash from the Continuous Backwash Filters and miscellaneous equipment discharges and recycles the wastewater back to TK-2001. Influent ETLM and ETCM are combined prior to entering TK-2001 and are monitored for pH, conductivity, and ORP. TK-2001 is an open top tank constructed of grade 304 Stainless Steel. Typically, the water level in TK-2001 is maintained at a lower height (~30%) to provide storage for influent wastewater. Wastewater from TK-2001 is pumped to one of the two treatment trains (Train A or B) via the Equalization Tank Transfer Pumps, P-2001A or P-2001B. Each treatment train has a dedicated pump with variable frequency drive (VFD) and effluent flow meter for controlling flow to each train.

3.3.2 Chrome Reduction Tanks (TK-2002A and TK-2002B)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

Each treatment train includes one Chrome Reduction Tank (dome roof tanks) constructed of fiberglass reinforced plastic, TK-2002A and TK-2002B. From the Chrome Equalization Tank, wastewater is directed to the bottom inlet of one of the Chrome Reduction Tanks. In the Chrome Reduction Tanks, hexavalent chromium is reduced to trivalent via the addition of Sulfuric Acid (Acid) and Sodium Bisulfite. Acid and Sodium Bisulfite are pumped from chemical storage tanks, consistent with Table 3.2, and are injected into the wastewater immediately before entering the Chrome Reduction Tanks. The Acid lowers the wastewater pH to speed up the reduction reaction, while the Sodium Bisulfite (or, reducing agent) reduces the chromium to the trivalent form. To ensure a successful reduction reaction occurs, each tank is equipped with a vertical mixer, and the reduction tank wastewater is continuously monitored for pH and ORP. As such, the pH and ORP are adjusted and maintained within set ranges. Reduced wastewater effluent from the Chrome Reduction Tanks then flows by gravity to the pH Adjustment Tanks, TK-2003A or TK-2003B, for neutralization and precipitation.

3.3.3 pH Adjustment Tanks (TK-2003A and TK-2003B)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

From the Chrome Reduction Tanks, wastewater is directed to the bottom inlet of one of the pH Adjustment Tanks, TK-2003A or TK-2003B. The pH Adjustment Tanks are dome roof tanks constructed of fiberglass reinforced plastic. In the pH Adjustment Tanks, wastewater is neutralized through the addition of Sodium Hydroxide (Caustic) to precipitate trivalent chromium as insoluble chromium hydroxide. Caustic is pumped from the Caustic Storage Tank and is injected into the wastewater immediately before the Chrome Reduction Tank inlet. To facilitate chromium precipitation, each tank utilizes an overhead mixer and is continuously monitored for pH. The pH is sustained within an optimal range to achieve minimum solubility. Wastewater effluent from the pH Adjustment Tanks flows by gravity to respective treatment train Flash Mix Tanks, Flocculation Tanks, and Lamella Clarifiers.

3.3.4 Lamella Clarifiers (CF-2001A and CF-2001B)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

Following the pH Adjustment Tanks, wastewater flow enters Flash Mix Tank A or B and subsequently enters Flocculation Tank A or B. The Flash Mix Tanks introduce a Coagulant to influent wastewater and provide rapid mixing to bring non-settling particles together to form flocs. The Flocculation Tanks, which are situated immediately after the Flash Mix Tanks, provide slow mixing and introduce a flocculant (Polymer) to further enhance floc growth and to facilitate settling in the Lamella Clarifiers. From the Flash Mix Tanks, wastewater flows to the Lamella Clarifiers, CF-2001A or CF-2001B. The clarifiers are constructed of epoxy coated carbon steel and are designed for a peak flow rate and surface area available for sedimentation. Wastewater enters the Lamella Clarifiers through feed slots located on the side of the plates. The flow rises up the plates as solids settle on the plate surface, while sludge slides down the plates into a hopper. Clarified wastewater flows through orifice holes into an effluent box and discharges over a weir into an effluent trough. From the effluent trough, wastewater flows by gravity to the Continuous Backwash Filters. Redundant turbidity probes are installed in the effluent boxes of each of the Lamella Clarifiers to monitor the quality of outgoing wastewater.

3.3.5 Continuous Backwash Filters (F-2001A and F-2001B)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

Wastewater effluent from the Lamella Clarifiers enters the Continuous Backwash Filters (F-2001 or F-2001B) through the bottom of the filter units through a granular filter bed. The granular filter media captures solids and the clean (filtered) water rises into the filtrate pool above the filter bed. Filtered wastewater exits the Continuous Backwash Filters at the top of the filter over an effluent weir, where it flows by gravity to the Final pH Adjustment Tank. During the filtration process, the granular media is simultaneously cleaned and recycled throughout the filter. The Continuous Backwash Filters are designed to accommodate a specific design flow and bed surface area (see Table 3.1).

3.3.6 Former Final pH Adjustment Tank (TK-2004)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

The Final pH Adjustment Tank is a dome roof tank constructed of fiberglass reinforced plastic. Wastewater effluent flows by gravity from the Continuous Backwash Filters to the Final pH Adjustment Tank before discharge to Outfall 204. Wastewater effluent from TK-2004 is sampled via auto-sampler, and sampling results are reported as per the facility’s National Pollutant Discharge Elimination System (NPDES) permit. Currently, effluent flow to Outfall 204 is estimated through the addition and subtraction of four flow meters: two EQ Tank transfer pump flow meters, CTP sump flow meter, and the Greenbelt II flow meter. TK-2004 is equipped with an overhead mixer and pH probe (for continuous pH monitoring). If the pH probe indicates a pH reading that is not within the permitted discharge range, pH adjustment of TK-2004 wastewater can be completed through Acid addition and mixing. TK-2004 is not currently utilized for pH adjustment. If the pH in TK-2004 is determined to be out of range, the water is diverted to TK-2008 to be recycled back to TK-2001 to be treated again.

3.3.7 Sludge Handling – Sludge Holding Tank (TK-2005) and Filter Press (FP-2001)

Refer to Tables 3.1 and 3.2 for equipment and instrumentation design criteria details, including sizing and capacities.

Settled sludge collects in each of the Lamella Clarifier hoppers and is pumped via the Lamella Sludge Pumps to the Sludge Holding Tank (TK-2005). From the Sludge Holding Tank, Filter Press Feed Pumps transfer sludge to the Filter Press (FP-2001), where it is separated into solids (filter cake) and liquid. The resulting filter cake solids are collected in a roll-off container and are transported to a landfill for off-site disposal. The filtrate liquid is directed to the CTP Building Sump.

4. EQUIPMENT AGE AND CONDITION

Tables 4.1 and 4.2 below summarize the age and condition of the CTP Major Equipment and Instruments, as well as the CTP Chemical Equipment. The majority of all Major CTP Equipment and Instruments are original to the 2011 treatment plant upgrade and are approximately ten years in age. The condition of the equipment and instruments that follow is based on the following criteria:

- GOOD – Equipment is functional and well-maintained.
- SATISFACTORY – Equipment is functional as designed and may require minor maintenance.
- UNSATISFACTORY – Equipment is functional, but not as designed and may require frequent maintenance.
- POOR – Equipment requires immediate maintenance to continue functioning or is non-functional.

Table 4.1 CTP Major Equipment and Instruments – Age and Condition

Name	Age (yrs.)	Condition
CTP Building Sump	~10	GOOD
CTP Building Sump Pump A		SATISFACTORY
CTP Building Sump Pump B		SATISFACTORY
Chrome Equalization Tank	~10	GOOD
Equalization Tank Transfer Pump A		GOOD
Equalization Tank Transfer Pump B		GOOD
Stormwater Sump/Trench	~10	GOOD
Chrome Reduction Tank A	~10	GOOD
Chrome Reduction Tank B	~10	GOOD
pH Adjustment Tank A	~10	GOOD
pH Adjustment Tank B	~10	GOOD
Flash Mix Tank A	~10	GOOD
Flash Mix Tank B	~10	GOOD
Flocculation Tank A	~10	GOOD
Flocculation Tank B	~10	GOOD
Lamella Clarifier A	~10	GOOD
Lamella Clarifier B	~10	GOOD
Continuous Backwash Filter A	~10	GOOD
Continuous Backwash Filter B	~10	UNSATISFACTORY
Final pH Adjustment Tank	~10	GOOD
Sludge Holding Tank	~10	GOOD
Filter Press	~10	SATISFACTORY
Filter Press Feed Pump A	~10	SATISFACTORY
Filter Press Feed Pump B	~10	POOR

Overall, the majority of the CTP equipment and instruments are in “GOOD” working condition. However, as indicated in Table 4.1, a small group of equipment and instruments may require attention. This group includes the following:

- CTP Building Sump Pump A;
- CTP Building Sump Pump B;

- Continuous Backwash Filter B;
- Filter Press; and,
- Filter Press Feed Pump B.

The pumping capacity of the CTP Building Sump Pumps is less than the EQ Tank Transfer Pumps, which means there is a potential to flood the building sump. As such, the CTP Building Sump Pumps are labeled "SATISFACTORY." On September 27, 2021, Ramboll observed two of the four sand washers of Continuous Backwash Filter B appeared to be non-functional. However, no permit violations associated with the filters had been observed to date. Thus, the condition of Continuous Backwash Filter B is rated as "UNSATISFACTORY." On September 27, 2021, CTP operators indicated that the discharge pressure was inadequate for Filter Press Feed Pump B and that a replacement was scheduled. The Filter Press Feed Pump B is in "POOR" condition and requires immediate maintenance and/or replacement to resume normal operation. Furthermore, U. S. Steel maintenance personnel indicated that the Filter Press plates will need to be replaced in the near future; therefore, the Filter Press condition is rated as "SATISFACTORY."

Table 4.2 CTP Chemical Equipment – Age and Condition

Name	Age (yrs.)	Condition
Sulfuric Acid Dosing System		
Sulfuric Acid Tank	UNKNOWN	UNKNOWN
Sulfuric Acid Dosing Pump A	UNKNOWN	SATISFACTORY
Sulfuric Acid Dosing Pump B	UNKNOWN	SATISFACTORY
Sodium Bisulfite Feed System		
Sodium Bisulfite Storage Tank A	~10	GOOD
Sodium Bisulfite Storage Tank B	~10	GOOD
Sodium Bisulfite Feed Pump A	UNKNOWN	SATISFACTORY
Sodium Bisulfite Feed Pump B	UNKNOWN	SATISFACTORY
Caustic Feed System		
Caustic Storage Tank	~10	GOOD
Caustic Feed Pump A	UNKNOWN	SATISFACTORY
Caustic Feed Pump B	UNKNOWN	SATISFACTORY
Coagulant Dosing System		
Coagulant Storage Tank	UNKNOWN	GOOD
Coagulant Dosing Pump A	UNKNOWN	SATISFACTORY
Coagulant Dosing Pump B	UNKNOWN	SATISFACTORY
Polymer Feed System		
Polymer Day Tank	UNKNOWN	GOOD
Polymer Metering Pump A	UNKNOWN	SATISFACTORY
Polymer Metering Pump B	UNKNOWN	SATISFACTORY

Per Table 4.2, all of the CTP equipment and instruments are in "GOOD" or "SATISFACTORY" condition.

Based on the performance evaluation in Section 5.2.2.5, all chemical metering pumps are operating at 30% or less capacity. Based on discussions with CTP operators, the chemical metering pump controls have experienced some instability due to this capacity issue. As such, chemical metering pumps are rated as "SATSIFACTORY."

5. PERFORMANCE EVALUATION

5.1 Literature Review

Ramboll utilized the following sources (i.e., textbooks, professional publications, engineering standards, reference materials, etc.) to perform an evaluation of current system performance against typical equipment design parameters:

Clarifier Design Task Force, WEF. *Clarifier Design: WEF Manual of Practice No. FD-8*. 2nd ed., McGraw-Hill, 2006.

Design of Municipal Wastewater Treatment Task Force, WEF and ASCE/EWRI. *Design of Municipal Wastewater Treatment Plants*. 5th ed., McGraw-Hill, 2010.

Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. *Recommended Standards for Wastewater Facilities: Policies for the Design, Review, and Approval of Plans and Specifications for Wastewater Collection and Treatment Facilities*. 2014th ed., Health Research, Inc., Health Education Services Division, 2014.

Lipták Béla G. *Instrument Engineers' Handbook. Process Control and Optimization*. CRC Press, 2006.

"Operating Instructions for Filter Press Operation." 18 Oct. 2010.

Parkson Corporation. "Installation, Operation & Maintenance Manual: (2) MODEL 1135/55 LAMELLA GRAVITY SETTLER." 24 Nov. 2010.

5.2 Major Process Equipment

5.2.1 Chrome Equalization Tank (TK-2001)

<u>Standard Design Criteria:</u>

- Flow Equalization (Great Lakes 60-8)
  - Equalization basin capacity should be sufficient to effectively reduce expected flow and load variations to the extent deemed to be economically advantageous. With a diurnal flow pattern, the volume required to achieve the desired degree of equalization can be determined from a cumulative flow plot over a representative 24-hour period.
- Flow Equalization Controls (Great Lakes 60-9)
  - Inlets and outlets for all basin compartments shall be suitably equipped with accessible external valves, stop plates, weirs, or other devices to permit flow control and the removal of an individual unit from service. Facilities shall also be provided to measure and indicate liquid levels and flow rates.
- Wet Weather Flow Equalization (Great Lakes 10-9)
  - If the ratio of design peak hourly flow to design average flow is 3:1 or more, flow equalization shall be considered. This may be accomplished by either building a wet weather retention basin and gradually returning the excess flow to the treatment plant during off-peak periods or by providing a plant large enough to handle all flows.

