BLACK LIQUOR RECOVERY BOILER
ADVISORY COMMITTEE

MINUTES OF MEETING
Virtual Teams Presentation
October 6 & 7, 2020

OBJECTIVE

BLRBAC's objective is to promote improved safety of chemical recovery boilers and their auxiliaries through the interchange of technical knowledge, experience, and data on past and any future recovery boiler incidents.
Bylaws - 2.1

OFFICERS

Chairman:	**David von Oepen** WestRock Demopolis, AL	Cell: 334-341-7900 **david.vonoepen@westrock.com**
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Treasurer:	**Len Olavessen** LENRO, Inc. Bartow, FL 33830	Cell: 901-573-8343 **olavessen@aol.com**

REGULAR MEMBERSHIP

Organizations operating, manufacturing, or ensuring chemical recovery boilers are eligible.

ASSOCIATE MEMBERSHIP

Organizations having a direct interest or role in the safety of chemical recovery boilers are eligible.

CORRESPONDING MEMBERSHIP

Companies residing outside of the United States which finds it impractical to attend meetings on a regular basis because of distance and expenses, but desires to be involved and informed of BLRBAC activities.
Bylaws - 3.1

BLRBAC INTERNET ADDRESS: ---- www.blrbac.net
IRS Employer ID/Tax ID (IRS E.I.N.T./T.I.N.) ---- #13-366-5137

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FUTURE BLRBAC MEETINGS

With the uncertainty of the Restrictions in travel, Virtual meetings may be necessary.

Spring	**April**	**5, 6 & 7**	**2021**
Fall	**October**	**4, 5 & 6 tentative**	**2021**

"Bring Operator(s). Give them a chance to hear firsthand!"

Past Chairman Lon Schroeder

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* **NOTE:** For varying reasons, the previously published meeting dates have been changed at the discretion of the Executive Committee.

BLRBAC has established its own NEW website at: www.blrbac.net

At this website you will find a copy of past Meeting Minutes and the next Meeting Notice. Therefore, each Representative and Associate Representative is asked to inform their people of this WEB site. This is where they can obtain the following BLRBAC documents:

BLRBAC MEETING NOTICE

COVER LETTER	General Information
REGISTRATION FORM	Will be available on the website with a link to register and pay on line.
CROWNE PLAZA HOTEL	Blocked room dates, pricing, address, hotel phone numbers
SCHEDULE	List of subcommittee activities on Monday and Tuesday
AGENDA	Reports given to Joint BLRBAC Meeting on Wednesday
OPERATING PROBLEMS QUESTIONNAIRE	Mail/e-mail completed questionnaires to Bentley Sherlock. These will be given to the Vice Chairman and he will see that your concerns are brought up and discussed during the Operating Problems session at the next meeting.

These are available at the **BLRBAC INTERNET ADDRESS**: **www.blrbac.net**

BLRBAC Guidelines & Recommended Practices

LEGAL NOTICE

Recommended Good Practice For Design, Operation, and Testing of the Emergency Shutdown System for Black Liquor Recovery Boilers
(Dated: October 2018)

Safe Firing of Black Liquor in Black Liquor Recovery Boilers
(Dated: April 2016)

Materials & Welding Guidelines
(Dated: April 2013)

Safe Firing of Auxiliary Fuel in Black Liquor Recovery Boilers
(Dated: February 2012)

Fire Protection in Direct Contact Evaporators and Associated Equipment
(Dated: February 2016)

Personnel Safety & Training
(Dated: April 2018)

Application of Rotork Actuators on Black Liquor Recovery Boilers
(Dated: October 2005)

Boiler Water Management Guidelines for Black Liquor Recovery Boiler
(Dated: April 2016)

Instrumentation Checklist and Classification Guide for Instruments and Control Systems Used in the Operation of Black 9Liquor Recovery Boilers (Dated: April 2014)

Thermal Oxidation of Waste Streams in Black Liquor Recovery Boilers
(Dated: April 2017)

If you have any questions, contact:

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-- VIRTUAL MEETING --

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‡ = **Denotes attendance at last meeting, Sept 15, 2020**
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Registration List*

Due to technical difficulties, the list will not be provided in these meeting minutes.

MAIN COMMITTEE MEETING

1.0 INTRODUCTION – David von Oepen – Chairman

Okay, so real quick. Please remember that all BLRBAC subcommittee meetings including this session are held in strict compliance with BLRBAC Anti-Trust Policy. Discussion involving prices, pricing policy and a restraint on competition are not allowed. It is traditional for us to read that policy. The second order of business is to go over the ground rules for the meeting. This is a virtual meeting allowed attendees must refrain from taking pictures, photosand screenshots. Material deemed appropriate for sharing will be published in the meetingminutes.

Please keep your microphones muted. Scott will let you unmute if needing to speak. Chat message to the moderator with Scott Moyer, who did a good job yesterday as the ESP subcommittee moderator, will then allow you to on the cell and then you can ask questions or make comments. When speaking as always, state your name, and who you affiliated with. You can unmute yourself by using the *6 key. I am asking that everyone who is not a member of the Executive Committee to keep their camera's off. You can raise your hand with the hand icon and chat with Scott and Scott will pick up on that and then relay your message.

Real quick at the bottom of the screen, you can see the icons that are available for Microsoft teams left to right. Participant icon can see who is in the meeting, dialog box there, that is how you chat as one just right of that one, you got your hand that's it's just raise your hands and I've got something I want to say, Scott will see that and may stop and ask you to unmute.

Got that out of the way so will move into the meeting agenda for today scheduled for three hours. Introductions of the executive committee this morning will introduceourselves one by one. Again, my name is David von Oepen, I work for Westrock. and thechairman of the executive committee. Bentley Sherlock with Georgia-Pacific is the vicechairman on the executive committee. Len Olavessen with LENRO and is the treasurer.Everett Hume is the Secretary and works for FM Global. Jimmy Onstead works for FMGlobal and is the Insurance Representative. John Phillips works for Andritz and is the

Manufacturer Representative. Frank Navojosky with International Paper Co. and is the Operating Company Representative.

Okay, that's the Executive Committee. In looking at the participant list of this meeting and looks like we have a quorum of the member companies, so I'm declaring that we do have a quorum.

2.0 Old Business

ACCEPTANCE OF THE SPRING 2019 MEETING MINUTES – David von Oepen

The meeting minutes for the Fall 2019 BLRBAC Session have been posted on the Website. I am sure that everybody has looked at them. Does anyone have any comments regarding the Fall 2019 Meeting minutes? Can I get a motion to accept the minutes? We have a motion. Do I have a second? Anybody opposed? Alright, the Fall 2019 Meeting minutes have been approved and accepted as posted. Thank you very much.

Is there any other Old Business to bring to life? If not, we will move on to New Business.

3.0 New Business Report (Everett Hume)

New Members and Representative Changes. Your Executive Committee met at least a couple of times since the cancelled Spring Meeting. We have Five Companies that have requested Membership in the Associate Membership Category; Allied Cladding of Florida Surfatas out of North Carolina, Babcock Power out of South Carolina, Environmental Energy Services out of Connecticut. We have One Regular Membership request from Kruger Wayagamack out of Quebec. The Executive Committee voted to accept all these in the Associated and Regular Member categories. That's all I have.

We'll move on to the Executive Committee report.

4.0 Executive Committee Report (David von Oepen)

The Executive Committee met last week in closed virtual session to discuss the budget and Len will into more detail in just a few minutes.

There have been some significant changes in how we operate that we want to talk about. First, Barbara and Frank Holich have retired and are no longer providing meeting and Secretarial Services for BLRBAC. They have done a great job for the organization over the years. They have been around since the inception of BLRBAC. It takes a lot of work to provide for the registration services that they been doing for some of the years, typing of the minutes and getting all the materials gathered for our meetings. The Executive Committee wants to

thank them for the dedicated Services and love of BLRBAC, excellent participation in our meetings over the years and we wish them Good Luck in their retirement.

Whichever way you want to take a look at the Executive Committee has searched for and selected a new meeting planning company or service company called 'Metro Connections'. They will take credit cards. Registration both early and door, for in person meetings. Also, they will help with reading materials, badges and involved in the registration at in person meetings. We used them to register everybody for the Fall Virtual Meeting, which Was a smaller role than what we will use them for. Will hopefully have a plan to have a Face-To-Face meeting in the Spring if all goes well.

As for the Executive Committee, we did have a new member Frank Navojosky from International Paper Co. is accepted, Representative on the Executive Committee. He regularly brought his expressed expertise and experience in many of the other BLRBAC Meetings past and now he will participate on the Executive Committee. So, everybody welcome Frank and congratulate him on his big role in BLRBAC. Went on to Discuss,we have been notified by Len that he is planning to retire from his position as theTreasurer on the Executive Committee sometime next year. Len volunteered to be ourTreasurer the last 12 years and done a great job on the Executive Committee. Len's retirement will bea great loss for us.

