Eighth (8th) Status Report on XL-2 Projects at IP Androscoggin Mill, Jay, Maine; Progress as of March 31, 2002

By

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MANAGEMENT SUMMARY

Introduction

This is the 8th report on the XL-2 project being conducted at the Androscoggin Mill of International Paper Company in Jay, Maine. The report summarizes progress made as of March 31, 2002. The objective of this project is to implement COD and color reduction projects at the Androscoggin mill in lieu of implementation of best management practice in the cluster rules.

Project Status

To date, eight projects have been either implemented or approved for implementation to reduce COD and color in the mill effluent. Of the $780,000 available for the IP XL-2 project, $218,000 has been spent, while $666,000 is needed for the remaining projects. This means that based on the present estimates, not all the potential projects can be implemented within the budget.

Findings of the Second Mill-Wide COD and Color Balance

Based on the second mill wide COD and color balance it may be concluded that:

1. The appropriate effluent measurement for process monitoring and compliance purposes, is dissolved COD, **not** total COD.
2. Installation of conductivity probes in the black liquor cycle effluents will provide the mill and operators with the tools to detect spills and reduce COD and color emission in the mill effluent by respectively taking corrective action(s) and continuous process improvement.
3. Elimination of the black liquor emission associated with the A sluice filtrate and the carry-over from the flash tanks must receive the highest priority by the XL-2 team to achieve success in the project.

Project Implementation

Ten (10) conductivity meters have been ordered for monitoring the most important sewers of the pulp mill. The installation will be complete in the second quarter of 2002. An attempt to eliminate the black liquor release from the screen room by replacement of the A sluice filtrate by white water was abandoned because it resulted in increased soda losses of brownstock washing from about 9 lb Na_2O/BDT to about 13 lb Na_2O/BDT. Also, the bleaching demand increased from a kappa factor of 0.28 to 0.32 as a result of the increased black liquor carryover. Although the A sluice filtrate project may be facilitated by an improved cooking method ("down flow cooking") to be implemented in the 2nd quarter, the entire washing and black liquor evaporation system will be studied to identify solutions to recover the sluice filtrate without comprising brownstock washing efficiency.

Update on Effluent Discharge of COD and Color in Mill Effluent

Over the last three months, the total COD discharge has ranged between 32 and 34 Kg COD per AD metric ton of pulp produced. The dissolved COD discharge is approximately 25% lower. The discharge of colored matter from the mill during the fourth quarter, the last period for which data was available, was 44 kg per AD metric ton or 86 pounds per AD US ton of pulp. The current effluent limits on COD and color are 51 Kg COD per metric ton of pulp and 120 lbs color AD US ton pulp. The goals of the XL-2 project are 26 kg COD per air dry metric ton of pulp on COD and 50 lbs color per air dried U.S. ton on unbleached pulp. The current discharges of COD and color are well within the current limitations, but without implementation of additional removal projects through in-plant modification, it is doubtful whether the color goal set in the XL-2 project will be reached. In terms of dissolved COD, the effluent will approach the XL-2 goal.

Visit of Domtar Fine Paper Mill in Woodland, ME

Members of the Technical Team[1] visited the, Domtar fine paper mill located in Woodland, ME with the purpose of discussing steps that the Woodland mill has taken to reduce effluent discharges, specifically COD. Notable information learned during the visit is that COD is measured at 12 mill sewers on a daily basis. This information is compiled into a mill report and disseminated widely within the mill. Conductivity is measured in numerous sewers on an ongoing basis. This information is used by the operators to detect spills and to take corrective action. Operator training has been an important part of the program to control COD in the mill effluent. A strong system of accountability is in place in the facility to control spills.

Table of Contents

[1] Team members to visit the Domtar-Woodland paper mill were John Cronin and Ben Leber of IP, Chris Rasher of the EPA and Joseph Genco of the University of Maine

List of Tables

INTRODUCTION

An XL-2 Project is being conducted at the IP paper mill in Jay, Maine[2]. Seven (7) previous reports have been written summarizing the status of this project[3].

Under the terms of the XL agreement, the IP mill is exempt from Best Management Practice (BMP) in the water pollution portion of the Cluster rules. In exchange for this exemption, IP has agreed to take a number of steps designed to improve the quality of the mill effluent for COD and color beyond the levels likely to be attained through implementation of the BMP requirements.

A Technical Team is charged with identifying a list of potential effluent improvement projects at the IP facility primarily associated with the pulping and bleaching operation. These projects, when implemented, will reduce color and COD discharges to the Androscoggin River, which hopefully will achieve the goals of the XL-2 project. Based on the second mill-wide effluent COD and Color mass balance study performed during August 14–17, 2001, the projects to be implemented have been prioritized. Also, the study identified the dissolved COD measurement as the appropriate effluent parameter. The present document reports on the main findings of the 2nd mill-wide mass balance study, and the actions taken during the period of following the mill-wide balance until March 31st, 2002.

RESULTS OF 2nd MILL WIDE COD BALANCE

Main Findings from Study

The 2nd mill-wide COD and color balance was undertaken on August 14-17, 2001 to confirm the results of the 1st balance performed a year earlier on August 8-10, 2000. Other important objectives of the balance were to assess progress made to reduce Color and COD by

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[2] International Paper XL Project: Effluent Improvements", Final Project Agreement, Androscoggin Mill, Jay, Maine (June 29,2000).

[3] Genco, J. M., and van Heiningen, A., "Second (2nd) Mill-Wide COD Balance to Identify Important COD Point Sources", December 21st, 2001 (7th report), "6th Status Report on XL-2 Projects at IP Androscoggin Mill, Jay, Maine; Progress as of September 30, 2001", October 25th, 2001 (6th report), "Status Report on XL-2 Projects at IP Androscoggin Mill as of June 30, 2001", July 23, 2001 (5th report), "Status Report on XL-2 Projects at IP Androscoggin Mill", April 25, 2001 (4th report), "Comparative Analysis of XL-2 Projects", December, 28, 2000 (3rd report), "Mill-Wide COD Balance to Identify Important COD Point Sources", October 18, 2000 (2nd report), "First Summary Report for IP XL-2 Project, Initial Evaluation of COD Balance", August 9, 2000 (1st report).

the implemented XL-2 projects, to identify additional projects, and lastly to determine the suitability of using COD as a process-monitoring tool. The following is a summary of the main findings of the study:

- The total BOD and COD, as measured at the bar screen, were 13% and 20% lower relative to the 2000 balance.
- For process monitoring and compliance purposes, the appropriate effluent measurement is dissolved COD, **not** total COD. This follows from the finding that 53% of the total COD is from the paper mill and 37% from the black liquor cycle, while for dissolved COD, 13% is from the paper mill and 78% from the black liquor cycle. Since the removal efficiency of suspended solids by the waste water treatment system is 95%, the dissolved COD released by the mill to the receiving waters is about ¾ of the total COD. Therefore, the dissolved COD of process effluents is the parameter which impacts the effluent quality.
- The bleach plant represents 63% of the dissolved COD in the black liquor cycle. The next largest contributor is the A pulp mill general sewer. Sources that contribute to this stream include the screen room and the flash tanks.
- The black liquor cycle is also the largest contributor of color in the final effluent (65%).
- The bleach plant and A pulp mill represent 56% and 31% of the color of the black liquor cycle respectively.
- The specific conductance gives a good indication of the black liquor cycle effluents for dissolved COD.
- The A pulp mill caustic sewer is much more toxic than the acid sewer, while the #3 paper machine is non-toxic.