5.2.2 CTP Building Sump (TK-2008)

Standard Design Criteria:

- Wet Wells (Great Lakes 40-5)
  - The design fill time and minimum pump cycle time shall be considered in sizing the wet well. The effective volume of the wet well shall be based on the design average flow determined in accordance with Paragraph 11.24 (identified below) and a filling time not to exceed 30 minutes unless the facility is designed to provide flow equalization. When the anticipated initial flow tributary to the pumping station is less than the design average flow, provisions should be made so that the fill time indicated is not exceeded for initial flows.
- Hydraulic Capacity (Great Lakes 10-4)
  - Paragraph 11.24: The design average flow is the average of the daily volumes to be received for a continuous 12-month period expressed as a volume per unit time. However, the design average flow for facilities having critical seasonal high hydraulic loading periods (e.g., recreational areas, campuses, industrial facilities) shall be based on the average of the daily volumes to be received during the seasonal period.

5.2.3 Outside Stormwater/Acid Sump

Standard Design Criteria:

- Wet Wells (Great Lakes 40-5)
  - The design fill time and minimum pump cycle time shall be considered in sizing the wet well. The effective volume of the wet well shall be based on the design average flow determined in accordance with Paragraph 11.24 (identified below) and a filling time not to exceed 30 minutes unless the facility is designed to provide flow equalization. When the anticipated initial flow tributary to the pumping station is less than the design average flow, provisions should be made so that the fill time indicated is not exceeded for initial flows.
- Hydraulic Capacity (Great Lakes 10-4)
  - Paragraph 11.24: The design average flow is the average of the daily volumes to be received for a continuous 12-month period expressed as a volume per unit time. However, the design average flow for facilities having critical seasonal high hydraulic loading periods (e.g., recreational areas, campuses, industrial facilities) shall be based on the average of the daily volumes to be received during the seasonal period.

5.2.4 Chrome Reduction Tanks (TK-2002A and TK-2002B)

Standard Design Criteria:

- Acid addition by pH control (lower to pH of approximately 2.5 S.U.) (Lipták 2035)
- Reducing agent addition by ORP control (nominal control point +250 mv) (Lipták 2035)
- Detention Time of approximately 10-15 minutes (Lipták 2035)

5.2.5 pH Adjustment Tanks (TK-2003A and TK-2003B)

Standard Design Criteria:

- Neutralize pH (range of 7.5-8.5) (Lipták 2036)
- Retention Time of at least 10 minutes (Lipták 2036)

5.2.6 Flash Mix Tanks (A and B)

Standard Design Criteria:

- Flash Mixing (Great Lakes 110-2)
  - Each chemical shall be mixed rapidly and uniformly with the wastewater flow stream. Where separate mixing basins are provided, they should be equipped with mechanical mixing devices. The detention period should be at least 30 seconds.

5.2.7 Flocculation Tanks (A and B)

Standard Design Criteria:

- Flocculation (Great Lakes 110-2)
  - The particle size of the precipitate formed by chemical treatment may be very small. Consideration should be given in the process design to the addition of synthetic polyelectrolytes to aid settling. The flocculation equipment should be adjustable in order to obtain optimum floc growth, control deposition of solids, and prevent floc destruction.

5.2.8 Lamella Clarifiers (CF-2001A and CF-2001B)

Standard Design Criteria:

- Maximum Influent Values (Parkson 2)
  - Peak flow into the Lamella Clarifiers equal to or less than 900 US GPM and Total Suspended Solids equal to or less than 300 mg/L
- Intermediate Settling Tanks (Great Lakes 70-2)
  - Surface overflow rates for intermediate settling tanks following series units of fixed film reactor processes should not exceed 1,200 gallons per day per square foot [49 $m^3/(m^2 \cdot d)$] based on the design peak hourly flow. Higher surface settling rates to 1,500 gallons per day per square foot [61 $m^3/(m^2 \cdot d)$] based on the design peak hourly flow may be permitted if such rates are shown to have no adverse effects on subsequent treatment units.
- Liquid – Solids Separation (Great Lakes 110-2)
  - The velocity through pipes or conduits from flocculation basins to settling basins should not exceed 1.5 feet per second (0.5 m/s) in order to minimize floc destruction. Entrance works to settling basins should also be designed to minimize floc shear.

5.2.9 Continuous Backwash Filters (F-2001A and F-2001B)

Standard Design Criteria

- High Rate Effluent Filtration (Great Lakes 110-5 and 110-6)
  - Granular media filters may be used as an advanced treatment device for the removal of residual suspended solids from secondary effluents. Filters may be necessary where effluent concentrations of less than 20 mg/L of suspended solids and/or 1.0 mg/L of phosphorus must be achieved or to obtain adequate turbidity reduction for urban water reuse. A pre-treatment process such as chemical coagulation, flocculation and sedimentation, or other acceptable process should precede the filter units where effluent suspended solids requirements are less than 10 mg/L.
  - Filtration rates shall not exceed 5 gpm/sq ft [3.40 $L/(m^2 \cdot s)$] based on the design peak hourly flow rate applied to the filter units. The expected design maximum suspended solids loading to the filter should also be considered in determining the necessary filter area.

  - Total filter area shall be provided in two or more units, and the filtration rate shall be calculated on the total available filter area with one unit out of service.
- If used for solids removal only, the moving bed filters media turnover rates range from 305 to 460 mm/h or four to six turnovers per day (Design 13-84)

5.2.10 Former Final pH Adjustment Tank (TK-2004)

The Former Final pH Adjustment Tank is used for sampling only; the tank is not utilized to perform pH adjustment. As such, there are no mixing or detention time requirements.

5.3 Major Supporting Equipment

5.3.1 Sludge Holding Tank (TK-2005)

Standard Design Criteria:

- Mechanical Dewatering Facilities (Great Lakes 80-20)
  - Provision shall be made to maintain sufficient continuity of services so that sludge may be dewatered without accumulation beyond storage capacity. The number of vacuum filters, centrifuges, filter presses, belt filters, other mechanical dewatering facilities, or combinations thereof should be sufficient to dewater the sludge produced with the largest unit out of service. Unless other standby wet sludge facilities are available, adequate storage facilities of at least four days production volume, in addition to any other sludge storage needs, shall be provided. Documentation shall be submitted justifying the basis of design of mechanical dewatering facilities.

5.3.2 Filter Press (FP-2001)

Standard Design Criteria:

- Mechanical Dewatering Facilities (Great Lakes 80-20)
  - Provision shall be made to maintain sufficient continuity of services so that sludge may be dewatered without accumulation beyond storage capacity. The number of vacuum filters, centrifuges, filter presses, belt filters, other mechanical dewatering facilities, or combinations thereof should be sufficient to dewater the sludge produced with the largest unit out of service. Unless other standby wet sludge facilities are available, adequate storage facilities of at least four days production volume, in addition to any other sludge storage needs, shall be provided. Documentation shall be submitted justifying the basis of design of mechanical dewatering facilities.

5.4 Operating Review

The operating data review, which follows, is separated into two sections: General Operating Data Review and Major Equipment Data Review. The general review section concentrates on the plant influent and effluent data, while the major equipment review analyzes data at specific steps within the treatment process. The basis of the data is as follows:

- General Operating Data Review Section: Plant flow values are based on NPDES DMR data. Influent, and effluent analytical values are based on ALS sampling data over time period 11/3/2021 to 11/12/2021.
- Major Equipment Operating Review Section: Values are based on U. S. Steel provided performance data (10-min averages) over time period 11/3/2021 to 11/12/2021.

5.4.1 General Operating Data Review

Tables 5.1 and 5.2 below summarize the overall percent removal achieved by treatment Train A and B for permit parameters considered as targeted contaminants for removal. The calculation of overall percent removal utilizes EQ Tank Effluent data as representative of plant influent concentrations and Sand Effluent data as representative of plant effluent concentrations. During the analyzed time period, 11/3/2021 to 11/12/2021, there were no permit violations.

General operating data review observations include the following:

- Treatment Trains A and B are ≥98% effective in removing Total Chromium and Hexavalent Chromium.
- Treatment Trains A and B are effective (≥86%) in the removal of Lead and Copper.
- Cadmium in the system influent and effluent was also analyzed for this time period was generally below detection limits in both the system influent and effluent.

Table 5.1 Train A – Overall Percent Removal

Parameter	Date	Effluent Concentration (mg/L)	Overall Percent Removal
Total Chromium	11/3/2021	0.276	98%
	11/8/2021	0.210	100%
	11/9/2021	0.260	100%
Hex. Chromium	11/3/2021	0.000031	100%
	11/8/2021	0.000142	100%
	11/9/2021	0.000180	100%
Lead	11/3/2021	0.00058	86%
	11/8/2021	<0.000148	99%
	11/9/2021	0.000234	98%
Copper	11/3/2021	0.00782	96%
	11/8/2021	0.00541	100%
	11/9/2021	0.00721	99%

Qualifiers:
(<):Analyzed but not detected above the MDL.

Table 5.2 Train B – Overall Percent Removal			
Parameter	**Date**	**Effluent Concentration (mg/L)**	**Overall Percent Removal**
Total Chromium	11/5/2021	0.129	100%
	11/11/2021	0.375	100%
	11/12/2021	0.342	100%
Hex. Chromium	11/5/2021	0.000374	100%
	11/11/2021	0.000188	100%
	11/12/2021	0.000033	100%
Lead	11/5/2021	<0.000148	98%
	11/11/2021	0.000328	98%
	11/12/2021	0.000283	99%
Copper	11/5/2021	0.00123	100%
	11/11/2021	0.01460	99%
	11/12/2021	0.01540	99%
Qualifiers: (<):Analyzed but not detected above the MDL.			

5.4.2 Major Process Equipment Operating Review

The following subsections utilize U. S. Steel provided performance data to evaluate major CTP equipment.

5.4.2.1 Chrome Reduction Tanks

Table 5.3 presented below compares EQ Tank Influent and Chrome Reduction Tank ORP and pH values. This comparison incudes the average, minimum, and maximum of the pH and ORP 10-min averages over the time period 11/3/2021 to 11/12/2021.

Table 5.3 Chrome Reduction Tanks – Performance Data								
	TRAIN A				**TRAIN B**			
	EQ Tank Influent		**Chrome Reduction Tank A**		**EQ Tank Influent**		**Chrome Reduction Tank B**	
	ORP (mV)	**pH (S.U.)**	**ORP (mV)**	**pH (S.U.)**	**ORP (mV)**	**pH (S.U.)**	**ORP (mV)**	**pH (S.U.)**
Average	475	5.15	181	2.40	501	4.38	148	2.41
Minimum	374	2.83	153	2.34	500	2.69	111	2.25
Maximum	501	7.92	209	2.47	501	6.54	177	2.62

Performance data review observations include:

- The optimal pH range in the Chrome Reduction Tanks is approximately 2.5 S.U. Treatment Trains A and B operate within close proximity of this range.
- The optimal ORP range in the Chrome Reduction Tanks is approximately 250 mV. Treatment Trains A and B operate below this range.

5.4.2.2 pH Adjustment Tanks

The following table provides a summary of the pH Adjustment Tank effluent pH data. This summary includes the average, minimum, and maximum of the effluent pH 10-min averages over the time period 11/3/2021 to 11/12/2021.

Table 5.4 pH Adjustment Tanks – Performance Data		
	TRAIN A	TRAIN B
	Effluent pH (S.U.)	Effluent pH (S.U.)
Average	8.14	8.02
Minimum	7.26	3.48
Maximum	8.77	8.62

Performance data review observations include:

- The optimal pH range in the pH Adjustment Tanks is between 7.8 and 8.5 S.U. On average (most of the time), Treatment Trains A and B pH are within this range.
- The minimum pH value of 3.48 S.U. (far out of optimal range) identified for Treatment Train B is indicative of a chemical feed control issue. The maximum caustic pump speed value of 99.62% for Treatment Train B in Section 5.4.2.5. further confirms this control issue.

5.4.2.3 Lamella Clarifiers

The following table provides a summary of the Lamella Clarifiers effluent turbidity data. This summary includes the average, minimum, and maximum of the effluent turbidity 10-min averages over the time period 11/3/2021 to 11/12/2021.

Table 5.5 Lamella Clarifiers – Performance Data						
	TRAIN A			TRAIN B		
	Effluent Turbidity A (NTU)	Effluent Turbidity A1 (NTU)	Effluent Turbidity A2 (NTU)	Effluent Turbidity B (NTU)	Effluent Turbidity B1 (NTU)	Effluent Turbidity B2 (NTU)
Average	0.83	0.73	0.64	0.86	0.67	1.16
Minimum	0.29	0.16	0.15	0.35	0.09	0.16
Maximum	14.73	16.04	17.81	18.01	17.08	71.19

Performance data review observations include:

- The effluent turbidity for Treatment Trains A and B is less than 2 NTU on average.
- The maximum effluent turbidity for both Treatment Trains is above 15 NTU, which appears to correspond with the startup of the Lamella Clarifiers. During startup, the flow increases from 0 to 200 gpm causing the settled solids to resuspend temporarily, before settling again (less than 10 minutes).

5.4.2.4 Continuous Backwash Filters

The following table provides a summary of the Continuous Backwash Filters influent flow data and flux rates. The flux rate is calculated based on the total flow over the area of the filter (filter area is 92 sq. ft per unit). The summary includes daily maximum Greenbelt II flow data as well as corresponding EQ Tank Transfer Pump flow data over the time period 11/3/2021 to 11/12/2021.