The Executive Committee is looking for someone who is interested in becoming the Treasurer for the Executive Committee. Please let me know if you are a person thatwants to volunteer, or if you know of anybody that would fit that role, contact me byemail or anybody on the Executive Committee. Contact information is on the Website BLRBAC.net, but basically the treasurer is responsible for receiving all the funds for the meetings not necessarily personally, but through our organization. Currently the Metro Connections are depositing that money into the bank. They are responsible for paying any obligation that BLRBAC has. They prepare a report and budget for the receipts and expenses of BLRBAC in the also prepare a Budget or Each Fiscal Year. This is reported out on each BLRBAC Meeting the Fall and Spring. Treas. Will coordinate with a new accounting firm to prepare our tax returns from BLRBAC every year. So that is the duties of the Treasurer and again we are looking for some volunteers.

We are looking to getting an accounting firm to provide the Tax Preparation Services for BLRBAC, so that treasurer would just interact with the accounting firm to be sure that the tax returns are filled out and completed.

Also, in the closed meeting discussed the Website as most members know is not quite up to date. A lot of it is, but some of it is not. We have relied on the son of one of our members to keep it up, He has done a fantastic job for BLRBAC over the years. He is moving on in his career and is no longer able to develop the time necessary to keep it up. We are looking for volunteers. Are you good at creating websites and managing the site within BLRBAC? We are also looking outside BLRBAC for service that would help us develop a new website. Duties would include updating the website maybe five or six

times a year. Our BLRBAC website is out of date. Still functional but it is not very user-friendly to update. We are looking to upgrade the website. It will be an additional expense.

With all these changes and new expenses there will be an increase in the BLRBAC meeting registration fees, at least temporarily, and several unknowns we have to work through, still working out the details. Most of those are being worked out with the meeting planning services, Metro Connections. We are looking at getting a new accounting service to help us with our tax returns every year and the expenses of new website development and expenses related to that. We are proposing that the new registration costs goes to $300 for early registration and $350 at the door. Len will show us how we need to increase our balances against our expenses in his Treas. report, which is next. Just Another side comment if we do have another virtual meeting in the future there will be some fee associated with that. Are There Any Questions?

Okay and with that, Len can you give us the Treasurer report?

5.0 Treasurer's Report (Len Olavessen)

As David pointed out we had quite a few changes in our annual expenses because the Holich's decided to retire and we are a corporation, which means we need to do things a little bit differently, as far as accounting.

1. Checking Balance as of 10/07/2020: $20,998.54

2. Anticipated Expenses for rest of year: $12,000.00
   a. MetroConnections: $ 6,700.00
   b. ESP Secretary: $ 3,000.00
   c. Accounting Expenses: $ 2,000.00
   d. Credit Eqpt Lease: $ 300.00

3. Estimated Checking Balance End of 2020: $ 8,998.54

4. By utilizing MetroConnections to manage our meeting registrations, we now have the ability to accept on line registration payments by credit/debit cards; as well as at door credit/debit cards.

5. Meeting Statistics:
   265 Total Registrations

6. 97 Off Shore Attendees
   a. Finland, Chile, Sweden, Japan, Brazil, Canada, Germany, Austria, Australia, France, Thailand

7. No one has volunteered to take over the position of Treasurer. As a result, BLRBAC will establish an accounting firm to handle the financial matters of this organization, as well as our tax returns. That is why we have included accounting services expenses in the 2021 budget.

So, what that leaves us with, is a balance at the end of the year just under $9000. That is the lowest balance we had at the end of any year since I have been Treas.

Metro Connection offers us a lot of capability that we did not have before, which includes online credit card or debit card acceptance. They do the form, which we link on our website, so that you can apply for the meeting and pay for with a credit card or debit card. So that's a good plus for us. It's something that a lot of people have been requesting for quite some time.

This meeting we had about 265 registrations and 97 of them were out of the United States so that was a substantial increase over our normal face-to-face meetings where we typically see somewhere around 20 to 25 Offshore attendees. The reference to me retiring and slowly pulling out of the industry so I can start chasing after my bucket list is true. If we do get someone who is willing to be Treas., we are setting up the accounting firm so you know whoever does the job will not have to worry about tax returns or anything like that. I have agreed that I'll stick around until we make the transition. Hopefully, we will have a Face-To-Face meeting in the spring. That is the planning going forward. Any questions as to where we stand at the moment?

6.0 Secretary's Report (Everett Hume)

Regarding the website, we have made substantial progress. Bentley and I have been working to establish how to do this. I have been digging into some sources to figure out what the original process was, who set it up and who is responsible for it. As of this morning some progress has been made and by year end, we hope to have a new website.

When we shift our present website to a new platform, we may have to change our web domain name. Hoping to avoid this, but there is a chance this could happen. Be assured that we will make this change a seamless as possible for the membership. We are striving to make this a much cleaner, much, much more modern, and certainly much more up-to-date. So, keep your fingers crossed. We know stale websites tend to be a turnoff. We hope to fix that in the upcoming months on.

Not having a paid professional secretarial service at the moment is also going to have an impact on the speed at which document are completed and uploaded.

That is all I have.

MEMBER COMPANY ACQUISITION

MEMBERSHIP COMPANY STATUS CHANGES – None at this time.

*{**Secretary's Note**: The Company Membership List posted on the BLRBAC website may be out of date and not reflecting all the mergers, acquisitions, and name changes that have occurred. Anyone who sees something that needs changing should bring it to the attention of the BLRBAC Chairman*

7.0 SUBCOMMITTEE REPORTS

7.1 AUXILIARY FUEL REPORT – Bruce Knowlen

Minutes of the Meeting of the Safe Firing of Auxiliary Fuels Subcommittee, September 15, 2020

The meeting began at 10:05 AM CDT. BLRBAC's antitrust statement was read and guidelines were explained to manage this first virtual meeting.

A brief overview of BLRBAC, the SFAF subcommittee and its document history was provided for some that were new our meeting. We also took subcommittee attendance and introduced the members. We had 10 of the 11 members participating with about 35 guests.

The minutes of the last Meeting, held on April 8, 2019, were read and accepted.

For **new business**, a question was raised by one of the guests regarding any available training from BLRBAC to gain knowledge on recovery boiler operation to aid individuals while they were rising in organizations. The response was that BLRBAC did not supply specific training materials. The guest was referred to the BLRBAC documents and the other subcommittees to find a significant collection of topics for safe boiler operation. For recovery boiler operator training, materials have been complied by the American Forest and Paper Association and some vendors participating at BLRBAC that specialize in this.

A question was sent in by email from a person of an insurance organization regarding SFAF Item 7 on Table 11 "Audible Alarms and Visual Indicators Recommended for Auxiliary Fuel", page 61: FAILURE OF AUXILIARY FUEL TRIP VALVE TO CLOSE. The questions was whether the recommendation was looking for an interlock with a failure of a valve to indicate closed. If so, what would this interlock be? It was

explained that this table was addressing the needs for alarms and indicators to alert the operator that intervention may be called for. The document did not elaborate but input from the group suggested actions of manual valve isolation. If possible, logic could cause isolation at the header. Since this type of logical fault may involve anything from a signaling issue to an actual valve problem, the operator is called to investigate because of the alarm.

In another new business question, the subject of torches for spout clearing was raised. Should these be considered as auxiliary fuel firing equipment? If so, what would be the provisions for interlocks? Would they have to be incorporated into the main burner header and/or the igniter header? A review of prior discussions at BLRBAC on this was offered. The question was asked, should we add these torches as a subject in our document? It was decided that this should be a topic for our next meeting. [Note: Following this meeting, the SFBL document was shown to supply some direction in section 10.1 of their document. We will coordinate with them.]

Under **old business,** the recent completed review of Section 5.3, Other Audible Alarms and Visual Indicators, Table 12, pages 62-64 were discussed. This section in our document includes many references to subjects being handled by other subcommittees in BLRBAC. Our intention is to have many of these items adopted by the groups that manage these subjects. We plan to remove these entries to avoid future conflicts.

Next Meeting - The next meeting of the SFAF subcommittee is scheduled for 2021 in the spring.

The meeting adjourned at 11:55 CDT.

7.2 ESP SUBCOMMITTEE REPORT – John Andrews

(See ***Appendix A*** – Incident List)

The ESP Subcommittee met in closed virtual session on Monday September 29th, 2020 with 13 members represented. The Subcommittee met in open virtual session on Tuesday morning October 6th, 2020 with 13 members represented and about 105 guests.

During the open session, the Subcommittee reviewed 37 incident reports from North America and 4 International Incidents. These reports represent the full year of 2020 since there was no Spring Meeting. Of the 37 incidents, there was one Smelt Water Explosions at the IP mill in Bogalusa, LA and no Dissolving Tank Explosions reported during this session. Ten (10) of the reported leaks were classified as critical incidents and 26 were non-critical incidents. An ESP was performed in 7 of the incidents including 4 of the 7 critical incidents that

should have been ESP'd and the incident with the Smelt Water Explosion. Three of the critical leaks were identified during an outage while performing a hydrostatic pressure test.