Recommendations

Based on the 2nd balance the following main recommendations were given:

- To improve the mass balance closure of future surveys, calibrate existing flow meters and install flow meters where they are presently absent.
- Finish closing the screen room, and reduce black liquor carryover from the A pulp mill flash tanks going to the sewer.

- Reduce the kappa number to the bleach plants. Improvements to the oxygen delignification system will allow this to happen.
- Install conductivity probes in the black liquor cycle effluents.

PROJECT STATUS

The active projects which are presently funded or are being studied for possible future funding after approval by the Collaborative Group are summarized in Table 1.

Table 1. Projects in Progress or Being Considered as of March 31st 2002

Project / Engineer	**Status**	**Completion Date**	**Estimated Cost*** *(Thousand $)*
Sewer Conductivity Cells (Funded) / Tim Hall	• Engineering complete. • Order placed for cells.	• 2nd Quarter	$50
Flash Tank Demister (Funded) / Curt Treadwell	• Hold (Awaiting startup of down flow cooking)	• Will be determined after startup of the "Down Flow Cooking" project in the 2nd quarter of 2002	$161 (Estimated Cost = $180; Spend ytd = $19)
O2 Mixer (Not Funded)	• Need XL-2 input. Identified multiple mixers.	• TBD (Delivery time for mixer is 12~16 weeks)	$240
O2 Level Transmitter (Funded) / Curt Treadwell	• Installation complete. Tuning transmitter.	• Complete installation by end of 1st quarter (No Change)	$29
O2 Consistency Transmitter (Not Funded)	• Obtained transmitter costs.	• TBD – Need XL2 input	TBD
O2 Chute Improvements (Vent Only) (Not Funded)	• Developed budgetary estimates and scopes	• TBD – Need XL-2 input	$23
O2 Chute Improvements (Reposition chute Only) (Not Funded)	• Reviewed with N&G. Scope to be further developed.	• TBD	$150
A Sluice Filtrate (Funded) / Ben Leber	• Awaiting down flow cooking startup. Will not work in current configuration	• Hold	$13
Sub Total – Projects in Progress or Being Considered			*$666*

Sewer Conductivity Probes

Ten (10) conductivity meters will be installed in each of the following sewer locations:

I. Pulp Mill

1. Blow tank sewer
2. B diffusion washer/ digester sewer
3. B general sewer
4. A general sewer
5. Blow tank sewer
6. Acid sewer

II. Recovery Plant

1. A evaporator sewer
2. B evaporator sewer
3. A concentrator sewer
4. Recovery boiler #2

The sensors will measure conductivity and pH. The signal will be displayed and recorded in the mill PI system. High conductivity values will cause an alarm in the appropriate control room, and require that the operators investigate the cause and take corrective action(s).

Flash Tank Demister

The objective of the flash tank demister project is that its installation will eliminate black liquor carryover with the flashed steam. The tie-ins necessary for the installation are in place. However, the actual installation of the flash tank demister is on hold until evaluation of the impact of "Down Flow Cooking", a project which will be implemented on the A digester in the 2nd quarter of 2002. The rationale for the project is that the change to down flow cooking in the bottom of the digester (as opposed to countercurrent washing as is presently done) may reduce the vapor loading in the A flash tank due to the lower black liquor temperature, despite its expected larger flow rate. In order to obtain an accurate baseline, the mill will test the COD and color release from this source prior to the start of the down flow cooking project.

Second O_2 Mixer

It is felt that the degree of delignification of the oxygen delignification system will improve with the installation of a second mixer after the first mixer, immediately before the oxygen delignification tower. The appropriate mixer has been identified, and a request for

\$10,000 for detailed engineering of the installation of the second O_2 mixer will be tabled at the next meeting of the Collaborative Team.

O_2 Level Transmitter

A beta-gauge level transmitter has been installed in the stand pipe of the oxygen delignification system. The benefit of this project is that the constant level in the standpipe will eliminate situations whereby the oxygen delignification is bypassed because of an overflow in the feed system. Final tuning of the instrument is in progress.

O_2 Chute Improvements

The feed line connecting to the O_2 delignification stand pipe, called the O_2 Chute, contains two elbows which cause flow irregularities in the pulp suspension, especially at higher consistencies. Straightening the pipe is expected to lead to an improved operation of the oxygen delignification system, and thus to a lower kappa number entering the bleach plant. A higher degree of oxygen delignification will be obtained from a more stable operation at higher pulp consistencies. A request for \$10,000 for detailed engineering of straightening the existing O_2 chute will be tabled at the next meeting of the Collaborative Team. In addition, a request for \$23,000 to install an 8-inch vent on the chute will be proposed. The latter modification will allow the removal of entrained air so as to improve the continuous flow of the pulp suspension into the O_2 system.

A Sluice Filtrate

A flow of about 150 GPM of filtrate from the #1 brown stock washer of the A (softwood) pulp mill is presently used to sluice the rejects collected on the flat screen in the screen room. To eliminate this continuous release of black liquor to the sewer, the 150 GPM was replaced by white water, and the filtrate from the #1 brown stock washer integrated in the wash flow. This was done during the period of December 27, 2001 to January 04, 2002. Due to the resulting reduction in addition of fresh wash water by the same amount, the soda losses of the brownstock washing increased from about 9 lb Na_2O/BDT to about 13 lb Na_2O/BDT. Similarly, the bleaching demand had to be increased from a kappa factor of 0.28 to 0.32 as a result of the increased black liquor carry over. The measurement results are summarized in Table 2.

Table 2. Results of Sluice Filtrate Replacement by White Water

Process Situation	**Production Rate** *(UBBDT/Day)*	**Kappa Factor** *(-)*	**Soda Losses** *(Lbs. Na_2O/BDT)*
Before WW Introduction (12/1/01 – 12/26/01)	547 ± 121	0.28 ± 0.02	8.6 ± 1.8
During WW Introduction (12/27/01 – 01/04/02)	507 ± 133	0.33 ± 0.03	13.1 ± 3.9
After WW Introduction (01/05/02 – 01/31/02)	719 ± 194	0.28 ± 0.02	10.0 ± 3.1

Because of the significant deterioration in washing efficiency resulting from the reduced washing dilution factor, the replacement of sluice filtrate by white water was terminated, and the system returned to the original situation of using 150 GPM of filtrate from the #1 brown stock washer for sluicing the rejects. Since the A sluice filtrate is one of the biggest point sources of COD released to the sewer, another way must be found to integrate the wash filtrate in the black liquor recovery system. Although this may be facilitated by downflow cooking, the technical team will be studying the entire washing and black liquor evaporation system to identify possible process solutions. The objective is to recover the sluice filtrate without comprising the brown stock washing efficiency.