Table 5.6 Continuous Backwash Filters – Performance Data								
	TRAIN A				TRAIN B			
Date	GBII Max SW Flow (gpm)	EQ Tank Transfer Pump Flow (gpm)	Total Flow Entering Dynasand (gpm)	Flux Rate (gpm/ ft^2)	GBII Max SW Flow (gpm)	EQ Tank Transfer Pump Flow (gpm)	Total Flow Entering Dynasand (gpm)	Flux Rate (gpm/ ft^2)
11/3/2021	208.58	200.05	408.63	4.44				
11/4/2021	208.66	193.38	402.04	4.37				
11/5/2021					208.65	229.97	438.62	4.77
11/8/2021	210.96	119.96	330.92	3.60				
11/9/2021	183.47	129.93	313.40	3.41				
11/11/2021					212.18	1.00	213.18	2.32
11/12/2021					211.22	140.01	351.23	3.82

Notes:
(GBII): Greenbelt II
(SW): Stormwater

Performance data review observations include:

- It assumed that the Greenbelt II flow was not impacted by precipitation. During this time period, the Gary/Chicago International Airport weather station did not record any precipitation.
- As per Section 5.2.9, high rate effluent filtration rates shall not exceed a flux of 5 gpm/sq ft. Treatment Trains A and B flux rates do not exceed 5 gpm/sq ft during the analyzed time period.
- Table 3.1 indicates the manufacturer's design flow as 250 gpm. Even though this design flow rate is exceeded when both the EQ Tank Transfer Pumps and Greenbelt II pumps are pumping simultaneously, as stated above the Standard Design Criteria flux rate is not exceeded.

5.4.2.5 Chemical Equipment – Feed Systems

The following table provides a summary of the Chemical Feed System pump speed data. This summary includes the average, minimum, and maximum of the pump speed 10-min averages over the time period 11/3/2021 to 11/12/2021.

Table 5.7 Chemical Equipment – Performance Data									
	TRAIN A					TRAIN B			
	Caustic Pump Speed (%)	Sodium Bisulfite Pump Speed (%)	Sulfuric Acid Pump Speed (%)	Polymer Pump Speed (%)	Coagulant Pump Speed (%)	Caustic Pump Speed (%)	Sodium Bisulfite Pump Speed (%)	Polymer Pump Speed (%)	Coagulant Pump Speed (%)
Average	25.45	15.43	12.08	14.24	8.79	30.77	16.14	16.03	9.20
Minimum	0.30	0.02	0.07	0.01	0.01	6.19	0.91	0.68	0.46
Maximum	69.20	28.00	32.90	50.05	16.00	99.62	25.01	55.58	14.29

Performance data review observations include:

- Typically, chemical feed pumps are designed to operate between 30-70% of their design capacity.
- All chemical feed pumps for Treatment Trains A and B are operating at the low end of their operating range.

- As indicated previously in Section 5.4.2.2, the pH value of pH Adjustment Tank B was outside of the optimal range. This pH value corresponded to the Caustic Feed Pump operating at 99.62%, which suggests the pH control loop for the caustic pump became unstable.

6. OPERATIONS, MONITORING, AND CONTROLS EVALUATION

6.1 Operator Daily Activities

The operator daily activities include the following:

- Inspect all CTP equipment, piping, and instruments, and make note of all maintenance items requiring attention;
- Record abnormal conditions;
- Complete the CTP Log Sheet (Form 7093-03);
- Complete the CTP Filter Press Log Sheet (Form 7093-15);
- Perform a comparison bench test for pH every 2 hours at Chrome Reduction Tank (TK-2002A or TK-2002B);
- Perform a comparison bench test for pH every 2 hours at pH Adjustment Tank (TK-2003A or TK-2003B);
- Perform a daily hexavalent chromium test on a sample from the CTP Building Sump (TK-2008);
- Make up the polymer; and,
- Operate the Filter Press (FP-2001).

Ramboll identified the following deficiencies based on a review of the operator daily activities and related forms.

CTP Daily Activity Deficiencies:

- None.

CTP Log Sheet (Form 7093-03) Deficiencies:

- The operators are using the blank area next to polymer day tank boxes for notes and observations. Revise the form to change this area to a formal note section.
- Add a daily check on system equipment, such as: Mixer running? Y/N.
- Settling quality data, such as SSV, are not being collected. If any such data are collected, this should be noted. If the operator is adjusting chemicals, that adjustment should be documented. If the chemical vendor sets the chemical dosage, they should provide documentation to U. S. Steel of any actions taken. A test similar to the one outlined in SOP NSCS-M-P-7091-04 for settleable solids analysis should be performed if no such data are being collected.
- Operators should record the settings of the chemical feed system. Either the operator or chemical vendor should run a calibration column on the chemical feed daily and document it.

CTP Filter Press Log Sheet (Form 7093-15) Deficiencies:

- Ramboll suggests adding a small “Notes” column or a damp option in-between wet and dry, since the operators are currently using this notation.
- Only include the press drop and start information. If this data are necessary to include on Form 7093-03, include a dedicated area to do so. Operators are currently using the “Anomalies” section of Form 7093-03 to record these actions.

6.2 Online Monitoring

The table below presents some of the instruments currently installed at the CTP.

Table 6.1 CTP Online Monitoring

Equipment	Variable	Process Control	Units
ETLM/ETCM transfer pipe before Chrome Equalization Tank (TK-2001)	pH	Monitor influent pH, ORP and conductivity to predict treatment requirements	S.U.
	ORP		mV
	Conductivity		mS/cm
Chrome Equalization Tank (TK-2001)	Water level	Monitor volume in tank	Volume as %
	Level Switch	Indicates high level in tank	N/A
Chrome Reduction Tanks (TK-2002A and TK-2002B)	Flow (1 per train)	Monitor influent flow and controls coagulant and polymer feed rates	gpm
	pH (2 per train)	Monitor effluent pH and controls acid feed rate	S.U.
	ORP (2 per train)	Monitor effluent ORP and controls bisulfite feed rate	mV
pH Adjustment Tanks (TK-2003A and TK-2003B)	pH (2 per train)	Monitor effluent pH and controls acid and caustic feed rates	S.U.
Lamella Clarifiers (CF-2001A and CF-2001B)	Turbidity (4 per train)	Monitor effluent turbidity and alerts operator of potential high TSS in effluent	NTU
Continuous Backwash Filters (F-2001A and F-2001B)	pH (2 per train)	Monitor effluent pH and alarms and activates diverts effluent to recycle if pH is out of range	S.U.

6.3 Critical Alarms

Critical alarms indicate situations that are highly detrimental to the treatment process and can significantly affect the treated effluent; alarms may or may not include equipment shutdowns. Critical alarms at the CTP have operator adjustable setpoints. The critical alarms identified at the CTP are outlined in Table 6.2 below.

Table 6.2 CTP Critical Alarms

Equipment	Alarm	Control Variable	Result
Chrome Reduction Tanks (TK-2002A and TK-2002B)	HIGH HIGH LOW LOW	pH	After 2 minutes, system automatically start RECYCLE mode
	HIGH HIGH LOW LOW	ORP	
pH Adjustment Tanks (TK-2003A and TK-2003B)	HIGH HIGH LOW LOW	pH	After 2 minutes, system automatically start RECYCLE mode
Lamella Clarifiers (CF-2001A and CF-2001B)	HIGH HIGH	Turbidity	After 5 minutes, computer will SHUTDOWN the train

6.4 Operator Troubleshooting Activities

Document NSCS-M-P-7093-02-48 provides detailed information on how to address a deviation from the acceptable ranges of various control variables. It specifically highlights the process name, control system, method of control, required frequency of observation, possible sources for problems, possible strategies for addressing along with reference SOP documents for these variables.

7. MAINTENANCE AND RELIABILITY EVALUATION

Ramboll inspected the CTP equipment during a site walkthrough and had conversations with U. S. Steel Maintenance personnel. U. S. Steel performs various preventative maintenance activities at the CTP, as identified below, and has not had any permit violations due to equipment malfunction.

7.1 Key Preventative Maintenance Activities

U. S. Steel's Preventative Maintenance Program Plan (PMPP) identifies several maintenance activities which are regularized to ensure reliable operation. U. S. Steel Maintenance personnel conduct the following inspections as part of this plan:

- Daily
  - Test Chrome in CTP Trench
- Quarterly Inspections
  - Mixer motors – thermal checks
  - CTP Trench
  - Key equipment – lubrication
- Semi-Annual Inspections
  - Continuous Backwash Filters (F-2001A and F-2001B)
    - Check filter media level and maintain level as required
  - Filter Press (FP-2001)
  - Chrome Equalization Tank (TK-2001)
  - Chrome Reduction Tanks (TK-2002A and TK-2002B)
  - pH Adjustment Tanks (TK-2003A and TK-2003B)
  - Former Final pH Adjustment Tank (TK-2004)
  - Sludge Holding Tank (TK-2005)
  - ETLM/ETCM transfer piping
  - Stormwater Acid Trench
  - Chrome Line Evaporators
- Annual Inspections
  - Lamella Clarifiers (CF-2001A and CF-2001B)
  - Continuous Backwash Filters (F-2001A and F-2001B)
  - CTP Building Sump (TK-2008)
- Non-Destructive Testing (every five years)
  - Lamella Clarifiers (CF-2001A and CF-2001B)
  - Chrome Equalization Tank (TK-2001)
- Non-Destructive Testing (every ten years)
  - Sludge Holding Tank (TK-2005)
  - CTP Trench piping
  - ETLM/ETCM transfer piping

The facility's PMPP Plan also includes the following schedule for the calibration of key equipment:

- Monthly
  - Chrome Equalization Tank (TK-2001)
    - Inlet ORP meter
    - Inlet pH meter
    - Inlet Conductivity meter

- Semimonthly
    - Chrome Reduction Tanks (TK-2002A and TK-2002B)
        - ORP meter
        - pH meter
    - pH Adjustment Tanks (TK-2003A and TK-2003B)
        - pH meter
    - Lamella Clarifiers (CF-2001A and CF-2001B)
        - pH meter
- Quarterly
    - Lamella Clarifiers (CF-2001A and CF-2001B)
        - Turbidity meters
    - ETLM/ETCM Sumps
        - Conductivity meters
    - CTP Building Sump (TK-2008)
        - Conductivity meter
        - Level control
- Annually
    - CTP Train A and B
        - Influent flow meters
    - Greenbelt II
        - Flow meter
    - CTP Building Sump (TK-2008)
        - Flow meter
    - Chrome wastewater transfer pipes
        - Flow meters
- Yearly
    - Chrome Equalization Tank (TK-2001)
        - Level transmitter
    - Sulfuric Acid Tank
        - Level transmitter
    - Sodium Hydroxide Tank
        - Level transmitter
    - Sodium Bisulfite Tank
        - Level transmitters

Based on observations and discussions with U. S. Steel Maintenance personnel, all process monitoring instruments are inspected and calibrated every two weeks.

7.2 Planned Maintenance Activities

Some maintenance activities are performed at irregular intervals and are scheduled in advance, including:

- Cleaning of Continuous Backwash Filters A and B; and,
- Flushing of chemical feed lines.

7.3 Reliability Concerns

Based on Ramboll observations and conversations with operations personnel, potential reliability concerns were identified. U. S. Steel is aware of the items listed in the table below and is actively monitoring/addressing these issues.

Table 7.1 CTP Equipment Reliability Concerns

Component	Concern	Potential Impact on Treatment Process
Continuous Backwash Filters (F-2001A and F-2001B)		
Filter Media	Media clogging	Poor removal of solids; discoloration
Train B Low Level Switch	Not functioning	Air wash system continues to operate when no influent to sand filters wasting air.
Chemical Feed Pumps		
Sulfuric Acid Dosing Pumps (P-2009A and P-2009B)	Control/capacity issues	If the metering pumps are operating outside the design range (typically between 30 to 70% of operating pump capacity), the chemical feed rates can become difficult to control and/or unstable.
Sodium Bisulfite Feed Pumps (P-2005A and P-2205B)		
Caustic Feed Pumps (P-2004A and P-2004B)		
Coagulant Dosing Pumps (P-2015A and P-2015B)		
Polymer Metering Pumps (P-2011A and P-2011B)		

Prior to this evaluation, U. S. Steel personnel performed several other activities and upgrades to address past reliability concerns, including:

- Rebuilt Equalization Tank Transfer Pumps (P-2001A and P-2001B);
- Installed six turbidity meters on the Lamella Clarifier effluents; and,
- Installed redundant water quality monitoring probes.

8. EVALUATION SUMMARY

During the analyzed period, 11/3/2021 to 11/12/2021, the CTP was ≥98% effective in removing Total Chromium and Hexavalent Chromium.

In general, the Chemical Metering Pumps operated below 30 percent of their capacity, which potentially can impact chemical feed controls. At least one incidence of chemical control instability was observed with the caustic feed pumps, which resulted in the pH in the pH Adjustment Tank B operating out of the optimal pH range. However, no permit violations were observed.

The Continuous Backwash Filters operated above the manufacturer's design average flow of 250 gpm when the EQ Tank Transfer Pump and Greenbelt Pump discharged to the filters. However, the Standard Design Criteria flux rate is not exceeded.

9. RECOMMENDATIONS

9.1 Operating Philosophy Improvements

Several general improvements pertaining primarily to the administration activities should be implemented. These include:

- Review and revise Key Performance Indicators (KPIs).
- Revise log sheets and data collection to improve tracking of KPIs.
- Reaffirm personnel roles and responsibilities associated with treatment plant operations.
- Review and update Operating Manuals and Procedures to ensure consistent operating objectives and current process configurations.
- Review and update Preventative Maintenance Program Plan (PMPP) and improve tracking work orders in Oracle for non-routine maintenance.
- Review effectiveness of the personnel training program to identify potential improvements.

9.2 CTP Improvements

The following are CTP-specific recommendations:

- Return Continuous Backwash Filters to OEM recommended condition.
- Install blinds or disconnect the lines that enter top of Chrome Reduction Tanks.
- Perform Engineering Feasibility Assessment on Effluent Flow Monitoring.
- Perform Engineering Assessment on Chemical Metering Pump Capacity and Control.
- Install continuous monitoring (pH, ORP, conductivity) on the influent to two treatment trains.
- Perform Engineering Assessment of Greenbelt II flow and distribution to the Continuous Backwash Filters.