The basic definitions of Explosions, Critical Incidents and Non-Critical Incidents were revised by the Executive Committee in September 1999. They are summarized as follows:

Explosions: Only if discernible damage has occurred. This does not include incidents where there is only evidence of puffs or blowback alone. With the new emphasis on damage, more attention will be given to the extent of damage and the amount of downtime for the damage repair (as opposed to total downtime that includes other activities).

Critical Incidents: All cases where water in any amount entered the recovery unit (or could have entered) forward of isolating baffles (and therefore would be a similar criterion to the need to perform an ESP). This includes leaks of pressure parts of all sizes. Since small leaks often wash adjacent tubes to failure, this category is important to our learnings.

Non-Critical Incidents: Those cases that did not admit water to the boiler cavity defined above.

Appendix A contains a summary of the incidents reviewed during the meeting.

Incident Locations

The incident locations are summarized as follows:

- 19 – Economizer
- 5 – Superheater
- 5 – Boiler Bank
- 3 – Screen
- 1 – Upper Furnace
- 2 – Lower Furnace
- 2 - Penthouse

The general locations of the leaks for boilers in North America are shown in Figure 1, which displays a typical boiler, not representing any particular style or model. The yellow circles are the non-critical incidents and the red circles indicate the location of the critical incidents. One of the critical leaks are shown in the economizer section where it would be possible for water to get into the furnace through the generating bank since there are no solid baffles to stop the water spray. The black dot represents the location of the leak for the smelt

water explosion that was where the rear wall tubes form a screen behind the superheater and ahead of the generating bank. The tube sheared off due to fatigue and there were two other leaks in the same location as shown by the two red dots above the black dot.

The attached bar graphs (Figures 2 – 7) show the number of leaks reported by boiler location over the past 15 years in order to see if there is a trend in leaks occurring in a specific area. There does not appear to be any significant trend from any area during that time.

Incidents by Boiler Type

The incidents by the number of drums and the back end arrangement were reviewed. There were 11 incidents reported in single drum units and 25 incidents reported in two drum units. One of the incidents was in a three drum unit.

Four (4) of the reported incidents were in boilers with Cascade Evaporators and 4 of the units had a Cyclone Evaporator. Thirteen (29) of the incidents were from low odor units with extended economizers.

Leak Cause

The cause of the leak is a determination by the Subcommittee based on information in the reports and should not be considered the root cause of the incident. The breakdown is listed below:

- 9 – Mechanical Fatigue
- 2 – Thermal Fatigue
- 8 - Weld Failure
- 9 - Erosion or Corrosion Thinning
- 3 - Stress Assisted Corrosion or Stress Corrosion Cracking
- 3 – Mechanical Damage
- 1 – Flow Assisted Corrosion
- 2 – Unknown

How Discovered

Boiler Walkdown continues to be the major way leaks are discovered showing that operators maintain their diligence for leak detection. Twenty eight (28) of the leaks (76%) were initially indicated by operators during walkdowns. One leak was detected by Control Room Instrumentation observations, two were initially indicated by a unit trip and two were initially indicated by the leak detection system. Four leaks were discovered during Hydrostatic Testing.

Leak detection systems were reported to be installed on units in 17 of the incidents (46%). Two of the incidents reported that the leak detection system provided the initial indication of the leak and one confirmed the leak after subsequent evaluation.

Time to Initiate the ESP

The time to initiate the ESP system after the initial indication of the leak ranged from about 2 min to 6:20 hours. The incident with the long time between initial indication and the ESP was for a small leak that was hard to confirm. The median time from the incident reports that provided information on the timing was 20 min which is similar to recent years. The incident with the smelt water explosion took 33 minutes from the high furnace pressure trip to the smelt water explosion and subsequent ESP.

Incident Review

Figure 8 shows the Critical Incidents reported each year. There were 10 reported this meeting which is the total for the year. Figure 9 shows the history of Recovery Boiler Explosions showing the smelt water explosion reported at March of 2020 with the prior reported explosion in 2017.

Figure 10 shows the history of reported dissolving tank explosions with the last one reported in 2017. Following the recommendations from Section 10 of the Safe Firing of Black Liquor document would prevent many of the reported dissolving tank incidents that have occurred in the past and maybe there has been some improvement in smelt spout and dissolving tank operation as a result of these efforts.

Figure 11 the five-year rolling average which is back up to 0.4 indicating there have been two explosions in the last 5 years.

Figure 12 is a plot of explosion history per 100-boiler operating years. This is a statistical summary of the experience across the industry. The smelt water explosion experience has increased slightly to 0.47 explosions per 100 boiler operating years due to the explosion reported this year, but the total explosions, which includes all boiler explosions and dissolving tank explosions, decreased slightly to .85 explosions per 100 boiler years. The factor is calculated by a summation of all reported explosions since 1948 divided by a summation of the number of boilers reported in service each year during the same period. We have accumulated over 19,010 total recovery boiler operating years in the BLRBAC database for North America and have recorded 90 smelt water explosions with resulting damage to the boiler. We all need to continue to keep those trends going down.

List of Operating Boilers

The BLRBAC Boilers in Service Database currently has 180 active recovery boilers listed, 140 in the US and 40 in Canada with a decrease of one boiler in the US. In the US, the average age is 41.9 years and the oldest is 68 years. The average age in Canada is 42.3 years and the oldest boiler is 73 years which is a 1947 CE unit at Three Rivers, PQ.

The list is available on the BLRBAC web site. We urge you to look over the list and if there are any changes or corrections, contact Dean Clay at **dclay@bsimail.com**.

Learnings

There are several learnings and suggestions that come from review of the incident reports that may be of value for the industry. This is not a complete list but a few items that stood out during the incident review.

- Length of tube stubs when plugging tubes in economizer or gen bank should be minimized to prevent buildup at upper headers and possible steam blanketing at lower headers which may result in rapid corrosion.
- Feedwater O2 control is especially important in the useful life of economizers to prevent oxygen pitting.
- Consider adding economizers 25 -30 years old to strategic plans for replacement.
- Review economizer header feed tubes for proper flexibility and potential binding.
- Hydrostatic test of boiler should not be conducted until bed is sufficiently cooled, even for economizer leaks, because there may be unknown leaks in the superheater or furnace cavity.
- A central leak indicator screen should be developed in order to allow the operator to go to one screen to see all of his indicators of a possible leak. (Leak detection, Boiler chemical concentration and feed rate, ID fan speed, Stack temp., Steam FW differential, etc.). The screen should be reviewed at least every 4 hours.
- Review “Large Leak Logic” that closes feedwater control valve after a trip to make sure timing between low drum level and high furnace pressure trips are sufficient. High capacity feedwater systems may be able to supply large quantities of feedwater that would delay the time before a low drum trip level is actuated even with a large leak.
- Consider activating Leak Logic on either High Furnace Pressure or Low Drum Level
- All operators and management should be trained on Large Leak Logic and proper actions to take before opening FW valve.

- Consider having checklist for the operator to confirm the status of potential leak indicators prior to opening the FW valve after large leak logic activates. i.e. leak detection status, Steam/FW differential status, boiler water chemical status and feed rate status as well as operator reports of unusual sounds.
- FW steam differential alarms should be approximately 15% of MCR or 15-20K lb/hr above normal differential. Operators and management should be trained on proper actions to take. Alarm must be recurring so it will come back on if acknowledged but the differential alarm condition does not go away.
- Include scenario/table top drills for ESP situations in operator training.
- Train operators on leak detection system and alarms and proper actions when alarms are received, alarms must be recurring alarms
- All critical alarm settings should be known and documented.
- Alarm setting changes, process control changes should go through an MOC process. Alarm disabling should require a jumper tag. Jumper tag logs must be reviewed by the control room operator prior to all start-ups
- Critical trends (i.e. leak detection, Steam FW differential, Boiler cycles chemical concentration and federate, etc.) should be reviewed every 4 hours and logged.
- Areas at the top of the nose where the tubes bend out of the plane of the upper nose and turn vertical again (Sometimes called the rear wall screen area) should be checked to ensure the tube integrity in this area. Hangar tube attachments for units with this construction should also be checked.
- Train operators on the criticality of leaks in all sections of the boiler, internal and external, membrane construction and refractory imbedded tube locations, baffle locations, etc. to aid with the decision as to if water has the potential to enter the furnace or not, and to ESP or Not ESP. Show these areas on a boiler side view drawing that is posted in the control room.
- Determine normal time to restore drum level after a trip and include in training so operators recognize that extended time to recover drum level may indicate bigger problems. This can be determined from historical data.
- Be wary of Confirmation Bias (Three Mile Island) – better to assume the worst and prove that wrong
- Don’t go down “Rabbit Holes” just because something has been a problem in the past don’t ignore indications that there may be a different bigger problem.
- Mills should know the manufacturer recommended Sootblower pressure settings for the nozzle type installed at each location of the unit and have a system to ensure they are checked regularly (i.e. twice a year). Distance from the tubes being cleaned must be known to ensure peak impact pressures are not exceeded.

Incident Questionnaires

The Incident questionnaires are key to the operation of the ESP Subcommittee. We appreciate the good job that the mills have done in filling them out for their incidents.