FINANCIAL STATUS OF PROJECT

The financial status as of March 31st, 2002 of the projects which are in progress or are being considered is summarized in Table 3. Of the available \$780,000, \$218,000 has been spent, while \$666,000 is needed for the remaining projects. It is clear that not all the projects in Table 1 can be implemented since this would require \$104,000 more than the available \$780,000 for the IP XL-2 project.

Table 3. Financial Status as of March 31st 2002

	$ Thousands
Subtotal - Projects Completed	$218
Subtotal – Projects In Progress or Being Considered	$666
TOTAL COSTS – All Projects	$884
XL-2 Commitment	$780
MONEY AVAILABLE	($104)

COD AND COLOR IN MILL EFLUENT

The latest data regarding the discharge of COD and Color from the Androscoggin mill are shown summarized in Figures 1 through 5. These data have been updated to February 2, 2002.

COD at Bar Screen

Data for concentration of COD in the combined mill sewer (process effluent) going to the waste treatment plant is summarized in Figure 1. The data shown in Figure 1 were taken at the bar screen which is the entrance to the primary clarifiers. These data cover a two year period from January 1, 2002 until February 1, 2002. Average COD going to the clarifier over the two year time period was 1285 mg/liter while over the last six (6) months, the concentration of total COD going to the waste treatment plant has been about 1200 mg/liter.

COD in Mill Effluent

The data for the total COD (unfiltered samples) in the mill effluent has been updated to February 2, 2001 and is displayed in Figure 2. Over the last four month period, that is, the period between October 1, 2001 and February 2, 2002, the COD discharge has ranged between 32 and 34 Kg COD per AD metric ton of pulp produced. The current COD discharge level has increased since the summer 2001. During the time period of June 1 and September 1, 2001 the COD discharge in the mill effluent ranged between 26 to 31 kg per AD metric ton of pulp. During the summer months, a cationic flocculent (polymer) is added to improve the settling of the solids and improve color discharged from the wastewater treatment plant. Use of the polymer was discontinued during the fall 2001 and winter 2002 months. It is plausible that the low COD during the summer period resulted in part from the use of the coagulant addition.

Soluble Versus Total COD Removal in the Waste Treatment System

Data on the removal of COD in the waste treatment plant are shown in Figure 3. The average removal in the waste treatment system is about 80.6% based on the total COD. It has previously been documented[4] that the waste treatment system is not particularly effective in removing dissolved COD and rather effective in removing suspended COD. John Cronin of the IP environmental staff has recently begun measuring both the soluble and the total COD in the mill effluent. These data are summarized in Figure 4 and show that approximately 78% of the COD discharged from the mill is soluble COD and only 22% is COD in the form of suspended solids. This value is in agreement with the measurements of the latest COD balance which showed that the soluble COD released to the Androscoggin River amounted to 76% of the total (suspended plus dissolved) COD, as a result of the 95% efficiency of removal of suspended material by the IP waste treatment system. It should be noted that the XL-2 COD goal of 26 kg per air dry metric ton of pulp will be approached when the more relevant value of the dissolved COD is used rather than the (so far historically reported) total COD measurement.

Update on Effluent Discharge of Color in Mill Effluent

Color in Mill Effluent. The data for color in the mill effluent has been updated through the fourth quarter of 2001. These data are displayed in Figure 5. The discharge of colored matter from the mill during the fourth quarter was 44 kg per AD metric ton or 86 pounds per AD US ton of pulp. Color discharge from the mill has been gradually declining since 1996, but has hit a plateau. Current and past discharge from the mill have been well below the 120 lbs color per AD US ton pulp limit set in the Phase I goal of the XL project but still well above the final goal of 50 lbs color per AD US ton pulp set by the XL project.

Comparing the discharge of color during the summer and winter months, the cationic polymer that is added in the summer appears to improve the COD discharge much more so than that of the color. This suggests that dissolved substances are responsible for the final effluent color. Thus, it appears that polymer addition leads to supplementary settling of suspended

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[4] Genco, J. M., and van Heiningen, A., "Second Mill-Wide COD Balance Study", Dec. 21, 2001 (7th report).

material that contributes to effluent COD, while the effluent color is caused by dissolved material, such as organic material coming from the black liquor cycle of the pulp mill. The color data taken from recent samples of the 2nd color and COD balance support this hypothesis. Finally these results reinforce the importance of testing samples for COD content, both before and after filtration through a 0.8µm glass filter.

Comparison to Goals for COD and Color Set in the XL-2 Project

The current effluent limits on COD are 51 Kg COD per metric ton of pulp. This effluent limitation exists until 2004 at which time it is to be reduced to 26 kg/AD metric ton of pulp. The data shows that over the last three (3) months of calendar year 2001, the COD discharge of the mill was within the current effluent limit (51 Kg COD per metric ton of pulp) but would exceed the goal of the XL-2 project (26 kg COD per metric ton of pulp). Similarly, the current color discharge is well above the goal of 50 lbs color per AD ton on pulp. Without implementation of additional COD and color removal projects through in-plant modification, it is doubtful whether we will be able to reach the goals set in the XL-2 project.

VISIT TO DOMTAR BAILEYVILLE MILL

Mill Facilities

On March 21, four members of the Technical Team[5] visited the, Domtar fine paper mill located in Woodland, ME. The purpose of the visit was to discuss steps that the Woodland mill has taken to reduce effluent discharges, specifically COD. Several years ago, the Woodland mill completed a successful COD reduction program. Mr. Scott Beal, Manager of Compliance and Technology hosted the visit to the Woodland facility. Mr. Jay Beaudoin, Superintendent of the wastewater treatment facilities conducted the tour and discussed the steps that the mill took to reduce COD from the pulp mill.

The Woodland mill of Domtar has a 1500 ton per day kraft mill that produces bleached hardwood kraft manufactured primarily from birch, beech and maple. The mill also has one paper machine that produces about 360 tons per day of reprographics paper. Much of the

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[5] Team members to visit the Domtar-Woodland paper mill were John Cronin and Ben Leber of IP, Chris Rasher of the EPA and Joseph Genco of the University of Maine.

hardwood kraft pulp is sold on the open market and within the Domtar circuit. Pulp production has been cut back to about 1000 tons per day because of poor market conditions.

Control of COD Discharges at Domtar-Baileyville

A strong effort has been made to control spills and monitor COD going to the sewer. Among the items the group found most interesting were the following:

COD Measurements. COD is measured at 12 mill sewers on a daily basis. This information is compiled into a mill report and disseminated widely within the mill.