APPENDIX 1
CTP PROCESS DESIGN TABLES

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
			CURRENT INFLUENT & EFFLUENT PARAMETERS			
TOTAL INFLUENT STREAM CHROME REDUCTION TANK A				From 11/3/2021 to 11/12/2021		
Influent flow	gpm	250	450	160	280	Des. Avg. based DSF design flow; Des. Peak based on Lamella Peak Flow
TSS	mg/L	NA	NA	309	829	
Oil and Grease	mg/L	NA	NA	NA	NA	
Total chromium	mg/L	NA	NA	84	184	
Hex. chromium	mg/L	NA	NA	22	35	
Zinc	mg/L	NA	NA	0.0175	0.0396	
Lead	mg/L	NA	NA	0.0114	0.0195	
Nickel	mg/L	NA	NA	NA	NA	
Cadmium	mg/L	NA	NA	Non-detect	NA	
Copper	mg/L	NA	NA	0.77	1.57	
Silver	ug/L	NA	NA	NA	NA	
Total Cyanide	mg/L	NA	NA	0.002164	0.00272	
Napthalene	mg/L	NA	NA	NA	NA	
Tetrachloroethylene	mg/L	NA	NA	NA	NA	
Total Toxic Organics	mg/L	NA	NA	NA	NA	
Fluoride	mg/L	NA	NA	0.48	0.87	
pH	S.U.	NA	NA	2.8 - 7.9	NA	Current Avg. and Peak based on EQ Tank Influent
ORP	mV	NA	NA	374 - 501	NA	Current Avg. and Peak based on EQ Tank Influent
Conductivity	uS/cm	NA	NA	0.18 - 0.42	NA	Current Avg. and Peak based on EQ Tank Influent

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TOTAL EFFLUENT STREAM OUTFALL 204						
TSS	mg/L	NA	NA	2.9	9	
Oil and Grease	mg/L	NA	Report	0	2.3	
Total chromium	mg/L	NA	NA	0.14	0.2	
Hex. chromium	mg/L	Report	Report	0.00012	0.00014	
Zinc	mg/L	NA	NA	0.002	0.007	
Lead	mg/L	0.038	0.066	Non-detect	NA	
Nickel	mg/L	0.21	0.36	0.0015	NA	
Cadmium	mg/L	0.0077	0.013	0	0.00011	
Copper	mg/L	0.030	0.052	NA	NA	
Silver	ug/L	0.076	0.13	0.0000044	NA	
Total Cyanide	mg/L	0.0075	0.013	Non-detect	Non-detect	
Napthalene	mg/L	NA	NA	NA	NA	
Tetrachloroethylene	mg/L	NA	NA	NA	NA	
Total Toxic Organics	mg/L	NA	NA	NA	NA	
Fluoride	mg/L	NA	NA	NA	NA	
pH	S.U.	6 to 9	6 to 9	8	8.2	
ORP	mV	NA	NA	NA	NA	
Conductivity	uS/cm	NA	NA	NA	NA	

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2001 CHROME EQUALIZATION TANK						
Diameter	ft	24.62	24.62	24.62	24.62	P & ID Drawing A744-0315
Height	ft	17.33	17.33	17.33	17.33	P & ID Drawing A744-0315; SSH (Sea Surface Height)
Capacity	ft^3	8,250	8,250	8,250	8,250	
	gal	60,000	60,000	60,000	60,000	P & ID Drawing A744-0315
Hydraulic retention time (HRT)	min	240	133	375	214	
	hr	4	2.2	6.3	3.6	
KEY PERFORMANCE INDICATORS						
Hydraulic retention time (HRT)	min	Varies	Varies	Varies	Varies	

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2002A CHROME REDUCTION TANK A						
CHEMICAL ADDITION						
Sulfuric acid (95%) dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	816	816	NA	NA	P & ID Drawing A744-0331
Sodium bisulfite (40%) dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	1,752	1,752	NA	NA	
MIX TANK						
Diameter	ft	10.0	10.0	10.0	10.0	P & ID Drawing A744-0316
Height	ft	19.0	19.0	19.0	19.0	P & ID Drawing A744-0316; SSH (Sea Surface Height)
Capacity	ft^3	1,492	1,492	1,492	1,492	
	gal	11,090	11,090	11,090	11,090	P & ID Drawing A744-0316
Hydraulic retention time (HRT)	min	44	25	69	40	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0316
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0316
	hp/1000gal	0.135	0.135	0.135	0.135	
KEY PERFORMANCE INDICATORS						
pH (effluent)	S.U.	2.5	2.5	2.4	2.5	
ORP (effluent)	mV	250	250	181	209	

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2003A PH ADJUSTMENT TANK A						
CHEMICAL ADDITION						
Sodium hydroxide (50%) dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	816	816	NA	NA	P & ID Drawing A744-0328
MIX TANK						
Diameter	ft	7.0	7.0	7.0	7.0	P & ID Drawing A744-0316
Height	ft	19.0	19.0	19.0	19.0	P & ID Drawing A744-0316; SSH (Sea Surface Height)
Capacity	ft^3	731	731	731	731	
	gal	5,430	5,430	5,430	5,430	P & ID Drawing A744-0316
Hydraulic retention time (HRT)	min	22	12	34	19	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0316
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0316
	hp/1000gal	0.276	0.276	0.276	0.276	
KEY PERFORMANCE INDICATORS						
pH (effluent)	S.U.	8	8	8	8	
FLASH MIX TANK A						
CHEMICAL ADDITION						
Coagulant dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	168	168	NA	NA	P & ID Drawing A744-0334
MIX TANK						
Capacity	gal	140	140	140	140	P & ID Drawing A744-0317
Hydraulic retention time (HRT)	min	0.56	0.31	0.88	0.50	
	sec	34	19	53	30	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0316
	hp	0.5	0.5	0.5	0.5	P & ID Drawing A744-0316
	hp/1000gal	3.571	3.571	3.571	3.571	

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
FLOC TANK A						
CHEMICAL ADDITION						
Polymer Solution dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	1,752	1,752	NA	NA	P & ID Drawing A744-0330
MIX TANK						
Capacity	gal	900	900	900	900	P & ID Drawing A744-0317
Hydraulic retention time (HRT)	min	3.60	2.00	5.63	3.21	
	sec	216	120	338	193	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0317
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0317
	hp/1000gal	1.667	1.667	1.667	1.667	
CF-2001A LAMELLA CLARIFIER A						
Effective plate area	ft^2	1,135	1,135	1,135	1,135	P & ID Drawing A744-0317
Hydraulic loading rate	gpm/ft^2	250	450	160	280	
KEY PERFORMANCE INDICATORS						
Turbidity	NTU	3	3	0.73	17.81	
F-2001A CONTINUOUS BACKWASH FILTER A						
Total filter area	ft^2	92	92	92	92	P & ID Drawing A744-0318
Compressed air (CA) usage	cfm @ 35 psig	13	13	13	13	P & ID Drawing A744-0318
Backwash rate	gpm	NA	NA	NA	NA	
Hydraulic loading rate	gpm/ft^2	2.72	4.89	1.74	3.04	
KEY PERFORMANCE INDICATORS						
Turbidity	NTU	NA	NA	NA	NA	

TREATMENT TRAIN A

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2004 FINAL PH ADJUSTMENT TANK						
Diameter	ft	6.0	6.0	6.0	6.0	P & ID Drawing A744-0323
Height	ft	8.0	8.0	8.0	8.0	P & ID Drawing A744-0323; SSH (Sea Surface Height)
Capacity	ft^3	226	226	226	226	
	gal	1,640	1,641	1,642	1,643	P & ID Drawing A744-0323
Hydraulic retention time (HRT)	min	7	4	10	6	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0323
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0323
	hp/1000gal	0.915	0.914	NA	NA	Mixer currently not in use
TK-2005 SLUDGE HOLDING TANK						
Diameter	ft	8.0	8.0	8.0	8.0	P & ID Drawing A744-0324
Height	ft	13.3	13.3	13.3	13.3	P & ID Drawing A744-0324; SSH (Sea Surface Height)
Capacity	ft^3	670	670	670	670	
	gal	5,500	5,500	5,500	5,500	P & ID Drawing A744-0324
Hydraulic retention time (HRT)	min	NA	NA	NA	NA	
	hr	NA	NA	NA	NA	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0324
	hp	1	1	1	1	
	hp/1000gal	NA	NA	NA	NA	P & ID Drawing A744-0324
FP-2001 FILTER PRESS						
Filter feed pump flow	gpm	100	100	100	100	P & ID Drawing A744-0324
Filter feed pump pressure	tdh	231	231	231	231	P & ID Drawing A744-0324
Capacity	ft^3	30	30	30	30	P & ID Drawing A744-0324
Compressed air (CA) usage	scfm @ 60 psig minimum	25	25	25	25	P & ID Drawing A744-0324
Press time	hours	NA	NA	NA	NA	

TREATMENT TRAIN B

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
CURRENT INFLUENT & EFFLUENT PARAMETERS						
TOTAL INFLUENT STREAM CHROME REDUCTION TANK A				From 11/3/2021 to 11/12/2021		
Influent flow	gpm	250	450	158	250	Des. Avg. based DSF design flow; Des. Peak based on Lamella Peak Flow
TSS	mg/L	NA	NA	225	537	
Oil and Grease	mg/L	NA	NA	NA	NA	
Total chromium	mg/L	NA	NA	78	137	
Hex. chromium	mg/L	NA	NA	24	45	
Zinc	mg/L	NA	NA	0.021	0.053	
Lead	mg/L	NA	NA	0.0123	0.0214	
Nickel	mg/L	NA	NA	NA	NA	
Cadmium	mg/L	NA	NA	Non-detect	Non-detect	
Copper	mg/L	NA	NA	1.21	2.57	
Silver	mg/L	NA	NA	NA	NA	
Total Cyanide	mg/L	NA	NA	0.00298	0.00499	
Naphthalene	mg/L	NA	NA	NA	NA	
Tetrachloroethylene	mg/L	NA	NA	NA	NA	
Total Toxic Organics	mg/L	NA	NA	NA	NA	
Fluoride	mg/L	NA	NA	0.53	0.99	
pH	S.U.	NA	NA	2.25 - 2.62	NA	Current Avg. and Peak based on EQ Tank Influent
ORP	mV	NA	NA	111 - 177	NA	Current Avg. and Peak based on EQ Tank Influent
Conductivity	uS/cm	NA	NA	0.15 - 0.36	NA	Current Avg. and Peak based on EQ Tank Influent

TREATMENT TRAIN B

Latest Revision	
Date:	4-Jan-22
Revision:	1
Description:	FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TOTAL EFFLUENT STREAM OUTFALL 204						
TSS	mg/L	NA	NA	2.9	9	
Oil and Grease	mg/L	NA	Report	0	2.3	
Total chromium	mg/L	NA	NA	0.14	0.2	
Hex. chromium	mg/L	Report	Report	0.00012	0.00014	
Zinc	mg/L	NA	NA	0.002	0.007	
Lead	mg/L	0.038	0.066	Non-detect	NA	
Nickel	mg/L	0.21	0.36	0.0015	NA	
Cadmium	mg/L	0.0077	0.013	0	0.00011	
Copper	mg/L	0.030	0.052	NA	NA	
Silver	mg/L	0.076	0.13	0.0000044	NA	
Total Cyanide	mg/L	0.0075	0.013	Non-detect	Non-detect	
Naphthalene	mg/L	NA	NA	NA	NA	
Tetrachloroethylene	mg/L	NA	NA	NA	NA	
Total Toxic Organics	mg/L	NA	NA	NA	NA	
Fluoride	mg/L	NA	NA	NA	NA	
pH	S.U.	6 to 9	6 to 9	8	8.2	
ORP	mV	NA	NA	NA	NA	
Conductivity	uS/cm	NA	NA	NA	NA	

TREATMENT TRAIN B

Latest Revision	
Date:	4-Jan-22
Revision:	1
Description:	FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2001 CHROME EQUALIZATION TANK						
Diameter	ft	24.62	24.62	24.62	24.62	P & ID Drawing A744-0315
Height	ft	17.33	17.33	17.33	17.33	P & ID Drawing A744-0315; SSH (Sea Surface Height)
Capacity	ft^3	8,250	8,250	8,250	8,250	
	gal	60,000	60,000	60,000	60,000	P & ID Drawing A744-0315
Hydraulic retention time (HRT)	min	240	133	380	240	
	hr	4	2.2	6.3	4.0	
KEY PERFORMANCE INDICATORS						
Hydraulic retention time (HRT)	min	Varies	Varies	Varies	Varies	

TREATMENT TRAIN B

Latest Revision	
Date:	4-Jan-22
Revision:	1
Description:	FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2002B CHROME REDUCTION TANK B						
CHEMICAL ADDITION						
Sulfuric acid (95%) dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	816	816	NA	NA	P & ID Drawing A744-0331
Sodium bisulfite (40%) dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	1,752	1,752	NA	NA	
MIX TANK						
Diameter	ft	10.0	10.0	10.0	10.0	P & ID Drawing A744-0316
Height	ft	19.0	19.0	19.0	19.0	P & ID Drawing A744-0316; SSH (Sea Surface Height)
Capacity	ft^3	1,492	1,492	1,492	1,492	
	gal	11,090	11,090	11,090	11,090	P & ID Drawing A744-0316
Hydraulic retention time (HRT)	min	44	25	70	44	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0316
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0316
	hp/1000gal	0.135	0.135	0.135	0.135	
KEY PERFORMANCE INDICATORS						
pH (effluent)	S.U.	2.5	2.5	2.4	2.6	
ORP (effluent)	mV	250	250	148	177	