Dean has updated the questionnaire in the past to be more interactive and should be easier to complete. There has been a problem with the Questionnaire form that is available on the web side so to get the latest Questionnaire send an email to Dean Clay at dclay@bsimail.com and he will send you the latest form that is fully functional. When you have completed the report, send the file to Dean Clay at **dclay@bsimail.com**.

Please remember that when you are adding pictures into the questionnaire document, it is best that you import the picture as .JPG files rather than cut and paste to minimize the resulting file size.

Figure 1

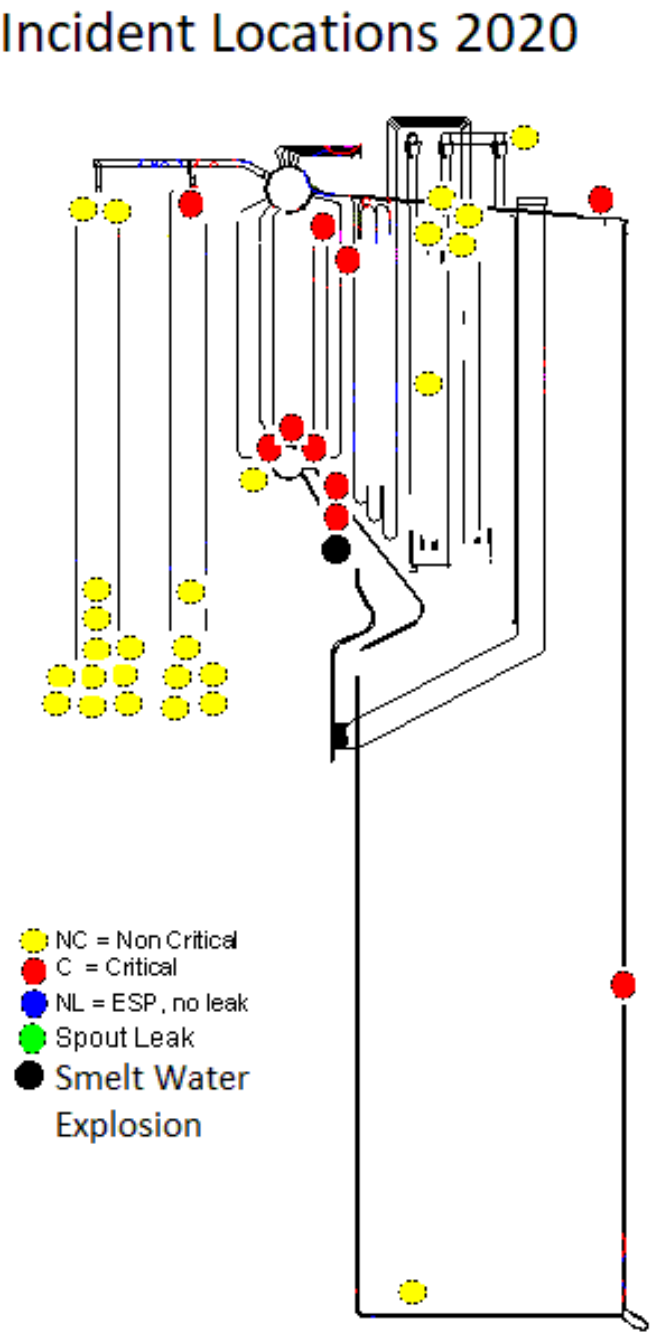
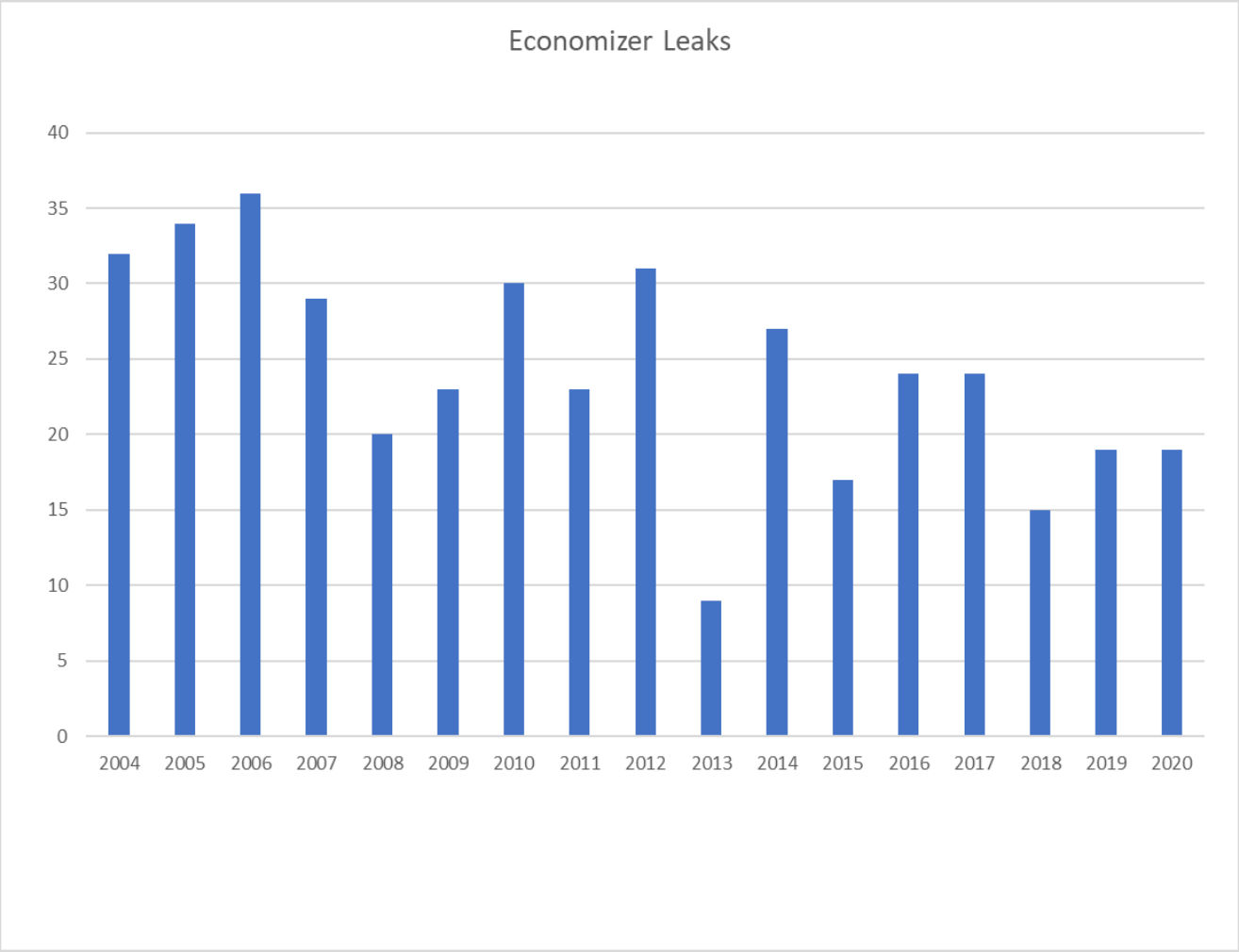

Incident Locations 2020
NC = Non Critical
C = Critical
NL = ESP, no leak
Spout Leak
Smelt Water Explosion