Conductivity Measurements. Conductivity is measured in ***'many'*** sewers on an ongoing basis. This information is used by the operators to detect spills and to take corrective action.

Operator Training. Operator training has been an important part of the program to control COD in the mill effluent. Operators are trained to react quickly to high conductivity readings in the sewer as an indicator of spills.

Accountability. A strong system of accountability is in place in the facility to control spills. The supervisor is held accountable for discharges from his/her area of the mill.

Comparison of IP Jay to Domtar Woodland

Considerable operating data was given to us in the form of daily environmental reports. John Cronin, manager of the IP wastewater treatment facility, is preparing a summary table comparing discharges from both the Woodland and Androscoggin mill sites for presentation at a future technical team meeting.

The IP mill extended an invitation to personnel from the Domtar facility to have a reciprocal tour of the waste treatment facility.

PLANS FOR EVALUATING THE IP SOFTWOOD MINI-OXYGEN DELIGNIFICATION SYSTEM

In the softwood mill, IP operates a mini-oxygen delignification system. Improving the oxygen system is attractive because the dissolved solids from the system are recycled to the recovery boiler. Thus, these solids, although very dilute, are used as a heat source rather than going to the bleach plant where they are discharged as COD.

O_2 Delignification System at IP-Jay.

Figure 6 illustrates the softwood "mini" O_2 delignification system at the Androscoggin mill. In this system, caustic is added to brownstock kraft pulp in a standpipe following the brownstock washer. Steam entry prior to the reactor has been discontinued. Rather, hot wash water is being added in the brownstock washer to raise the temperature of the pulp. From the standpipe, the pulp is pumped with a medium consistency pump through a high shear mixer and through a pressurized reactor with a residence time of about 15 minutes. The pulp then is brought to atmospheric pressure in a blow tube and pumped through an atmospheric tower and then washed in post-oxygen washers. Process conditions and system performance data are summarized in Table 4 for the time period of February 11 through February 14, 2002.

Table 4. Process Data for Softwood Delignification System
February 11 Through March 14, 2002[a])

Item	Prod. Rate (BDT/day)	Stock Cons. In MC1 Pump (%)	Mid-Tower Temp of O2 Reactor	Stock Temp to O_2 Washer (F)	Stock pH From O_2 Washer	P# Stock from BS Washer	P# of Stock from Decker	Kappa # of Stock from BS Washer to O_2 System	Kappa # of Stock from Decker	% Delig
Average	570.6	9.6	176.3	164.6	11.7	19.3	13.8	27.9	20.3	26.9
Sdt. Dev.	107.9	1.3	4.4	6.4	0.2	1.1	1.1	1.8	1.4	5.6
COV	18.9	13.9	2.5	3.9	1.3	5.8	8.0	6.5	6.7	20.7

(a) Data Set. The data base consisted of 352 data points over the time period.

The production through the system varied between 325 to 783 BD US tons per day with an average value of about 571 tons per day with high coefficient of variation (19%). Other data that appear to have a high coefficient of variation besides the production rate are the stock consistency in the MC pump (14%) and the percent delignification (21%). The percent delignification averages about 27% but has a high coefficient of variation (21%). Jeff Pike, pulp mill superintendent indicated that the fresh caustic addition rate is about 1.5%. The fresh caustic addition would not include the carry over to the system and caustic present from recycle of filtrates. Jeff Pike has indicated that the caustic going to the oxygen reactor has been measured and gives about 3 grams per liter NaOH which corresponds to about 2.7% caustic in the pulp in the reactor. This would account for the high pH in the stock coming from the oxygen stage washer (11.7).

Problems With Existing O_2 System

Several problems exist with the oxygen delignification system. Sometimes the medium consistency pump does not have sufficient capacity and has recently been replaced. This should permit higher pressure to be run in the reactor. The plumbing between the brownstock washer and the oxygen reactor is long and because of space limitation laid out poorly. Because of the poor piping layout, sometimes stock gets hung up in the chute feeding the standpipe. This necessitates that the operators dilute the stock unnecessarily and low consistency pulp is going to the oxygen reactor, and in extreme cases, by-passing the oxygen reactor altogether. It is suspected that during the transit of the pulp between the standpipe and the reactor, the oxygen is becoming disengaged from the pulp and has a chance to move to the top of the process piping, which results in insufficient oxygen in contact with the pulp. Sufficient steam was not available to raise the temperature of the stock much above 175°F going to the reactor. Thus steam injection, the normal mode of operation for an oxygen system, has been discontinued.

Methods Suggested For Improving System Performance

Major process variables that determine the extent of delignification are (1) the pulp consistency in the reactor, (2) residence time in the reactor, (3) the caustic addition rate, (4) the reaction temperature, (5) the amount of oxygen added to the system, (6) the pressure in the oxygen reactor, and (7) the degree of mixing of the oxygen gas with the pulp. In addition, additional lignin will be removed by leaching in the atmospheric tower. This will be determined by the residence time in the tower, the consistency, and residual caustic concentration.

Several possibilities have been suggested for possibly improving the performance of the oxygen delignification system. These include (a) improving the process piping between the brownstock washer and the reactor to avoid diluting the stock and by-passing the reactor, (b) adding a second mixer just prior to the oxygen reactor to remix the oxygen gas with the pulp, (c) adding hydrogen peroxide ahead of the atmospheric tower to perform an E_{OP} stage in the atmospheric tower rather than simply an E_O stage, and (d) raising the temperature and/or consistency going to the primary reactor.