TREATMENT TRAIN B

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2003B PH ADJUSTMENT TANK B						
CHEMICAL ADDITION						
Sodium hydroxide (50%) dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	816	816	NA	NA	P & ID Drawing A744-0328
MIX TANK						
Diameter	ft	7.0	7.0	7.0	7.0	P & ID Drawing A744-0316
Height	ft	19.0	19.0	19.0	19.0	P & ID Drawing A744-0316; SSH (Sea Surface Height)
Capacity	ft^3	731	731	731	731	
	gal	5,430	5,430	5,430	5,430	P & ID Drawing A744-0316
Hydraulic retention time (HRT)	min	22	12	34	22	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0316
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0316
	hp/1000gal	0.276	0.276	0.276	0.276	
KEY PERFORMANCE INDICATORS						
pH (effluent)	S.U.	8	8	8	8	
FLASH MIX TANK B						
CHEMICAL ADDITION						
Coagulant dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	168	168	NA	NA	P & ID Drawing A744-0334
MIX TANK						
Capacity	gal	140	140	140	140	P & ID Drawing A744-0317
Hydraulic retention time (HRT)	min	0.56	0.31	0.89	0.56	
	sec	34	19	53	34	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0316
	hp	0.5	0.5	0.5	0.5	P & ID Drawing A744-0316
	hp/1000gal	3.571	3.571	3.571	3.571	

TREATMENT TRAIN B

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
FLOC TANK B						
CHEMICAL ADDITION						
Polymer Solution dose						
Minimum	gal/day	--	--	NA	NA	
Average	gal/day	--	--	NA	NA	
95 Percentile	gal/day	1,752	1,752	NA	NA	P & ID Drawing A744-0330
MIX TANK						
Capacity	gal	900	900	900	900	P & ID Drawing A744-0317
Hydraulic retention time (HRT)	min	3.60	2.00	5.70	3.60	
	sec	216	120	342	216	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0317
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0317
	hp/1000gal	1.667	1.667	1.667	1.667	
CF-2001B LAMELLA CLARIFIER B						
Effective plate area	ft^2	1,135	1,135	1,135	1,135	P & ID Drawing A744-0317
Hydraulic loading rate	gpm/ft^2	250	450	158	250	
KEY PERFORMANCE INDICATORS						
Turbidity	NTU	3	3			
F-2001A CONTINUOUS BACKWASH FILTER A						
Total filter area	ft^2	92	92	92	92	P & ID Drawing A744-0318
Compressed air (CA) usage	cfm @ 35 psig	13	13	13	13	P & ID Drawing A744-0318
Backwash rate	gpm	NA	NA	NA	NA	
Hydraulic loading rate	gpm/ft^2	2.72	4.89	1.72	2.72	
KEY PERFORMANCE INDICATORS						
Turbidity	NTU	NA	NA	0.90	71.19	

TREATMENT TRAIN B

Latest Revision
Date: 4-Jan-22
Revision: 1
Description: FINAL

ITEM	UNITS	DESIGN AVG.	DESIGN PEAK	CURRENT AVG.	CURRENT PEAK	COMMENTS
TK-2004 FINAL PH ADJUSTMENT TANK						
Diameter	ft	6.0	6.0	6.0	6.0	P & ID Drawing A744-0323
Height	ft	8.0	8.0	8.0	8.0	P & ID Drawing A744-0323; SSH (Sea Surface Height)
Capacity	ft^3	226	226	226	226	
	gal	1,640	1,641	1,642	1,643	P & ID Drawing A744-0323
Hydraulic retention time (HRT)	min	7	4	10	7	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0323
	hp	1.5	1.5	1.5	1.5	P & ID Drawing A744-0323
	hp/1000gal	0.915	0.914	NA	NA	Mixer currently not in use
TK-2005 SLUDGE HOLDING TANK						
Diameter	ft	8.0	8.0	8.0	8.0	P & ID Drawing A744-0324
Height	ft	13.3	13.3	13.3	13.3	P & ID Drawing A744-0324; SSH (Sea Surface Height)
Capacity	ft^3	670	670	670	670	
	gal	5,500	5,500	5,500	5,500	P & ID Drawing A744-0324
Hydraulic retention time (HRT)	min	NA	NA	NA	NA	
	hr	NA	NA	NA	NA	
Mixing provided	--	Mixer	Mixer	Mixer	Mixer	P & ID Drawing A744-0324
	hp	1	1	1	1	
	hp/1000gal	NA	NA	NA	NA	P & ID Drawing A744-0324
FP-2001 FILTER PRESS						
Filter feed pump flow	gpm	100	100	100	100	P & ID Drawing A744-0324
Filter feed pump pressure	tdh	231	231	231	231	P & ID Drawing A744-0324
Capacity	ft^3	30	30	30	30	P & ID Drawing A744-0324
Compressed air (CA) usage	scfm @ 60 psig minimum	25	25	25	25	P & ID Drawing A744-0324
Press time	hours	NA	NA	NA	NA	

APPENDIX 2
CHROME PLANT PROCESS FLOW DIAGRAM

SAVED: 11/30/21 11:19 AM

L:\ACTIVE PROJECTS\US STEEL\MIDWEST\2021 ENGINEERING EVALS\PRETREATMENT EVALUATION\CAD\USS MIDWEST CTP PFD.DWG

TK-2001 CHROME EQUALIZATION TANK

NUMBER OF UNITS		1
CAPACITY, gal ea.		60,000
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	VARIES
	MAX FLOW	.

TK-2008 CTP BUILDING SUMP

NUMBER OF UNITS		1
CAPACITY, gal ea.		1615
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	VARIES
	MAX FLOW	.

OUTSIDE STORMWATER / ACID SUMP

NUMBER OF UNITS		1
CAPACITY, gal ea.		N/A
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	VARIES
	MAX FLOW	.

TK-2002A CHROME REDUCTION TANK A

NUMBER OF UNITS		1
CAPACITY, gal ea.		11,090
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	55
	MAX FLOW	.

TK-2002B CHROME REDUCTION TANK B

NUMBER OF UNITS		1
CAPACITY, gal ea.		11,090
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	55
	MAX FLOW	.

TK-2003A pH ADJUSTMENT TANK A

NUMBER OF UNITS		1
CAPACITY, gal ea.		5,430
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	27
	MAX FLOW	.

TK-2003B pH ADJUSTMENT TANK B

NUMBER OF UNITS		1
CAPACITY, gal ea.		5,430
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	27
	MAX FLOW	.

FLASH MIX TANK A

NUMBER OF UNITS		1
CAPACITY, gal ea.		140
DETENTION TIME, sec	MIN FLOW	.
	AVG FLOW	42
	MAX FLOW	.

FLASH MIX TANK B

NUMBER OF UNITS		1
CAPACITY, gal ea.		140
DETENTION TIME, sec	MIN FLOW	.
	AVG FLOW	42
	MAX FLOW	.

FLOCCULATION TANK A

NUMBER OF UNITS		1
CAPACITY, gal ea.		900
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	4.5
	MAX FLOW	.

FLOCCULATION TANK B

NUMBER OF UNITS		1
CAPACITY, gal ea.		900
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	4.5
	MAX FLOW	.

CF-2001A LAMELLA CLARIFIER A

NUMBER OF UNITS		1
EFFECTIVE SURFACE AREA ft^2		1.135
HYDRAULIC LOADING RATE gpm/ft^2	MIN	.
	AVG	0.18
	MAX	.

CF-2001B LAMELLA CLARIFIER B

NUMBER OF UNITS		1
EFFECTIVE SURFACE AREA ft^2		1.135
HYDRAULIC LOADING RATE gpm/ft^2	MIN	.
	AVG	0.18
	MAX	.

F-2001A CONTINUOUS BACKWASH FILTER A

NUMBER OF UNITS		1
SURFACE AREA ft^2		92
HYDRAULIC LOADING RATE gpm/ft^2	MIN	.
	AVG	2.2
	MAX	.

F-2001B CONTINUOUS BACKWASH FILTER B

NUMBER OF UNITS		1
SURFACE AREA ft^2		92
HYDRAULIC LOADING RATE gpm/ft^2	MIN	.
	AVG	2.2
	MAX	.

FORMER FINAL PH ADJUSTMENT TANK

NUMBER OF UNITS		1
CAPACITY, gal ea.		1,640
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	0.1
	MAX FLOW	.

TK-2005 SLUDGE HOLDING TANK

NUMBER OF UNITS		1
CAPACITY, gal ea.		5,500
DETENTION TIME, min	MIN FLOW	.
	AVG FLOW	VARIES
	MAX FLOW	.

FP-2001 FILTER PRESS

NUMBER OF UNITS		1
CAPACITY, gal ea.		30 ft^3
HYDRAULIC LOADING RATE gpm/ft^2	MIN FLOW	.
	AVG FLOW	6
	MAX FLOW	.

CLIENT
UNITED STATES STEEL CORPORATION

NO.	DATE	REVISION	INT.
1	04JAN22	FINAL	LTE

DESIGNER / PROFESSIONAL ENGINEER RESPONSIBLE
DESIGNED BY TJP | PROJECT NO. 1690022867
CHECKED BY TJP | DATE 04JAN22
DRAWN BY W.JARRELL

RAMBOLL US CONSULTING, INC.

RAMBOLL

PROJECT
MIDWEST WASTEWATER TREATMENT EVALUATION
ADDRESS
6290 US-12, PORTAGE, IN 46368

SHEET DESCRIPTION
CHROME TREATMENT PLANT PROCESS FLOW DIAGRAM
DRAWING LOCATION

PFD-01

APPENDIX V
ENGINEERING EVALUATION – FINAL TREATMENT PLANT

Intended for
United States Steel Corporation

Document type
Evaluation Report

Date
January 2022

FINAL TREATMENT PLANT EVALUATION
U. S. STEEL MIDWEST PORTAGE, INDIANA

RAMBOLL Bright ideas. Sustainable change.

FINAL TREATMENT PLANT EVALUATION
U. S. STEEL MIDWEST PORTAGE, INDIANA

Project name	**U. S. Steel Midwest Engineering Evaluations**
Project no.	**1690022867**
Recipient	**Matt Story**
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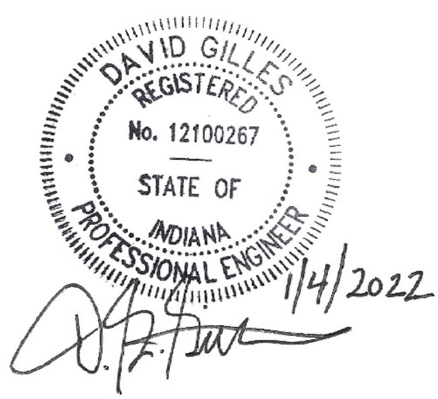

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TABLES

APPENDICES

1. EXECUTIVE SUMMARY

United States Steel (U. S. Steel) Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with Indiana Department of Environmental Management (IDEM), which requires U. S. Steel to evaluate the adequacy of the existing Final Treatment Plant (FTP) components and operations. The Agreed Order also stipulates that this evaluation must be certified by a Licensed Professional Engineer. Ramboll was contracted by U. S. Steel to develop and certify the Final Treatment Plant evaluation.

This report presents the details of the evaluation, which include a description of the treatment process, process unit sizes, equipment age and condition, operational, monitoring and control activities, plant maintenance and reliability, and a set of prioritized recommendations for implementation.

The FTP receives wastewater from all the mills and the Pretreatment Plant. The treatment process is primarily made up of flow equalization, oil separation and removal, pH augmentation to facilitate metals precipitation, and solids separation and removal. Based on Ramboll's performance evaluation, the Final Treatment Plant is operating well. The sampling data provided by U. S. Steel indicated the Final Treatment Plant is removing greater than 90% of the oil & grease (O&G).

Ramboll worked alongside U. S. Steel to inspect all relevant equipment, components, and operations in the Final Treatment Plant's current state. Ramboll recommendations are presented in Section 9 of this report.

2. INTRODUCTION AND GENERAL OVERVIEW

2.1 Background Information

U. S. Steel Midwest Plant is participating in an Agreed Order (Cases 2019-26434-W, 2019-26665-W) with IDEM, which requires U.S. Steel to evaluate existing components and operations of the Final Treatment Plant (FTP). The Agreed Order also stipulates that this study must be certified by a Professional Engineer. Ramboll was contracted by U.S. Steel to develop and certify the evaluation of this plant. Ramboll followed accepted engineering practices in the development of this evaluation for the site. These practices included visual observations, discussions with operators and site managers, inspection of wastewater treatment equipment, source sampling, on-line and augmented flow measurement, statistical data evaluation, review of permits and DMR data, and brainstorming with site personnel.

PFD-03, attached, provides a process flow diagram of the FTP, as well as the critical process design parameters of all major treatment plant equipment and tanks. The attachments also have a process table detailing unit sizes, critical design parameters at the plant's average and peak flow rates and some influent and effluent water quality parameters.

2.2 Purpose of Treatment Plant

The FTP is currently used to separate and remove light oils and particulate solids from its influent flows. This is accomplished via pH adjustment, charge stabilizers, and flocculant aids introduced over a series of treatment steps. Table 2.1 presents the source, nature, and approximate daily volumes to the FTP (based upon Source Survey conducted in 2021 by Ramboll).

Table 2.1 FTP Influent Sources

Nature	Total Flow (gallons/day)	
Typical Contaminants (Oil, Solids, None)	Average	Maximum
South Dirty Industrial Waste (DIW) Sewer		
Oil, Solids	2,263,263	2,904,519
North Dirty Industrial Waste (DIW) Sewer		
Oil, Solids	1,223,493	1,584,701
Pre-treatment Lift Station		
Oil, Solids	2,671,374	2,925,520
Note: Volumes are approximations.		

The treated effluent from the FTP flows to internal Outfall 104 prior to Outfall 004 and final discharge to the Burns Waterway.

2.3 Agreed Order Evaluation Requirements

The evaluation assesses the adequacy of the existing FTP components and operations per Agreed Order II.6.D. This includes the following:

- Identification of existing treatment components, including information on each unit's:
- Capacity;
- Age;

- Current condition;
- Treatment capability, including removal efficiency; and
- Characterization of the wastewater (source, nature, and volume) that it receives.
- Description of the current treatment operations, including detailed diagrams that depict flows to and through the FTP;
- Evaluation of the adequacy of treatment equipment and operations;
- Determination of process needs, including equipment repair, replacement; and
- Development of a plan and schedule for addressing treatment needs.

The information presented herein has been reviewed and certified by a Licensed Professional Engineer as indicated by the Agreed Order.