Figure 2


Economizer Leaks
40
35
30
25
20
15
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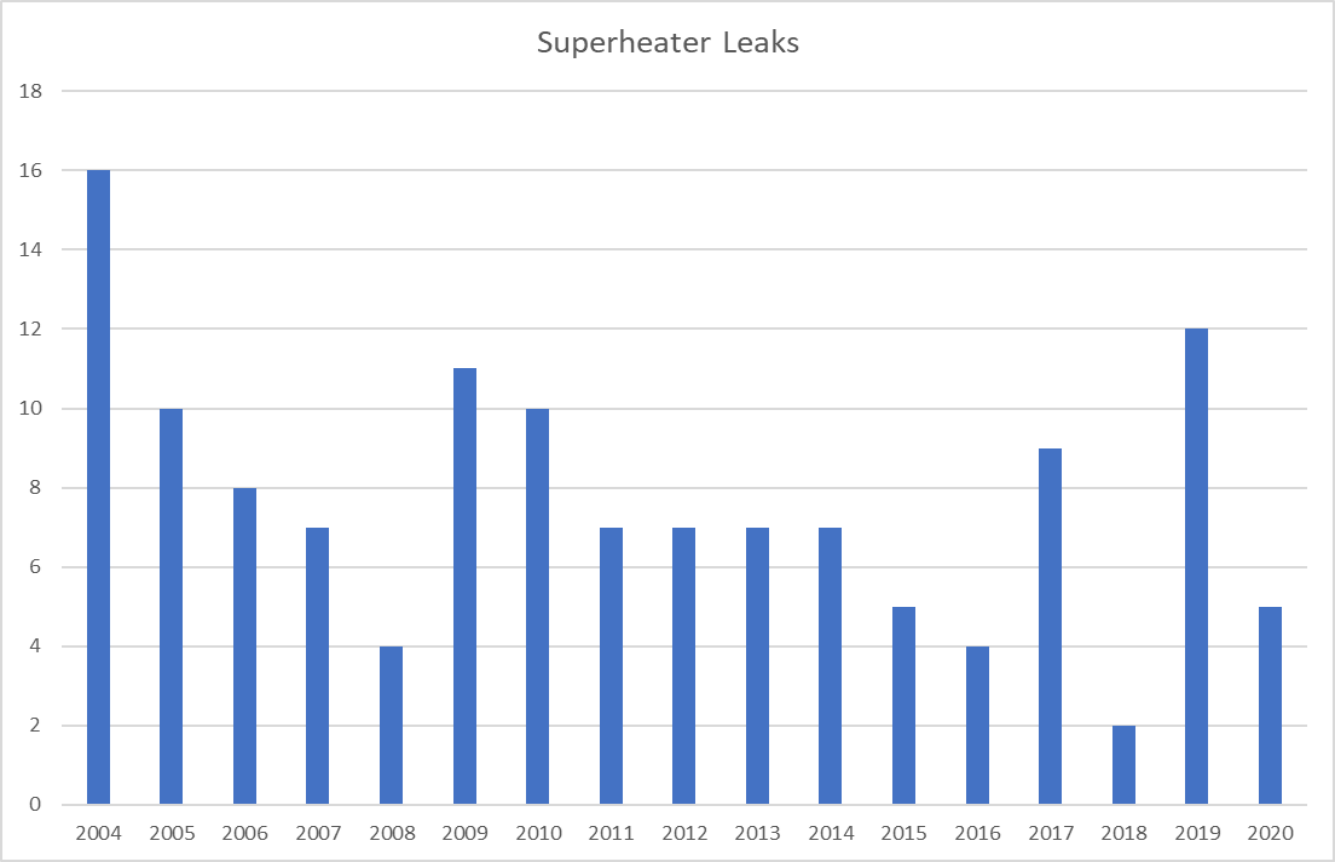
2020

Figure 3


Superheater Leaks
18
16
14
12
10
8
6
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2
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2008
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2010
2011
2012
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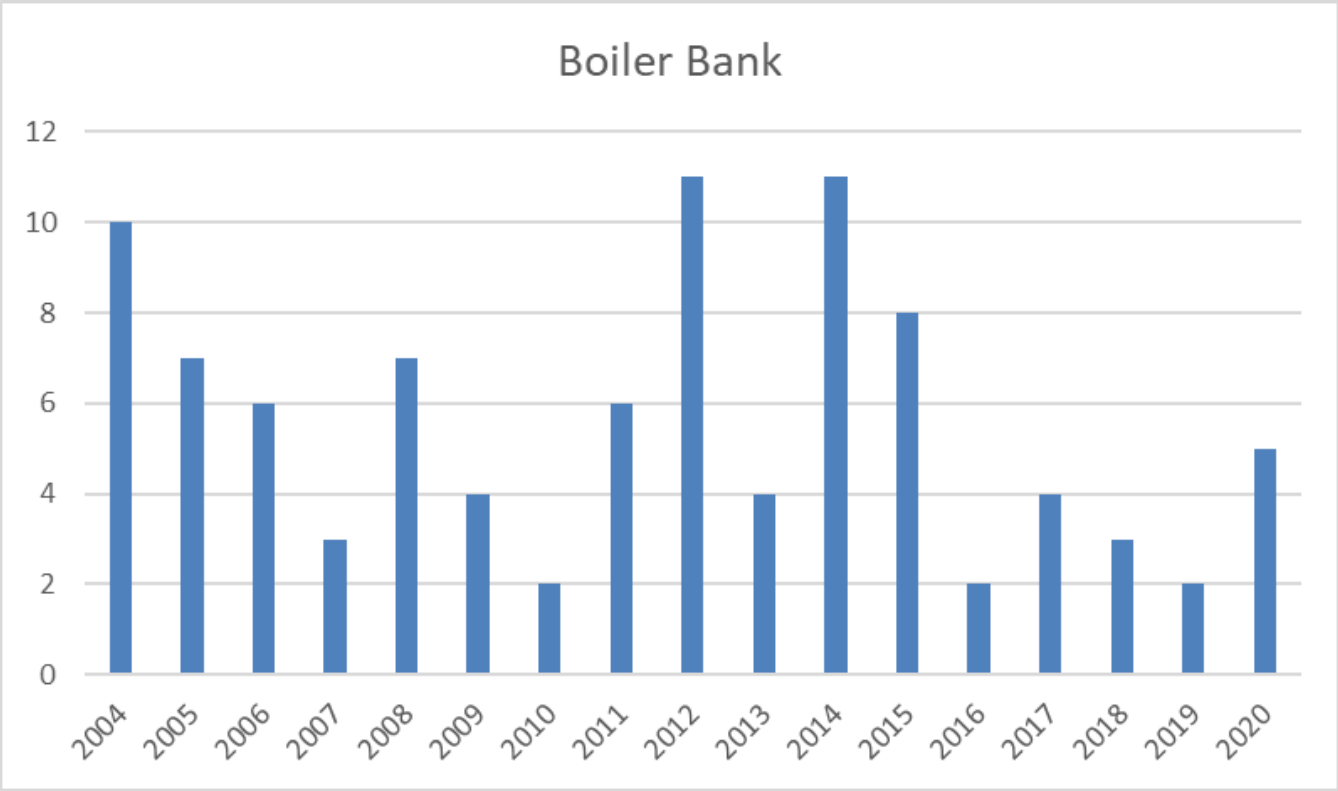
2020

Figure 4


Boiler Bank
12
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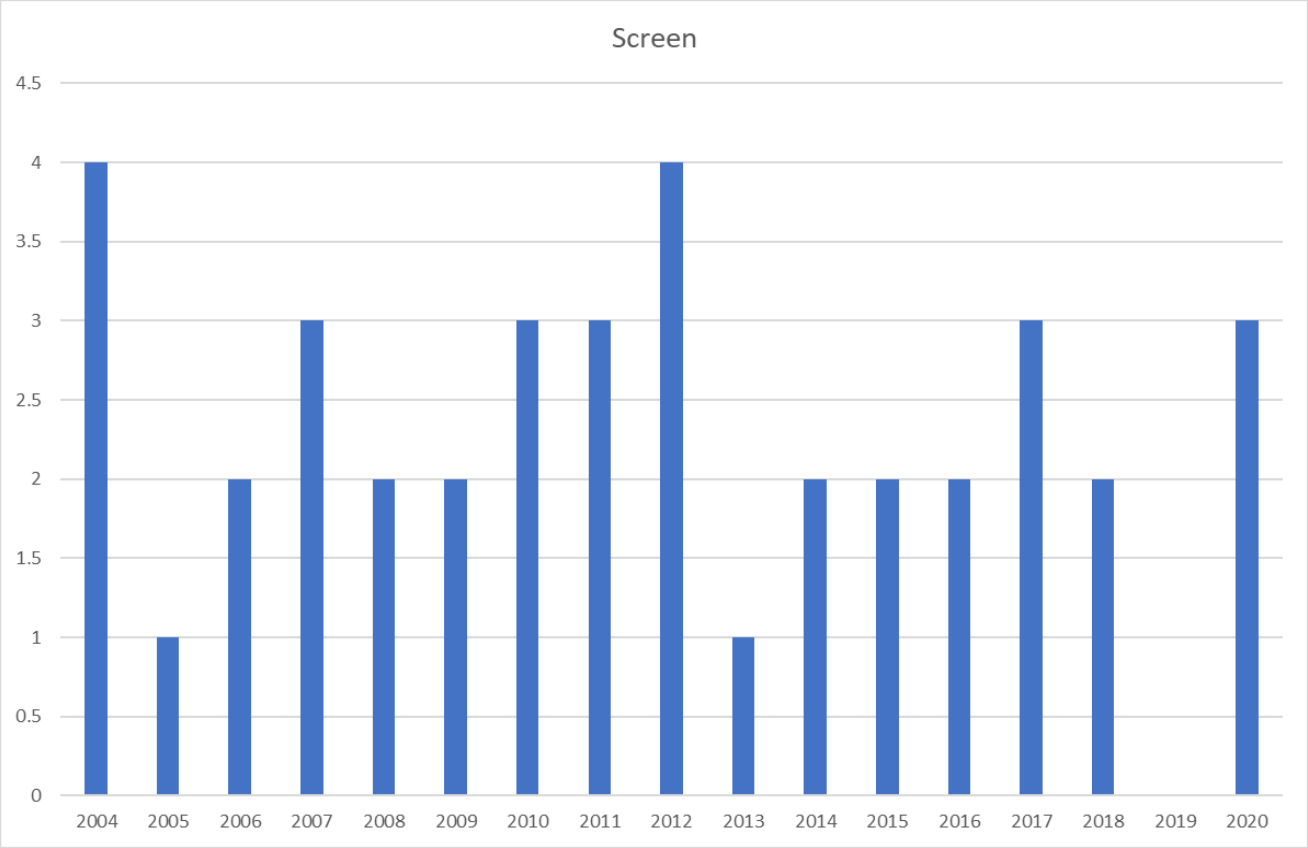
2020