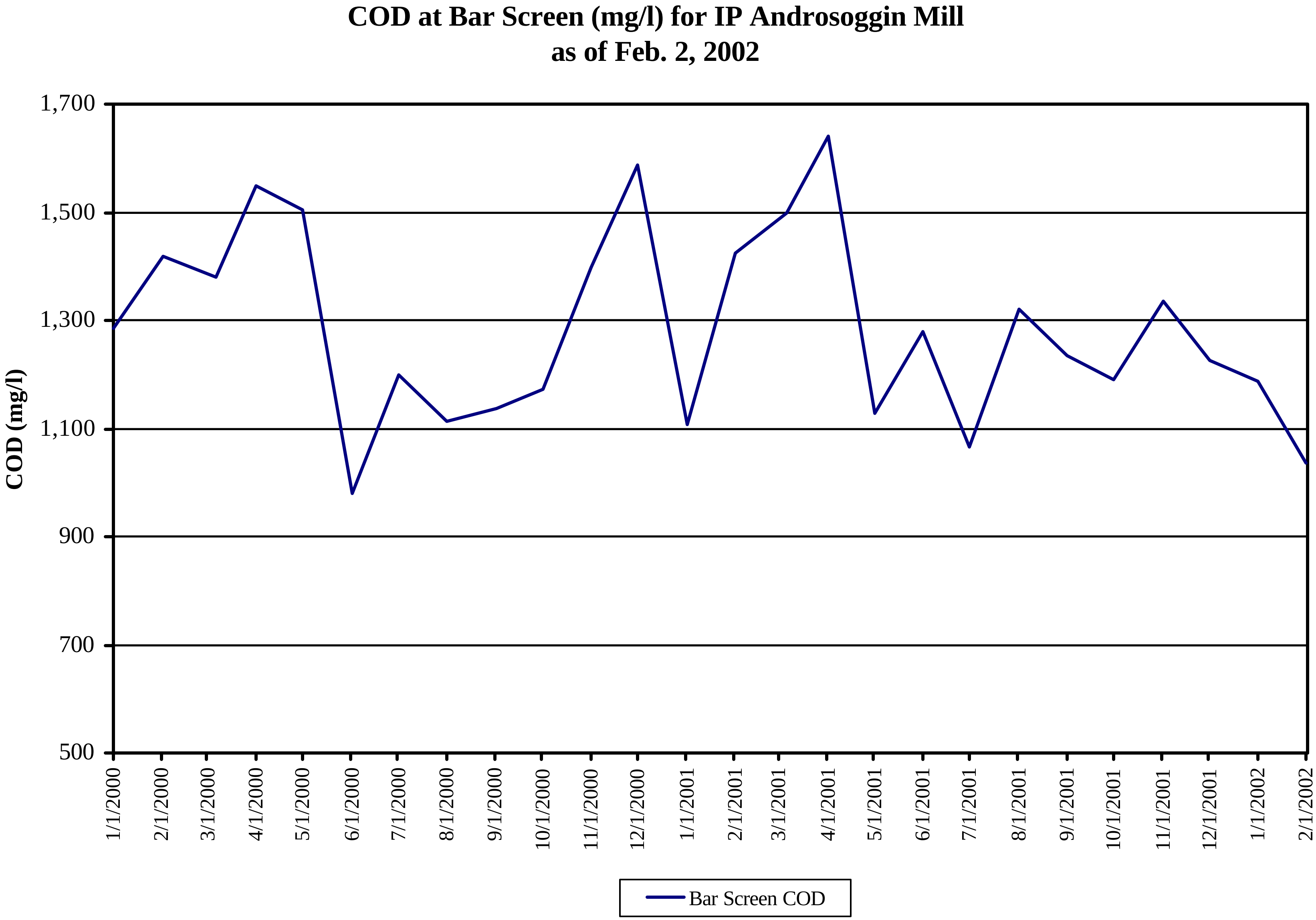
Oxygen Delignification Experiments

Experiments are planned to test the response of the IP softwood pulp to the major process variables that are known to effect oxygen delignification. These experiments are to be performed at the University of Maine. A preliminary experimental plan is shown in Figure 7. Experiments are planned to determine the effect of consistency, temperature, and caustic level in the reactor. Experiments will be performed to determine the effect of leaching in the atmospheric tower. A few experiments will also be performed to evaluate the idea of adding peroxide addition to the atmospheric tower, and whether chelating the pulp is necessary to control metals. Since the delignification experiments are performed under control conditions with a large excess of oxygen, it should be possible to determine whether the expenditure on a second mixer is warranted.

NEXT COLLABORATIVE MEETING

The next meeting of the Collaborative Team will be held at the International Paper Company mill in Jay, Maine on May 16, 2002.

Figure 1



COD at Bar Screen (mg/l) for IP Androsoggin Mill
as of Feb. 2, 2002
COD (mg/l)
1,700
1,500
1,300
1,100
900
700
500
1/1/2000
2/1/2000
3/1/2000
4/1/2000
5/1/2000
6/1/2000
7/1/2000
8/1/2000
9/1/2000
10/1/2000
11/1/2000
12/1/2000
1/1/2001
2/1/2001
3/1/2001
4/1/2001
5/1/2001
6/1/2001
7/1/2001
8/1/2001
9/1/2001
10/1/2001
11/1/2001
12/1/2001
1/1/2002
2/1/2002
Bar Screen COD