3. TREATMENT SYSTEM DESCRIPTION AND SIZING

3.1 Treatment Plant History

The current FTP was constructed around 1960. While some adjustments were made to the treatment process and equipment over the years, it has largely been consistent with the original design. A second defoamer storage and injection system was installed in late 2018 near the effluent channel to address the foaming concerns after treatment. In the fall of 2020, equipment was installed to reduce the pH in the equalization basins and promote the separation of oils.

The equipment to dose Lime slurry and coagulant to Mix Tank #2 has been removed. A waste pickle liquor tank and oil storage tank were decommissioned and removed. A sludge pumping station that received settled material from the equalization basins was also decommissioned. Waste sludge was originally pumped to a lagoon rather than the dewatering facility being used today.

3.2 Process Description

The three influent sources identified in Table 2.1 combine in a splitter box and flow by gravity into each of the manifolds to the North and South Equalization Basins. Oil separation, which occurs at these basins, can be manually removed using the skimming system and transferred to the scum/oil sump by the operator. The wastewater from each basin flows by gravity through a gate valve towards Mix Tank #1.

Prior to entering Mix Tank #1, a 30% lime slurry and recycled solids are added to the wastewater. This addition serves to adjust the pH and promote the flocculation and sedimentation processes in the downstream treatment stages. Wastewater in Mix Tank #1 is then mixed with a coagulant and flows by gravity into Mix Tank #2. Chemicals are not added within Mix Tank #2 before starch and polymer are added at the tank’s outlet.

The effluent of Mix Tank #2 is evenly split into the East and West Flocculation Tanks. These tanks are made up of three sections with submersed mixers in the first and second sections. The Flocculation Tank effluents flow via gravity to their corresponding Sedimentation Tanks, where the flight skimmers push lighter oils and floating materials to a C-channel skimming pipe. The C-channel pipe must be manually turned by the operator to collect the floating oils and other contaminants and transfer them into the scum/oil sump. Settled material is pushed by the flight skimmers into a collection trough, referred to as the cross-collector, that spans the width of each sedimentation tank. Pumps are installed at the ends of each of the cross-collector to continuously withdraw the settled material. A portion of the settled solids is recycled to the influent of Mix Tank #1, while the remaining solids are transferred to the sludge de-watering facility north of the FTP.

The treated wastewater from the East and West Sedimentation Tanks overflows a set of weir boxes. The effluent flow rate is measured by a Parshall Flume (Internal Outfall 104). Two defoaming chemicals are added to prevent foam in the effluent. Outfall 104 effluent is combined with non-contact cooling water and internal Outfall 204 ahead of external Outfall 004 to the Portage-Burns Waterway.

The skimmed materials collected in the scum/oil sump are pumped into the scum/oil tank manually by the operator. The operator manually decants from this tank to the North Equalization Basin, while the oils are transported to the oil processing equipment at the Pretreatment Plant by a third-party contractor. The attached PFD-03 summarizes this process.

The FTP was originally designed for an average flow of 6,800 gallons per minute (gpm). Currently, an average flow of approximately 6,800 gpm is being treated through the FTP, with a peak flow of 7,933 gpm (95^{th} percentile).

3.3 Equipment, Instrumentation, and Controls

The following sections detail the process equipment, instrumentation, and controls of each component in the FTP treatment system.

3.3.1 Equalization Basins

Wastewater from the splitter box enters the square, in-ground, concrete North and South Equalization Basins and flows through their corresponding influent manifolds. This manifold spans nearly the entire bottom length of each basin. The manifold is a perforated pipe with two effluent chimneys along its length to relieve flow. In the fall of 2020, U.S. Steel began injecting 93% sulfuric acid into the manifold to reduce the pH of the basins to between 3 and 3.5 s.u. to enhance the separation of oily contaminants. Between the equalization tanks is a manual oil skimming system that collects and transfers oils and floating contaminants to the scum/oil sump. Four air manifolds are placed at various locations around each tank that are fed by a positive displacement air blower. The air provides gentle mixing and oxidizes any ferrous iron in the wastewater. Each basin has an approximate volume of 225,000 gallons. When both basins are in service, each basin has a hydraulic retention time of approximately 66 minutes at the average flow and 57 minutes at the peak flow rate.

3.3.2 Mix Tank #1

Mix Tank #1 is an in-ground, concrete tank with a 10 HP mixer, an approximate volume of 23,000 gallons, and a hydraulic retention time of 3.4 minutes at the average flow rate and 2.9 minutes at the peak flow. Approximately 10% of the air from the positive displacement blower discharged to the equalization tank enters the mix tank. Prior to the mix tank, lime slurry and recycled solids are mixed with the equalization basin effluent. Coagulant is injected into this tank at a typical rate of 13 gals/day to achieve an approximate coagulant concentration of 2-3 ppm in the wastewater.

3.3.3 Mix Tank #2

Mix Tank #2 is identical to Mix Tank #1, with a 10 HP mixer, an approximate volume of 23,000 gallons, and hydraulic retention time of 3.4 and 2.9 minutes at the average and peak flow rates, respectively. Previously, lime slurry and other chemicals were added directly into this mix tank; however, water treatment additives are not directly added to the tank under current operation. A starch and polymer solution is added at typical flow rates of 5 and 13 gallons/day, respectively into the effluent stream of the mix tank.

3.3.4 Flocculation Tanks

Each flocculation tank has three sections. The first two section are separated by a steel wall with openings at the top and bottom. The second and third sections are separated by a wall of wooden slats. Each section has wooden baffles installed to improve the flocculation and settling of denser material, while only the first and second sections have submerged mixers to enhance particle collision and aggregation. The total approximate volume of each flocculation tank is 141,000 gallons. When both tanks are in service, each tank has a hydraulic retention time of approximately 42 minutes at the average flow and 36 minutes at the peak flow rate.

3.3.5 Sedimentation Tanks

The sedimentation tanks are long, sloped, in-ground rectangular units with two installed drive mechanisms. One drive system is dedicated to the chain and flight skimmers that remove floating material to the C-channel at the top of its rotation, and settled solids are removed to the cross-collector at the bottom of the skimmer rotation. A second drive system at the cross-collector includes another set of chain and flight skimmers that conveys material towards the ends of the cross-collector to be pumped out for recycling or de-watering. After the C-channel, each tank contains 18 weir boxes for the wastewater to flow over. The weir boxes have notches angled at 90 degrees, with most having a width of 4.5 inches, spaced 1.5 inches apart. Each sedimentation tank has an approximate volume of 637,000 gallons. When both tanks are in service, each tank has a hydraulic retention time of 3.1 hours and 2.7 hours at the average and peak flow rates, respectively.

3.3.6 Scum/Oil Separator Tank

The scum/oil separator tank is a metal lined above-ground tank with a volume of approximately 13,000 gallons located south of the operator building. The contents of the oil/scum sump are pumped into this tank manually for further separation. The separator tank is heated to approximately 100°F via a steam jacketed heat exchanger. Operations personnel decant the tank effluent back to the North Equalization Basin, while the oils are transported to the oil processing equipment at the Pretreatment Plant for processing by a third-party contractor.

3.3.7 Dewatering

Sludge pumped to the Dewatering Plant from the FTP is treated by a set of thickeners and filter presses. The filter presses are typically only operated during day shifts, five days a week. Decanted water from the thickeners and press filtrate return to the Pretreatment Lift Station, while the solids cake is transported to the on-site landfill.

4. EQUIPMENT AGE AND CONDITION

Table 4.1 below summarizes the age and condition of the Final Treatment Plant's major equipment. The condition of the equipment is categorized based on the following criteria:

- GOOD – Equipment is functional and well-maintained.
- SATISFACTORY – Equipment is functional as designed and may require minor maintenance.
- UNSATISFACTORY – Equipment is functional, but not as designed, and may require frequent maintenance.
- POOR – Equipment requires immediate maintenance to continue functioning or is non-functional.

Table 4.1 FTP Major Process and Chemical Equipment – Age and Condition

Name	Age (yrs.)	Condition
Equalization Tanks	~ 61	SATISFACTORY
Mix Tank #1	~ 61	SATISFACTORY
Mix Tank #2	~ 61	SATISFACTORY
Flocculation Tanks	~ 61	SAISFACTORY
Sedimentation Tanks	~ 61	SATISFACTORY
Scum/Oil Separator Tanks	~ 61	SATISFACTORY
Sulfuric Acid Tank		GOOD
Lime Slurry Tanks		SATISFACTORY
Starch Tank		GOOD
Coagulant Tank		GOOD
Polymer Tank		GOOD
De-Foamer Tank		GOOD

Overall, the equipment in the Final Treatment Plant was determined to be "SATISFACTORY" or better.

5. PERFORMANCE EVALUATION

5.1 Literature Review

Industry practices and relevant literature were referenced to determine the most appropriate design and operating standards. The referenced literature includes:

Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. *Recommended Standards for Wastewater Facilities: Policies for the Design, Review, and Approval of Plans and Specifications for Wastewater Collection and Treatment Facilities*. 2014th ed., Health Research, Inc., Health Education Services Division, 2014.

Minnesota Rural Water Association (MRWA). "Chapter 12 Coagulation - MRWA." https://www.mrwa.com/WaterWorksMnl/Chapter%2012%20Coagulation.pdf.

Tchobanoglous, George, et al. *Wastewater Engineering: Treatment and Resource Recovery*. McGraw-Hill Higher Education, 2014.

Monographs on Refinery Environmental Control Management of Water Discharges: Design and Operation of Oil-Water Separators*,* First ed., API Publication 421, 1991.

"Sedimentation." *Design of Municipal Wastewater Treatment Plants (WEF Manual of Practice No. 8)*, ASCE, Alexandria, 1992, pp. 449–459.

5.2 Major Process Equipment

5.2.1 Equalization Basins

Equalization basin capacity should be sufficient to effectively reduce expected flow and load variations to the extent deemed to be economically advantageous. With a diurnal flow pattern, the volume required to achieve the desired degree of equalization can be determined from a cumulative flow plot over a representative 24-hour period. (Great Lakes, 60-8).

5.2.2 Rapid Mixing

In a conventional plant, coagulants are added in the rapid mix tank. The typical residence time ranges from 30 seconds to two minutes (MRWA, 3).

5.2.3 Flocculation Tanks

Conventional sedimentation facilities have flocculation tanks with a detention time of 20 to 45 minutes (MRWA, 3).

5.2.4 Sedimentation Tanks

The following are the recommended design and operating parameters for the sedimentation tank:

Design Parameters

- Minimum total length: 10 feet (Great Lakes, 70-1).
- Minimum side water depth for primary settling: 10 feet (Great Lakes, 70-1).

Operating Parameters

- Hydraulic retention time at average flow: 1.5 to 2.5 hours (McGraw Hill, 393)
- Horizontal velocity: 4.0 to 5.0 feet/min (ASCE, 459)
- Surface loading rate with sludge return and no chemical addition: 600-800 gpd/ft^2 at average flow and 1,200-1,700 gpd/ft^2 at peak hourly flow (McGraw Hill, 394)
- Surface loading rate with chemical addition: 1700 and 2000 gpd/ft^2 at average flow (McGraw Hill, 394)

5.3 Operating Review

5.3.1 General Operating Data Review

A major treatment goal of the plant is the separation and removal of O&G. The equalization basins, sedimentation tanks, and auxiliary equipment are used to accomplish this. To ascertain the overall treatment performance, U. S. Steel collected several grab samples in November 2021 to measure the O&G removal efficiency. Samples were collected when both equalization basins and sedimentation tanks were operating. The measured percent removal is provided in Table 5.1.

Table 5.1 Final Treatment Plant Overall O&G Approximate Percent Removal

Date	O&G Removal (%)
11/3/2021	99
11/5/2021	91
11/8/2021	97
11/10/2021	92
11/12/2021	98
11/15/2021	98

Note: The result of the O&G sample taken on Nov. 5, 5:30pm was not reported properly by analytical lab and was not used in the calculations.

The results revealed on average, approximately 453 gals/day of O&G enters the plant from the DIWs (using an oil specific gravity of 0.80), with more than 80% of it coming from the South DIW. The peak influent oil from the South DIW is as high 980 gal/day, approximately. Although a relatively large amount of O&G enters the plant, most of it is removed in the treatment process. An average removal of 96% is shown in Table 5.1.

In addition to the goal of O&G removal, the plant is designed to separate and remove total suspended solids (TSS) and heavy metals using a chemical precipitation process. This is largely accomplished by chemical treatment and gravity settling in the sedimentation tanks. To gauge the system performance, grab samples were collected in November 2021 from various points in the process and measured for TSS. The plant's percent removal is provided in Table 5.2 below.

Table 5.2 Final Treatment Plant Overall Total Suspended Solids Percent Removal

Date	TSS Removal (%)
11/3/2021	97
11/5/2021	96
11/8/2021	95
11/10/2021	97
11/12/2021	97

Note: This is based on the difference in TSS concentrations from the plant effluent and influent.

The measured samples indicate approximately 2,300 lbs/day of suspended solids entering the plant from the North DIW, 1,100 lbs/day from the South DIW and 1,900 lbs/day from the Pretreatment Lift Station. Table 5.2 shows the plant consistently achieved a high rate of removal during the sampling days. The design and operating parameters of the sedimentation tanks are reviewed in Section 5.2.2 and better detail how those parameters promote solids removal.

In addition to O&G and suspended solids, U. S. Steel regularly monitors several other constituents to monitor NPDES permit compliance. These include fluoride, cyanide, hexavalent chromium, copper, and iron among others. Composite samples were collected and analyzed for these constituents in November 2021, by U. S. Steel. The concentration of fluoride in samples of Equalization Basin influent indicated a maximum influent loading of up to 10 lb/d, which is significantly lower than the Outfall 003 daily average limit of 150 lb/d. The reported cyanide concentration in the Equalization Basin influent were all below the Detection Limit of 0.002 mg/L except for one sample, which was just slightly above the Detection Limit at 0.00234 mg/L. The Equalization Basin influent hexavalent chromium concentration varied between values below the Detection Limit of 0.013 ug/L and below and above the Quantification Limit of 0.035 ug/L. The measured effluent concentrations and calculated percent removal for copper and iron are provided in Table 5.3.