Figure 5


Screen
4.5
4
3.5
3
2.5
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1.5
1
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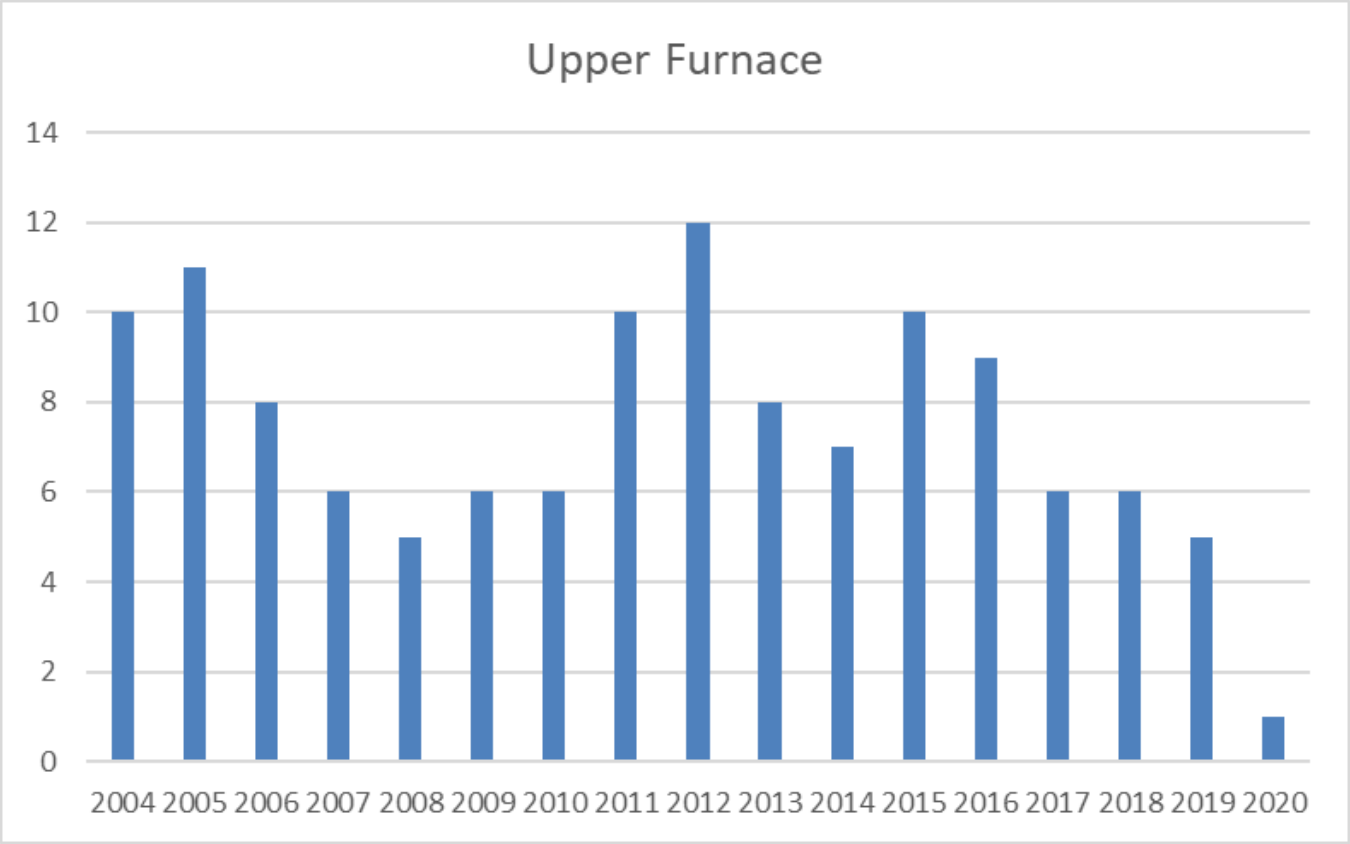
Figure 6


Upper Furnace
14
12
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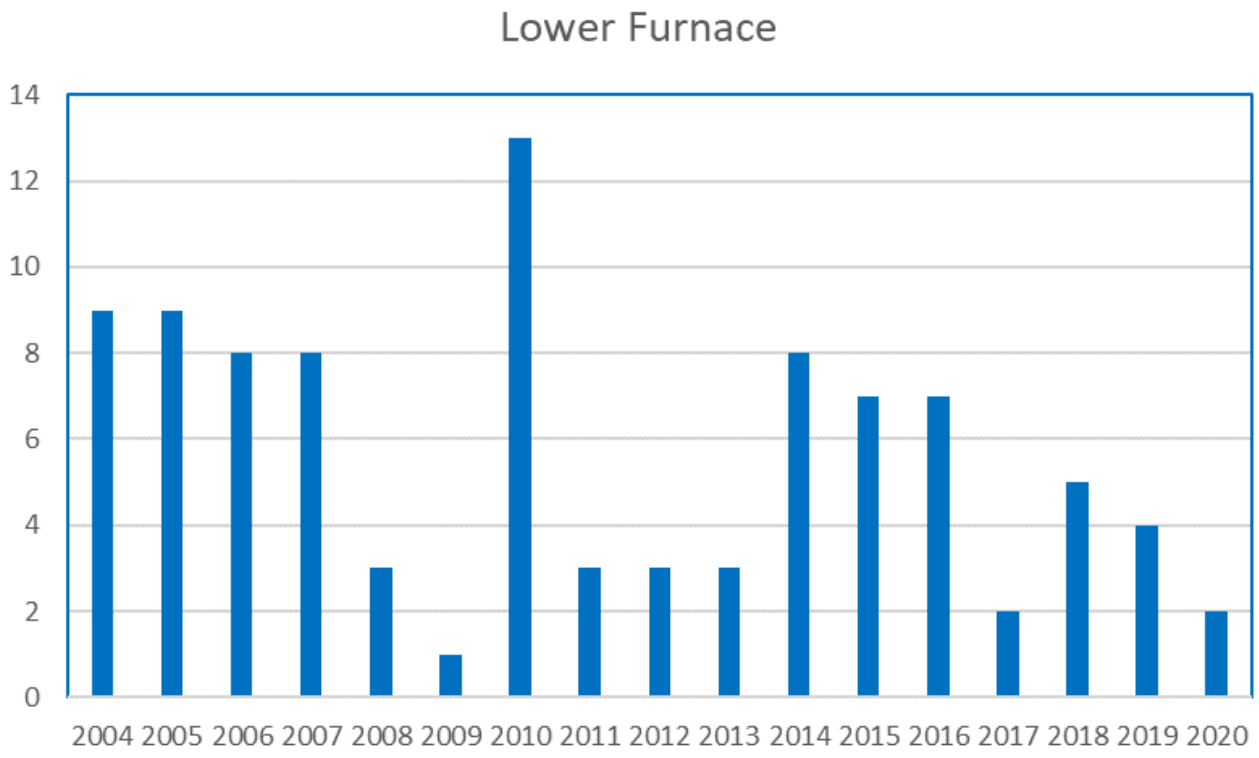
4
2
0
2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Figure 7


Lower Furnace
14
12
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2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

Figure 8
(Critical Exposure Classification Began in 1965, Changed to Critical Incident in 1999)