Figure 2

COD Data at IP Androscoggin Mill, Jay Maine
Data Complete to Feb. 2, 2002

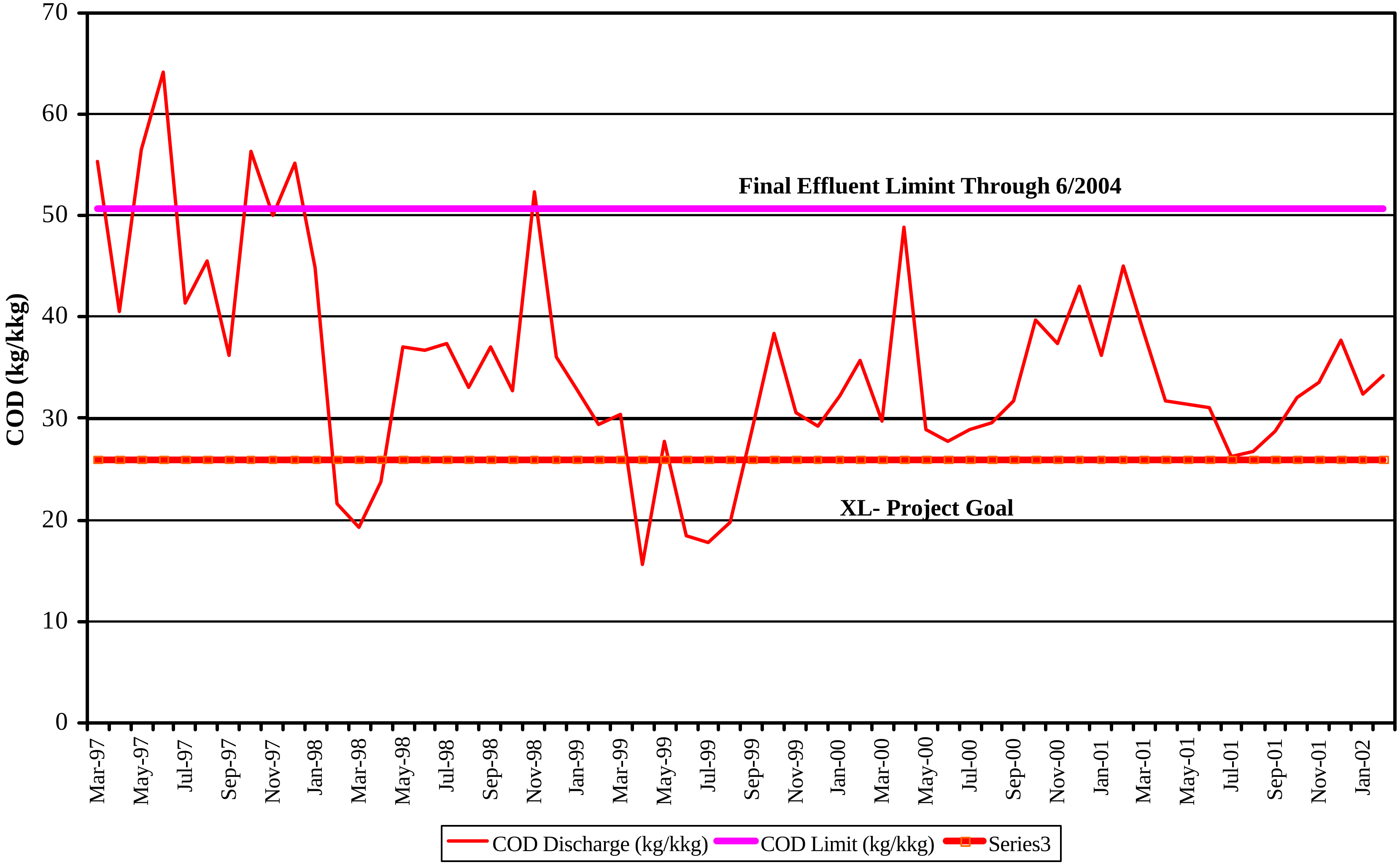


Figure 3

Removal of Total COD in the Waste Treatment Plant

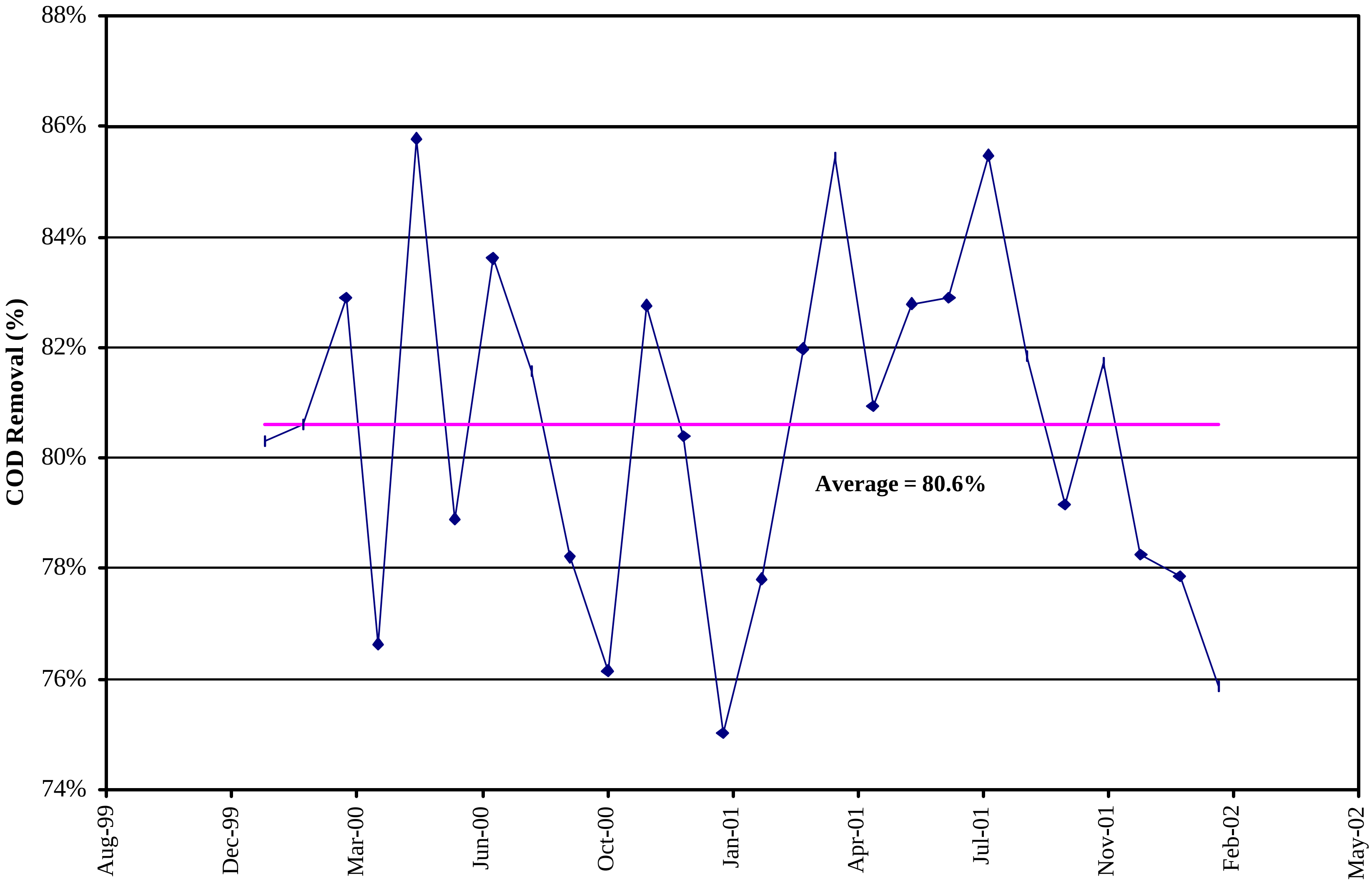


Figure 4.