Table 5.3 Final Treatment Plant Copper and Iron Approximate Percent Removal

Date	Copper		Iron	
	Effluent (mg/L)	Overall Percent Removal	Effluent (mg/L)	Overall Percent Removal
11/3/21	0.0006	93	0.18	97
11/5/21	0.0020	67	0.38	89
11/8/21	0.0014	91	0.35	97
11/10/21	0.0022	98	0.34	97
11/12/21	0.0006	99	0.3	98

Note:
Copper: MDL=0.000238 mg/L, Report Limit=0.00100 mg/L, iron: MDL=0.0404mg/L, Report Limit=0.0800 mg/L

The incoming copper was largely removed most of the time except for the result from November 5th, which shows an approximate removal of only 62%. This was because much less copper entered the plant that day relative to other sampling days. The plant shows good removal of incoming iron, with an average removal percent of 96%.

5.3.2 Major Process Equipment Operating Review

5.3.2.1 Equalization Basins

In addition to equalizing the flow and contaminant concentrations, the Equalization Basins have the added goal of separating and removing oil from the wastewater. With the addition of acid to reduce pH and a retention time of over an hour, oil can be expected to separate. U.S. Steel analyzed a series of O&G grab samples of the influent sources and effluent of the EQ in November 2021. These results are provided in Table 5.4 below.

Table 5.4 Equalization Basin Approximate O&G Removal

Date	Basin Influent O&G (mg/L)	Basin Effluent O&G (mg/L)	Basin Removal Efficiency (%)
11/3/2021	123	23	82
11/5/2021	22	23	-
11/8/2021	85	24	72
11/10/2021	23	14	39
11/12/2021	34	18	48
11/15/2021	26	17	35

Note: Reported 11/5 Influent O&G concentration approximately equal to Effluent concentration

The Equalization Basin can be assessed as an API to measure its oil removal performance. The industry guideline for the maximum horizontal velocity through an API is 3 feet/min (API Publication 42, 4-9). Assuming no short circuiting in the basin and the incoming wastewater flows around all the edges of the basin to the outlet, approximate horizontal velocities of 2.0 feet/min and 2.4 feet/min at the current average and peak flow rate are calculated (assuming cross sectional area equal to half the EQ Basin). These velocity rates are within the API guidelines, providing sufficient time for the light oils to rise to the surface and result in an O&G effluent concentration that meets API standards of below 50 mg/L.

5.3.2.2 Mix Tanks

The industry guideline for the hydraulic retention time of chemical mixing tanks is 30 seconds to 2 minutes. Both mix tanks in the treatment process have a retention time of 3.4 minutes and 2.9 minutes at the average and peak flow rates, respectively. These values are higher than the guideline and, as such, adequate for the treatment process.

5.3.2.3 Flocculation Tanks

The industry guideline for the hydraulic retention time of flocculating tanks is 20 to 40 minutes. The Flocculation Tanks at the Final Treatment Plant have retention times of 42 and 36 minutes at the average and peak flow rates, respectively, when both tanks are in operation. The retention times reduce to 21 and 18 minutes during a single tank operation at the average and peak flow rates, respectively. These values are within or near the guidelines and are adequate for the treatment process.

5.3.2.4 Sedimentation Tanks

Table 5.5 outlines the operating parameters for the sedimentation tanks at the current average and peak flows (95th percentile).

Table 5.5 Sedimentation Tank Operating Parameters

Flow Scenario	Flow (MGD)	Hydraulic Retention Time (hours)			Surface Loading Rate (gpd/ft^2)		
		Literature Standard	One Tank in Service	Two Tanks in Service	Literature Standard	One Tank in Service	Two Tanks in Service
Average	9.76	1.5 to 2.5	1.6	3.1	1,700 – 2,000	1,529	764
Peak (95th Percentile)	11.42		3.1	2.7		1,789	895

Note: Sedimentation tank volume includes cross collector, settling area and weir boxes

The calculations show that the hydraulic retention time for the two-tank and single tank operation always meets the industry standards, both at the average and peak flows. The surface loading rate guideline is also met in both flow scenarios and during both a single and two tank operation. In addition, horizontal velocity was calculated for the average flow and had results of 2 feet/min for the single tank operation and less than 1 feet/min during two tank operation. These rates are below the 4 to 5 feet/min guideline that would induce solids scouring.

6. OPERATIONS, MONITORING, AND CONTROLS EVALUATION

6.1 Operator Daily Activities

Standard operating procedures (SOP) are followed as described in document #NSCS-M-P-7091-02 that details the routine inspection and reporting activities for the plant. During each shift, the "Daily Operator Report" (Form #7091-01) is completed. This form includes various equipment and treatment process inspections, laboratory tests, data reporting, and system adjustments as needed. While completing the daily report, checks are made of several process variables to determine if they are outside of the control range. A control chart with references to various troubleshooting SOP documents is provided in document NSCS-M-P-7093-02-47.

An evaluation of Form #7091-01 produced several revisions and additions to consider and are presented below:

- Add a location for noting and documenting the status of the blowers, mix tank mixers and flocculation tank mixers;
- Add a qualitative response to the Outfall checks, such as "clear", "colorless", or "other";
- Add an "Acid Flow Rate" entry;
- Consider changing the "Yes No" response to the receipt of tankers to "No Yes, (Insert quantity)" to account for the potential for multiple deliveries in a shift;
- On the hourly chart, add a "/" in the middle to help keep the data separated for multiple readings (e.g., ACH and starch pump settings, sludge levels percent east/west, iron, pH).
- Once the operator completes the form, data should be entered in an electronic format, such as a spreadsheet or database, to facilitate tracking data and trending performance.

6.2 Online Monitoring

The table below presents some of the instruments currently installed at the FTP. U.S. Steel is working on updating the controls and monitoring system at the FTP, as currently they are only accessible by a local PLC.

Table 6.1 FTP Online Monitoring

Equipment	Variable	Units
North Equalization Basin	pH	s.u.
Channel before Mix Tank #1	pH	s.u.
Channel after Mix Tank #2	pH	s.u.
Sludge	Flow	gpm
Parshall flume	Flow	gpm
Mill Operation	Operating	N/A

6.3 Operator Troubleshooting Activities

Document NSCS-M-P-7093-02-47 provides detailed information on how to address a deviation from the acceptable ranges of various control variables. It specifically highlights the process name, control system, method of control, required frequency of observation, possible sources for problems, possible strategies for addressing the deviations along with reference SOP documents.

7. MAINTENANCE AND RELIABILITY EVALUATION

Ramboll inspected the equipment during a site walkthrough and had conversations with U. S. Steel Maintenance personnel. U. S. Steel also provided Ramboll with records of the routine maintenance performed on the equipment.

7.1 Key Preventative Maintenance Activities

A major planned and preventative maintenance activity is taking units with parallel systems offline, including:

- Equalization Basins;
- Flocculation Tanks; and
- Sedimentation Tanks.

When taken offline, these systems are drained, cleaned, inspected, and repaired typically every six months.

Other preventative maintenance activities include:

- Inspecting and lubricating key equipment in the FTP approximately every one to four months;
- Inspecting both mix tank areas approximately every six months;
- Inspecting and lubricating key equipment in the dewatering plant every one to four months;
- Inspecting sludge filter presses approximately every six months; and
- Inspecting the thickeners approximately every six months.

7.2 Reliability Concerns

Based on Ramboll observations and conversations with operations personnel, potential reliability concerns were identified. U. S. Steel is aware of the items listed in the table below and is actively monitoring/addressing these issues.

Table 7.1 Final Treatment Plant Equipment Reliability Concerns

Component	Concern	Potential Impact on Treatment Process
Equalization Basins		
pH monitoring location	Not representative of actual Basin effluent	Inconsistent pH in Basin not optimizing oil separation

Several other activities and upgrades were performed prior to this evaluation by U. S. Steel personnel to address past reliability concerns. These included the following:

- A new mixer gearbox and motor was installed in Mix Tank #1;
- The sludge line entering the dewatering facility from the FTP was heat traced; and
- The lime slurry storage tank mixer was replaced.

8. EVALUATION SUMMARY

The overall treatment performance of the Final Treatment Plant is good, with approximately 96% of the influent O&G removed and approximately 96% of the influent TSS removed by the system. The Equalization Basins are adequately sized to provide the time for O&G separation. The Sedimentation Tanks are also sized appropriately to remove the average influent solids loading when both units are operating.

Despite the excellent O&G removal performance by the Equalization Basins, O&G is still observed in the Mix Tanks and the Sedimentation Tanks. The Equalization Basins should be modified to improve oil removal to mitigate the potential of oil carryover to the Sedimentation Tanks. Additionally, on-line measurement of the Equalization Basin pH should be modified to measure the effluent from each Equalization Basin separately. This will provide an improved pH control by allowing acid flow to be controlled to each Equalization Basin.

U. S. Steel has already begun the process of modernizing the PLC for the Final Treatment Plant. This will allow for remote access viewing and data tracking of the plant performance. The updated PLC will also allow for automatic flow pacing of the coagulant and flocculant addition, which should improve removal efficiency of solids in the Sedimentation Tanks as the wastewater flow rate through the Pretreatment Plant changes.

Performance of the Sedimentation Tanks could potentially be improved by operating at a higher pH. Currently, the pH in the Mix Tanks is limited so that the effluent pH at Outfalls 104 and 004 is not exceeded. Operating at a higher pH should increase the amount of soluble metals removed from the wastewater.

Additional probes and sensors can be installed at the effluent from the Sedimentation Tanks to automatically alert operators to a potential upset condition. This could include on-line monitoring of conductivity and turbidity. In the event of an upset at the Sedimentation Tanks, operators do not have any capability to divert wastewater from the Outfall. A lift station could be installed to divert Sedimentation Basin effluent to the existing, unused million-gallon tank located south of the Final Treatment Plant. This would provide almost 2 hours of diversion capacity, which would provide time for wastewater operators to adjust the treatment system to correct the upset or allow production personnel to stop the production lines.

9. RECOMMENDATIONS

9.1 Operating Philosophy Improvements

Several general improvements pertaining primarily to the administration activities are recommended to be implemented, including:

- Review and revise Key Performance Indicators (KPIs).
- Revising log sheets and data collection to improve tracking of KPIs.
- Reaffirm personnel roles and responsibilities associated with treatment plant operations.
- Review and update Operating Manuals and Procedures to ensure consistent operating objectives and current process configurations.
- Review and update Preventative Maintenance Program Plan (PMPP) and improve tracking work orders in Oracle for non-routine maintenance
- Review effectiveness of the personnel training program to identify potential improvements.

9.2 FTP Improvements

The following are FTP specific recommendations:

- Modernization of the PLC
- Perform an Engineering Feasibility Assessment to Improve Oil Separation and Removal at Equalization Basins to include:
  - A trial of temporary floating oil skimmers to remove additional oil from the surface of the Equalization Basins.
  - Installing baffles and mixers to improve flow through the basins to improve oil separation.
  - Installing additional, permanent oil skimming locations.
  - Modifying the skimmer above the outlet boxes.
- Relocating the sampling location used for monitoring the Equalization Basin pH to sample from the effluent of each Equalization Basin, which should then be used to adjust the acid addition to that corresponding Equalization Tank.
- Install monitoring for conductivity and turbidity at the Sedimentation Basin effluent to signal alarms in the event of a treatment upset condition.
- Flow Pacing of coagulant and flocculant to improve solids capture.

APPENDIX 1
OPERATING PARAMETERS AND UNIT PROCESS SIZES – FINAL TREATMENT PLANT

OPERATING PARAMETERS AND UNIT PROCESS SIZES - FINAL TREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
INFLUENT PARAMETERS						
South DIW flow	gpm	2,100	NA	1,571	2,017	Design ave. based on flows outlined in drawing no. 742-0005 Current values from source survey
North DIW flow	gpm	1,700	NA	850	1,100	Design ave. based on flows outlined in drawing no. 742-0005 Current values from source survey
Pre-treatment lift station flow	gpm	3,000	NA	1,855	2,032	Design ave. based on flows outlined in drawing no. 742-0005 Current values from source survey
Total estimated influent flow	gpm	6,800	NA	4,276	5,149	The effluent flow data was used for the calculations
	gal/day	9,792,000	NA	6,157,440	7,414,560	Current values from source survey
Oil concentration	mg/L	NA	NA	55.0	115.0	Current values from Nov. 2021 sampling program
	lbs/day	NA	NA	2822.2	7105.7	
Total iron	mg/L	NA	NA	10.6	14.4	Current values from Nov. 2021 sampling program
pH	--	NA	NA	NA	NA	
Density	S.G.	NA	NA	NA	NA	
Temperature	Deg. F	NA	NA	NA	NA	
NORTH/SOUTH EQUALIZATION BASIN						
Length	ft	67.0	67.0	67.0	67.0	Drawing No. 742-0060 & 742-066
Width	ft	41.0	41.0	41.0	41.0	Drawing No. 742-0060 & 742-066
Height	ft	10.7	10.7	10.7	10.7	Drawing No. 742-0060 & 742-066
Operating depth	ft	7.5	7.5	7.5	7.5	Drawing No. 742-0060 & 742-066
Cross-sectional area at east/west view using height	ft^2	891	891	891	891	
Cross-sectional area of north/south view using height	ft^2	614	614	614	614	
Cross-sectional area of east/west view using operating depth	ft^2	**591**	**591**	**591**	**591**	
Cross-sectional area of north/south view using operating depth	ft^2	**395**	**395**	**395**	**395**	
Nominal volume	ft^3	48,324	48,324	48,324	48,324	
	gal	361,467	361,467	361,467	361,467	
Operating volume	ft^3	30,098	30,098	30,098	30,098	
	gal	225,132	225,132	225,132	225,132	According to 20210415 v9-DMS_Midwest_O_M_Plan, EQ Basins have a volume of 285,000 gallons
Hydraulic retention time (HRT) with one basin in service	minutes	33.1	NA	33.2	28.4	
Hydraulic retention time (HRT) with both basins in service	minutes	66.2	NA	66.4	56.8	
Effluent Parameters						
O & G	mg/L	NA	NA	20.0	24.0	Current values from Nov. 2021 sampling program NA- Not available
	lbs/day	NA	NA	1,626.7	2,284.8	NA- Not available