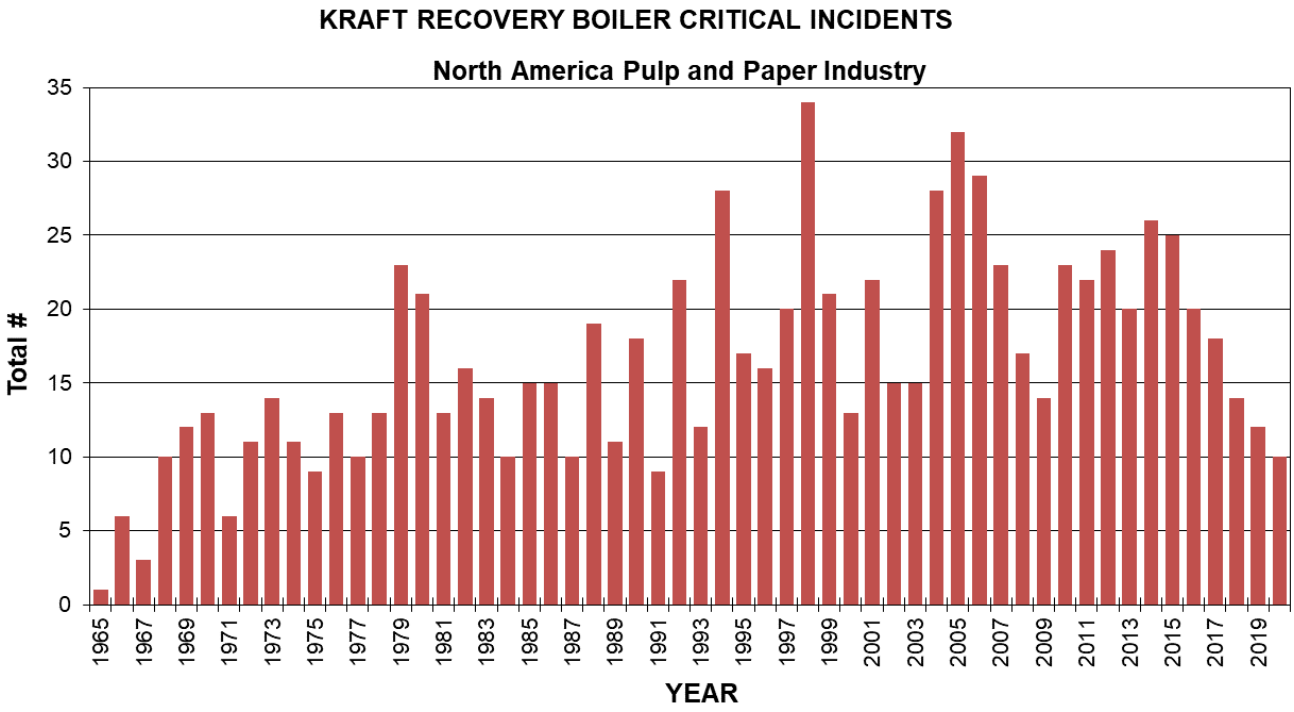

Figure 9

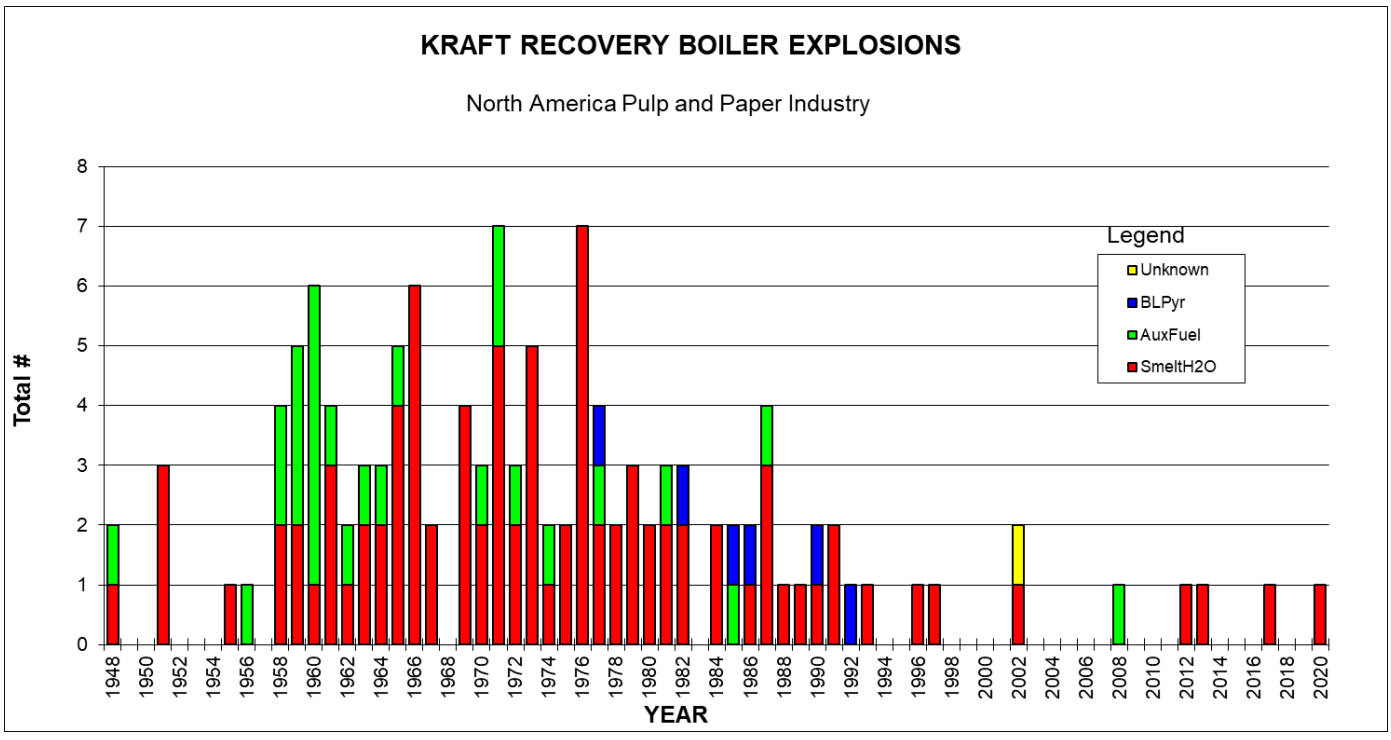

Figure 10

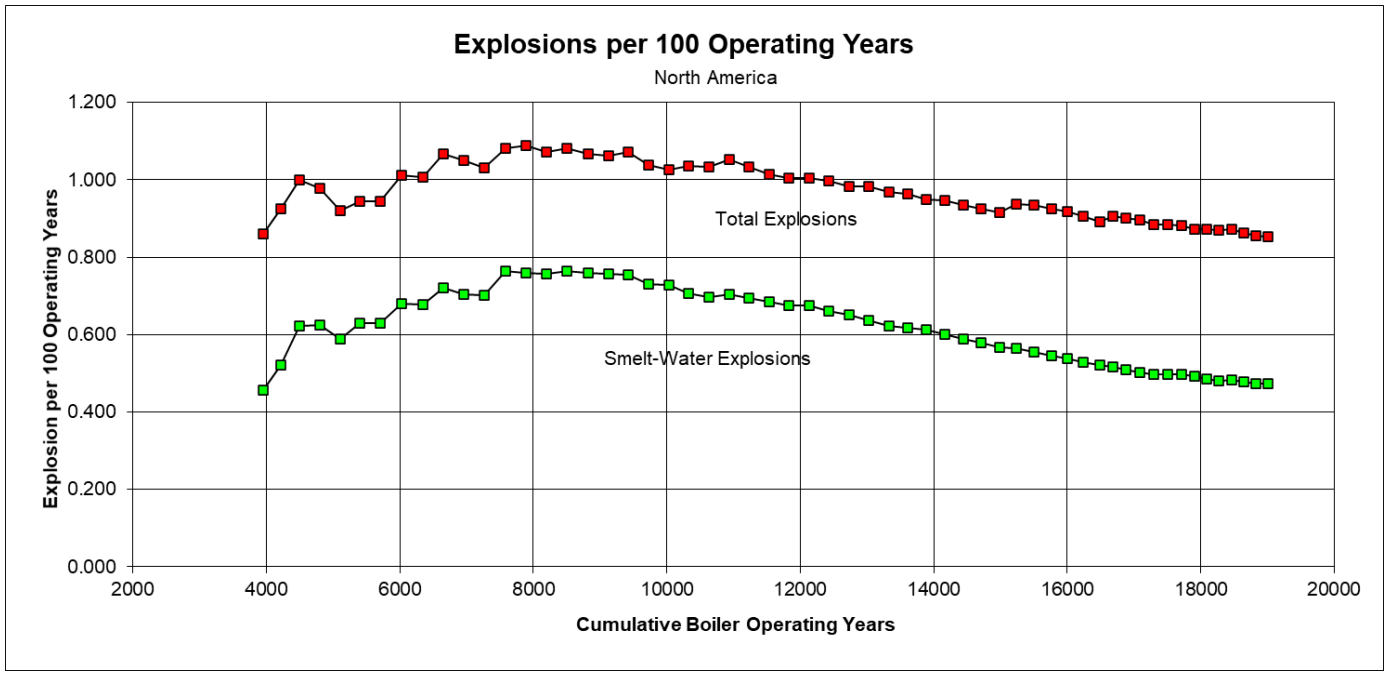
Explosions per 100 Operating Years
North America
Explosion per 100 Operating Years
1.200
1.000
0.800
0.600
0.400
0.200
0.000
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
Cumulative Boiler Operating Years
Total Explosions
Smelt-Water Explosions