Total and Dissolved COD in Mill Effluent

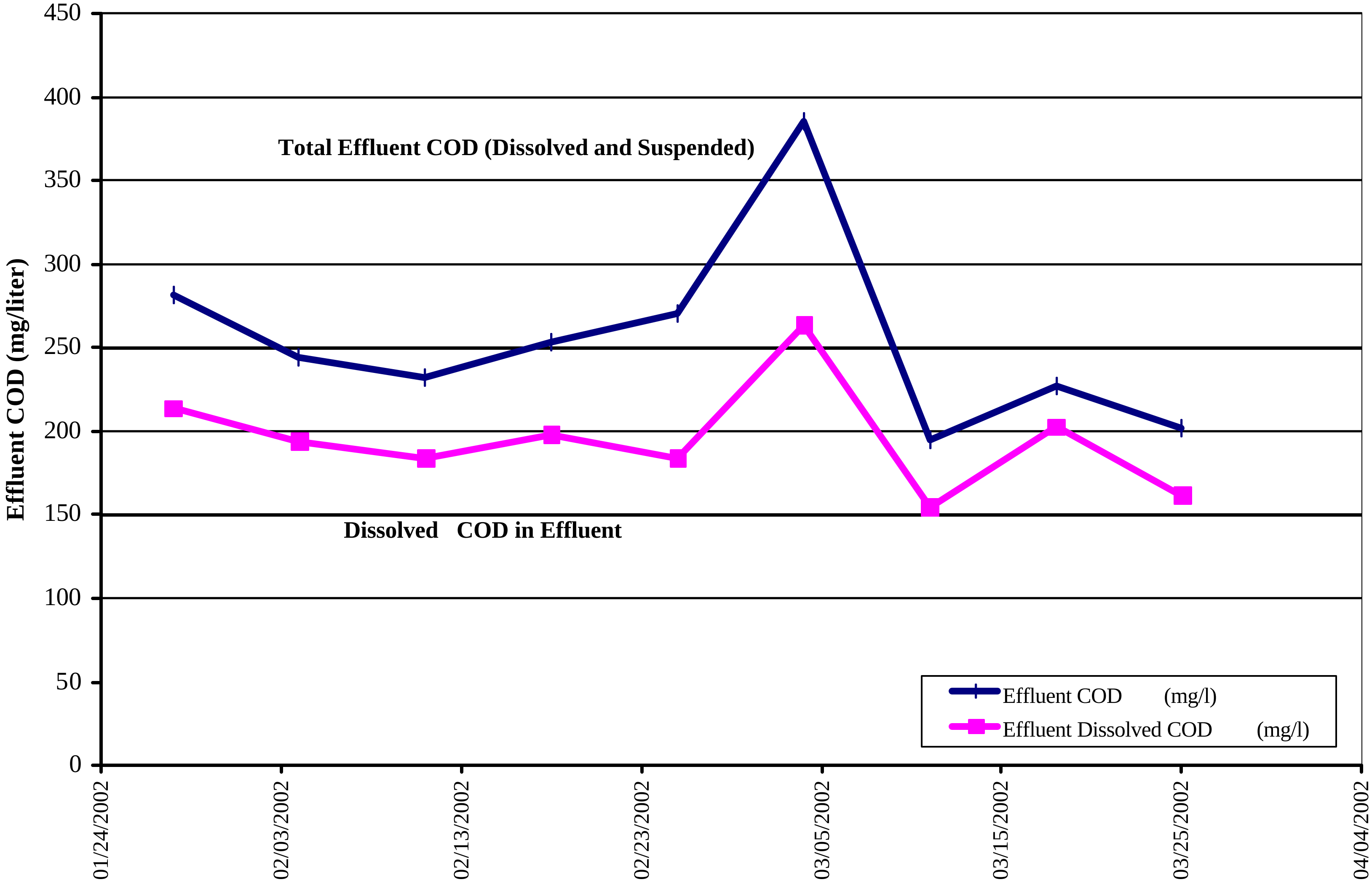


Figure 5.

Color in Final Mill Effluent, IP Androscoggin Mill, Jay, Maine - Data as of 4th Qtr, 2001

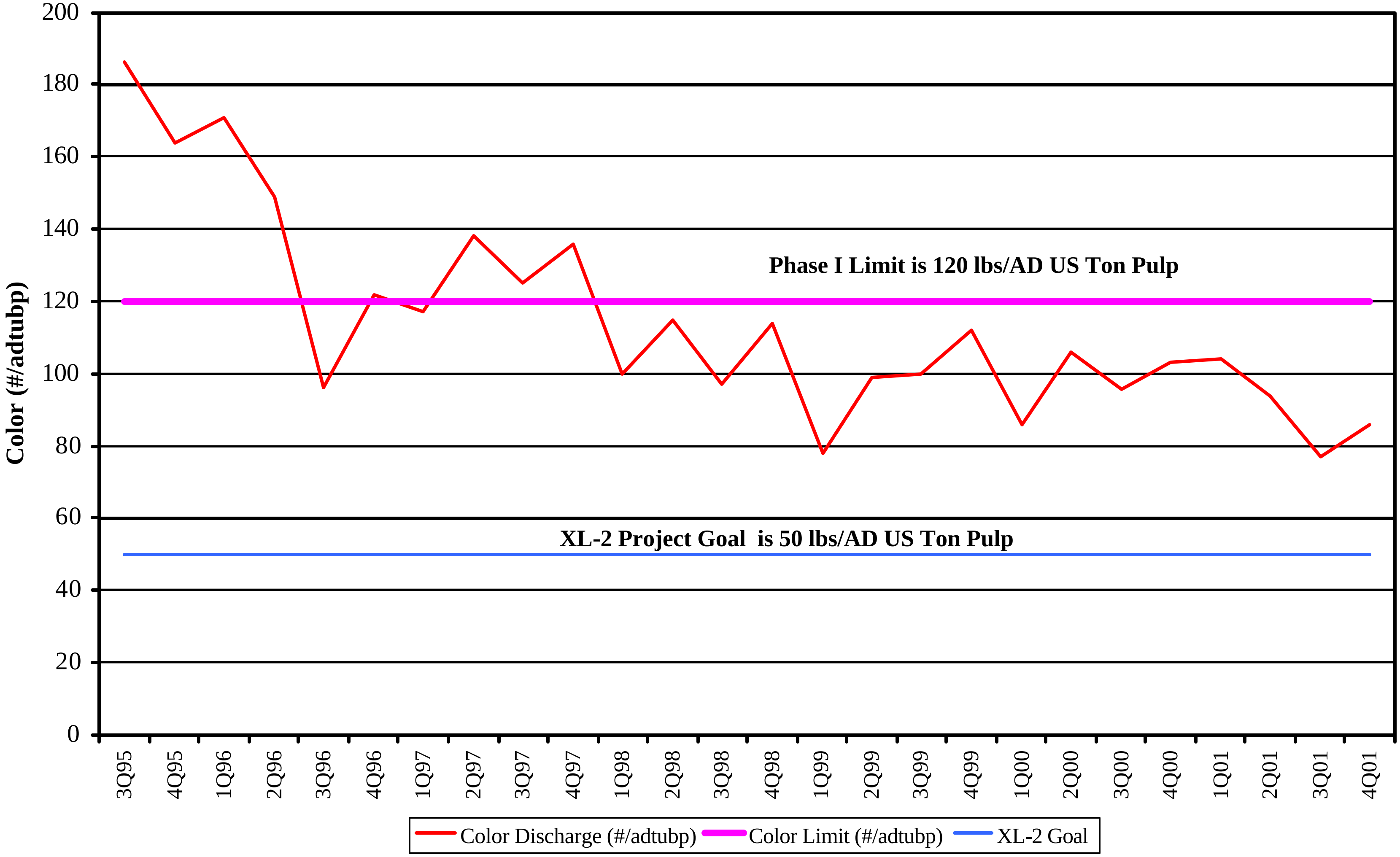


Figure 6.