OPERATING PARAMETERS AND UNIT PROCESS SIZES - FINAL TREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
CHEMICAL ADDITIONS & RECYCLE FLOW						
Average sulfuric acid dose	gal/day	--	--	319	389	August 2021 Operator Log Sheet Data
Neat sulfuric acid concentration	%	--	--	93	93	
Average lime dose	gal/day	NA	NA	2,000	2,000	August 2021 Operator Log Sheet Data
Neat lime slurry concentration	%	30	30	30	30	
						From ChemTreat
Coagulant flow	gal/day	NA	NA	13	13	NA - Not available
Coagulant dosage	ppm	NA	NA	2	2	Assuming density of water
						From ChemTreat
Flocculant flow	gal/day	NA	NA	5	5	NA - Not available
Flocculant dosagen	ppm	NA	NA	1	1	Assuming density of water
						From ChemTreat
Starch flow	gal/day	NA	NA	13	13	NA - Not available
Starch concentraton	ppm	NA	NA	2	2	Assuming density of water
						Current values from Nov. 2021 sampling program
Sludge density	mg/L	NA	NA	19,517	25,375	NA- Not available
Sludge recycle flow	gal/day	NA	NA	10,000	12,000	Assumed
	lbs/day	NA	NA	1,626	2,538	
MIX TANK #1						
Length	ft	**15.8**	**15.8**	**15.8**	**15.8**	Drawing No. 742-0352
Width	ft	14.2	14.2	14.2	14.2	Drawing No. 742-0352
						Drawing No. 742-0005 (hydraulic profile)
Depth	ft	13.6	13.9	13.6	13.9	Peak depth from Drawing No. 742-0352
Volume	ft^3	3,051	3,114	3,051	3,114	
	gal	22,824	23,294	22,824	23,294	
Hydraulic retention time (HRT)	minutes	3.4	NA	3.4	2.9	
Mixer	-	Mixer	Mixer	Mixer	Mixer	
	hp	10	10	10	10	
Volume turnover	hp/1000gal	0.44	0.43	0.44	0.43	
MIX TANK #2						
Length	ft	**15.8**	**15.8**	**15.8**	**15.8**	Drawing No. 742-0352
Width	ft	14.2	14.2	14.2	14.2	Drawing No. 742-0352
						Drawing No. 742-0005 (hydraulic profile)
Depth	ft	13.6	13.9	13.6	13.9	Peak depth from Drawing No. 742-0352
Volume	ft^3	3,042	3,114	3,051	3,114	
	gal	22,772	23,309	22,839	23,309	
Hydraulic retention time (HRT)	minutes	3.3	NA	3.4	2.9	
Mixer	-	Mixer	Mixer	Mixer	Mixer	
	hp	10	10	10	10	
Volume turnover	hp/1000gal	0.44	0.43	0.44	0.43	

OPERATING PARAMETERS AND UNIT PROCESS SIZES - FINAL TREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
FLOCCULATION TANK AS ONE COMPLETE UNIT						
Length	ft	38.5	38.5	38.5	38.5	Drawing No. 742-0353, plan view Inside wall to wall length
Width	ft	36.5	36.5	36.5	36.5	Drawing No. 742-0353, plan view. Inner wall to wall width Includes concrete supports, width slightly over-estimated
Height	ft	14.0	14.0	14.0	14.0	Drawing No. 742-0353 Elevation difference =(588.50+587.50)/2)-574
Operating depth	ft	13.4	13.5	13.4	13.5	Drawing No. 742-005 (hydraulic profile) Elevation difference = (587.39+587.36)/2)-574
Nominal volume	ft^3	19,674	19,674	19,674	19,674	
	gal	147,158	147,158	147,158	147,158	
Operating volume	ft^3	18,795	18,971	18,795	18,971	
	gal	140,588	141,902	140,588	141,902	151,000 gal according to S. Reece's Hydraulic Process Evaluation.
Horizontal velocity with one tank in service	ft/min	1.765	NA	1.760	2.041	
Horizontal velocity with both tanks in service	ft/min	0.883	NA	0.880	1.020	
Hydraulic retention time (HRT) with one tank in service	minutes	20.7	NA	20.7	17.9	
Hydraulic retention time (HRT) with both tanks in service	minutes	41.3	NA	41.5	35.8	
SEDIMENTATION TANK (INCLUDING CROSS COLLECTOR)						
Length	ft	165.8	165.8	165.8	165.8	Drawing No. 742-0353 Inner wall to wall length
Width	ft	38.5	38.5	38.5	38.5	Drawing No. 742-0353 Inner wall to wall width
Height	ft	15.0	15.0	15.0	15.0	Drawing No. 742-0353 Elevation difference = 589-((573+575)/2)
Operating depth	ft	13.3	13.3	13.3	13.3	Drawing No. 742-0353 Drawing No. 742-0005 (hydraulic profile) Elevation difference = ((587.36+587.31)/2)-((573+575)/2)
Nominal volume	ft^3	95,767	95,767	95,767	95,767	
	gal	716,336	716,336	716,336	716,336	According to 20210415 v9-DMS_Midwest_O_M_Plan, sedimentation tanks have a volume of 1,000,000 gallons
Operating volume	ft^3	85,169	85,169	85,169	85,169	
	gal	637,061	637,061	637,061	637,061	
Horizontal velocity with one tank in service	ft/min	1.8	NA	1.8	2.1	
Horizontal velocity with both tanks in service	ft/min	0.9	NA	0.6	0.7	
Surface loading rate with one tank in service	gpd/ft^2	1,534	NA	1,529	1,789	
Surface loading rate with both tanks in service	gpd/ft^2	767	NA	764	895	
Hydraulic retention time (HRT) with one tank n service	hours	1.6	NA	1.6	1.3	
Hydraulic retention time (HRT) with both tanks in service	hours	3.1	NA	3.1	2.7	

OPERATING PARAMETERS AND UNIT PROCESS SIZES - FINAL TREATMENT PLANT

ITEM	UNITS	DESIGN AVE.	DESIGN PEAK	CURRENT AVE.	CURRENT PEAK	COMMENTS
EFFLUENT (Outfall 104) PARAMETERS						
Flow	gal/day	9,792,000	NA	9,760,000	11,424,000	Current values are average and 95th percentile from DMR data 7/1/20 to 6/30/21
Oil concentration	mg/L	NA	NA	1.7	2.6	Current values are average and 95th percentile from DMR data 7/1/20 to 6/30/21
	lb/day	NA	NA	139.1	249.4	
Turbidity	FNU	NA	NA	3.4	5.5	Current values are average and 95th percentile from operator log sheets from 9/30/20 to 8/1/21
TSS	mg/L	NA	NA	4.1	7.2	Current values are average and 95th percentile from DMR data 7/1/20 to 6/30/21
Iron	mg/L	NA	NA	0.27	0.33	Current values from August 2021 Operator log sheet

APPENDIX 2
PFD-03: FINAL TREATMENT PLANT PROCESS FLOW DIAGRAM

NORTH EQUALIZATION BASIN		
NUMBER OF UNITS		1
CAPACITY, gal ea.		361,500
DETENTION TIME, min	AVG FLOW	66.4
	PEAK FLOW	56.8

SOUTH EQUALIZATION BASIN		
NUMBER OF UNITS		1
CAPACITY, gal ea.		361,500
DETENTION TIME, min	AVG FLOW	66.4
	PEAK FLOW	56.8

EQUALIZATION SCUM\OIL SEPARATOR TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		13,000
DETENTION TIME, min	AVG FLOW	VARIES
	PEAK FLOW	VARIES

MIX TANK #1		
NUMBER OF UNITS		1
CAPACITY, gal ea.		23,300
DETENTION TIME, min	AVG FLOW	3.4
	PEAK FLOW	2.9

MIX TANK #2		
NUMBER OF UNITS		1
CAPACITY, gal ea.		23,300
DETENTION TIME, min	AVG FLOW	3.4
	PEAK FLOW	2.9

WEST FLOCCULATION TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		147,000
DETENTION TIME, min	AVG FLOW	41.5
	PEAK FLOW	35.7

EAST FLOCCULATION TANK		
NUMBER OF UNITS		1
CAPACITY, gal ea.		147,000
DETENTION TIME, min	AVG FLOW	41.5
	PEAK FLOW	35.7

WEST SEDIMENTATION TANK		
NUMBER OF UNITS		1
SURFACE AREA ft^2		6,400
HYDRAULIC LOADING RATE gpd/ft^2	AVG FLOW	764
	PEAK FLOW	895

EAST SEDIMENTATION TANK		
NUMBER OF UNITS		1
SURFACE AREA ft^2		6,400
HYDRAULIC LOADING RATE gpd/ft^2	AVG FLOW	764
	PEAK FLOW	895

SLUDGE THICKENER A		
NUMBER OF UNITS		1
CAPACITY, gal ea.		.
DETENTION TIME, min	AVG FLOW	.
	PEAK FLOW	0

SLUDGE THICKENER B		
NUMBER OF UNITS		1
CAPACITY, gal ea.		.
DETENTION TIME, min	AVG FLOW	.
	PEAK FLOW	0

FILTER PRESS A		
NUMBER OF UNITS		1
SURFACE AREA ft^2		.
HYDRAULIC LOADING RATE gpm/ft^2	AVG FLOW	.
	PEAK FLOW	.

FILTER PRESS B		
NUMBER OF UNITS		1
SURFACE AREA ft^2		.
HYDRAULIC LOADING RATE gpm/ft^2	AVG FLOW	.
	PEAK FLOW	.

CLIENT UNITED STATES STEEL CORPORATION	NO.	DATE	REVISION	INT.
	1	04JAN22	FINAL	LTE

DESIGNER / PROFESSIONAL ENGINEER RESPONSIBLE
DESIGNED BY TJP — PROJECT NO. 1690022867
CHECKED BY TJP — DATE 04JAN22
DRAWN BY W.JARRELL

RAMBOLL US CONSULTING, INC.

RAMBOLL

PROJECT
MIDWEST WASTEWATER TREATMENT EVALUATION
ADDRESS
6290 US-12, PORTAGE, IN 46368

SHEET DESCRIPTION
FINAL TREATMENT PLANT PROCESS FLOW DIAGRAM
DRAWING LOCATION

PFD-03

SAVED: 11/30/21 11:19 AM

L:\ACTIVE PROJECTS\US STEEL\MIDWEST\2021 ENGINEERING EVALS\PRETREATMENT EVALUATION\CAD\USS MIDWEST CTP PFD.DWG

APPENDIX VI
REVIEW OF PREVENTATIVE MAINTENANCE PROGRAM AND STANDARD OPERATING PROCEDURES FOR COMMUNICATIONS

RAMBOLL

WATER

MEMORANDUM

Project name	**Review - PMPP and SOP NCSC-M-P-7010-01**
Project no.	**1690022867**
Client	**U. S. Steel Midwest**
To	**Matt Story**
From	**Matt Hausmann**
Prepared by	**Bryan Arndt**
Checked by	**Matt Hausmann**
Approved by	**David G Gilles, PE, PE Indiana Number 12100267**

January 4, 2022

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Ramboll was requested to review the Standard Operating Procedure (SOP) for releases, spills, and dumps, and the Preventive Maintenance Program Plan (PMPP).

In addition to the PMPP manual for the site, Ramboll received and reviewed SOPs for the Pretreatment Plant, Final Treatment Plant and the Chrome Treatment Plant. As part of this review, Ramboll reviewed operator log sheets for the Chrome and Final Treatment Plants. After review of the PMPP and SOP for releases, spills, and dumps, Ramboll has a few overarching comments.

Currently, only unit inspections performed by the maintenance department are documented in the Oracle work order system; however, operators are visually inspecting units more frequently as per SOP NSCS-M-P-7091-02. The operators should be recording completion of these inspections on a daily checklist. SOP NSCS-M-P-7091-02 outlines the inspections that should be performed; however, they are not indicated on the Final Treatment Plant log sheet, Form 7091-01. In addition to the items listed in the SOP, the following items should be included:

- The date, time, and name of the Inspector/Operator;
- A list of each process unit (e.g., EQ Basin), subunits (e.g., Cross-Collector), chemical feed systems units, rotating equipment, etc.;
- A list of alarms noted in last 24 hours;
- A yes or no checklist of conditions at each unit, such as:
  - Are leaks detected in tanks?
  - Are mixers operating?

Additionally, Ramboll recommends that U. S. Steel review the equipment and instrumentation inspection frequencies and activities to verify they are meeting or exceeding manufacturer recommendations.

Midwest currently lists two SOPs for releases, spills, leaks, and dumps (NSCS-M-P-7010-01 and NSCS-M-P-7091-03). Conflicting directions for spill responses could cause confusion, depending on which one an operator references. Both

SOPs should be combined into a single procedure for clarification. Also, the language in SOP 7010-01 could be adjusted to clearly differentiate between a wastewater ‘operator’ and a production line ‘operator’ with regards to responsibility, authority, and ability for shutting down production operations.

Form 7010-01 is used to record releases, spills, leaks, dumps, and washdowns. Ramboll recommends that this form, currently formatted to record two events per sheet, be reformatted to show only one event per sheet. Including a “Notes” section in place of a second event entry would be useful for communicating data and corrective actions across shifts. It is recommended that a sign-off block is added to the Form to verify that the information has been transferred to the next operator working the following shift.