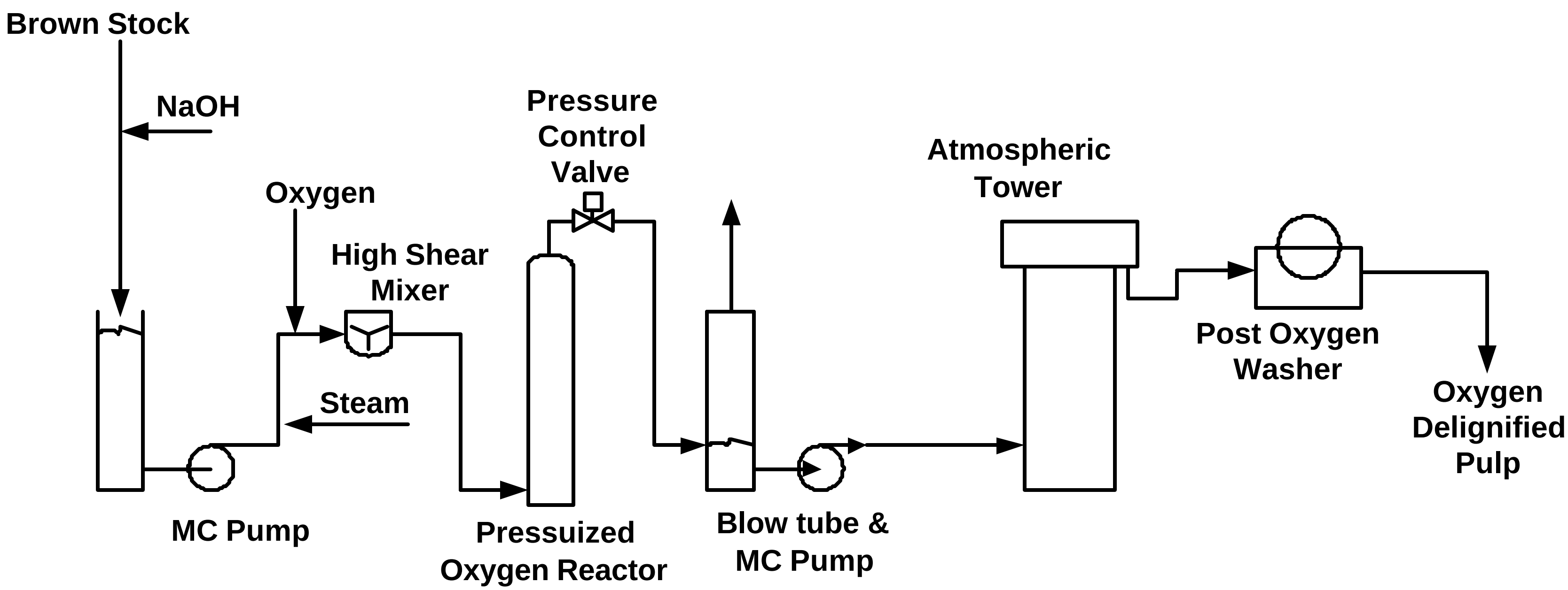
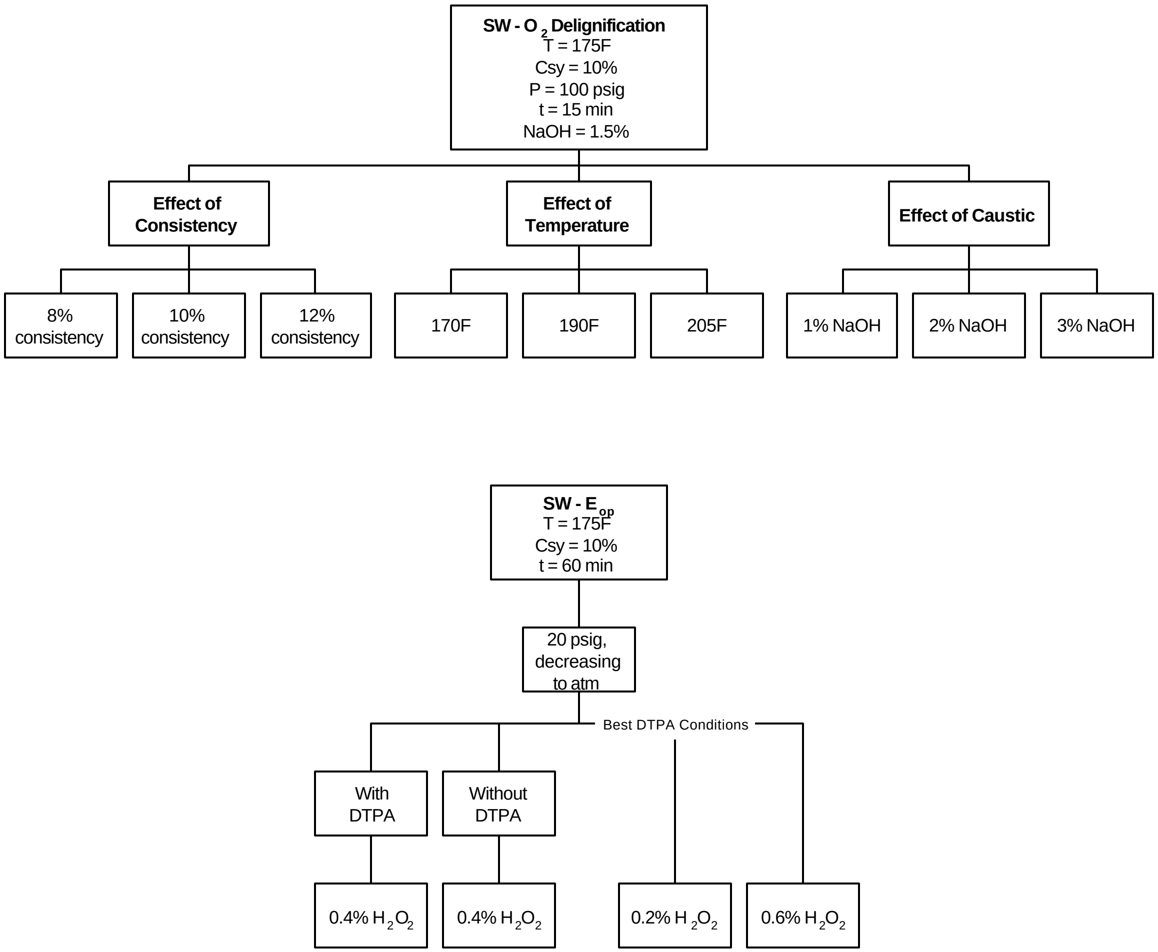

Brown Stock
NaOH
Oxygen
High Shear
Mixer
Steam
MC Pump
Pressure
Control
Valve
Pressuized
Oxygen Reactor
Blow tube &
MC Pump
Atmospheric
Tower
Post Oxygen
Washer
Oxygen
Delignified
Pulp

Figure 7.


SW - O2 Delignification
T = 175F
Csy = 10%
P = 100 psig
t = 15 min
NaOH = 1.5%
Effect of Consistency
Effect of Temperature
Effect of Caustic
8% consistency
10% consistency
12% consistency
170F
190F
205F
1% NaOH
2% NaOH
3% NaOH
SW - Eop
T = 175F
Csy = 10%
t = 60 min
20 psig, decreasing to atm
Best DTPA Conditions
With DTPA
Without DTPA
0.4% H2O2
0.4% H2O2
0.2% H2O2
0.6% H2O2