Figure 11

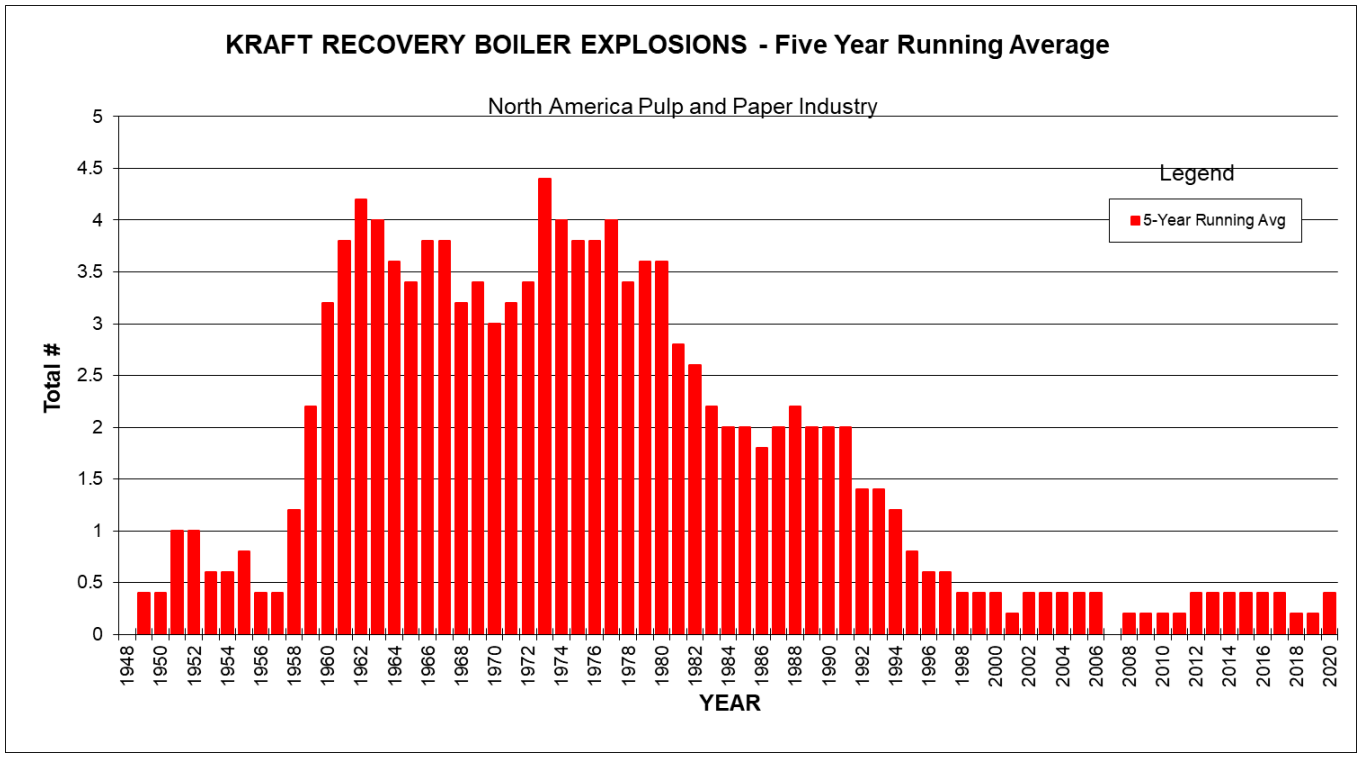
KRAFT RECOVERY BOILER EXPLOSIONS - Five Year Running Average
North America Pulp and Paper Industry
Legend
5-Year Running Avg
Total #
YEAR
0
0.5
1
1.5
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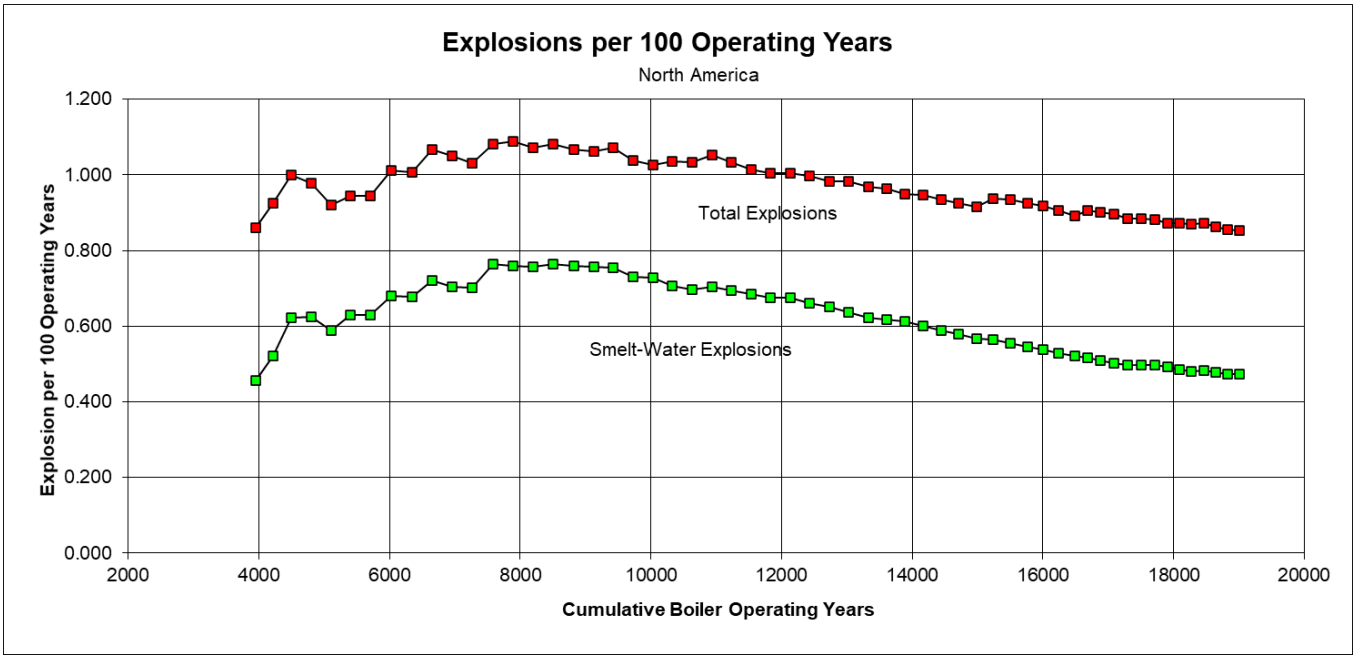
Figure 12



7. SUBCOMMITTEE REPORTS – (Cont.)

7.3 FIRE PROTECTION IN DIRECT CONTACT EVAPORATORS REPORT

September 16, 2020

This presentation is being done virtually via Webex Meeting

Meeting started at 9:00 Central Time

Introduction:

-Users please Mute and when speaking introduce yourself and your company.
-We have a facilitator
-Reading of the Anti-Trust Policy

Review of Minutes:

-Motion to accept. Second. Carried: Minutes Approved.

Outstanding Issues:

-Executive Committee did not review recommended guidelines due to COVID delays.
    -This will be reviewed during the spring 2021 Session.
-Does anyone have comments on how to keep fire protection nozzles open?
    -No additional comments. These suggested improvements will be submitted and reviewed as presented to the group.

Recent Events:

-2 Incident Reports Submitted and reviewed:

Mogi Guacu Incident:

-Key Takes:

- Power Outage Initiated the event
- Failure of UPS System isolated operators from operations on DCS/HMI
- Primary Protection of Cyclone was steam suppression
    - Due to power outage the steam header lost supply.
- Back-up fire protection was water based
    - Valve was fail safe Closed

-Discussion Ensued on:

-Should fire water valves should be fail-safe?

-Should we have verbiage specific to testing the fire water valve?

-Section 4.3 states "All Components" for fire protection

4.3 Inspection/Testing

Upon installation, the fire suppression system must be given a full system check. This should be done before allowing liquor into the unit. All components of the fire detection and suppression system must be functionally tested as a unit insofar as is practicable. Both manual and automatic methods of discharge must be used when performing this check.

The applicable National Fire Prevention Codes, the local construction codes, the OEM, and the Authority Having Jurisdiction should be referred to when choosing the scope and frequency of inspection. In any case, the system should be functionally tested at least every 12 months (every major outage). A program of alarm testing should be implemented that assures all relevant alarms are tested periodically. It is recommended that valve position checks, and water flow alarm tests be performed at least monthly.

-It was suggested by a committee guest (Bentley Sherlock) that "All Components" should include "*primary and secondary*" fire water

-We should consider changing all references to fire protection to include "Primary and Secondary, automatic and manual systems" This will be a topic of discussion in Spring 2021

session-Should have a bypass with manual valve that is in safe location.

4.1 General

Due to its ability to absorb heat, water is the preferred fire-fighting medium. Supplies of mill fire protection water are typically designed to be available regardless of plant condition. For these two reasons alone, a water spray system is the first choice for a suppression system protecting a Direct Contact Evaporator. Concern has been expressed about water spray initiating a smelt-water reaction during a fire. A properly designed system will initiate quickly enough, and bring the temperatures down far enough to preclude the formation of smelt. If molten smelt is not allowed to form, no reaction is possible.

Steam can be an effective fire-fighting medium, but loss histories indicate steam systems designed in the past were not effective because the limitations of the systems were poorly understood. Correct placement of steam injection nozzles and reliability of steam supply are crucial to a successful and effective installation.

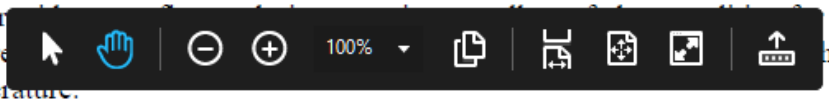
Current and accurate drawings of any fire suppression system should be maintained on site, and be available to control room operators.

Regardless of the style of suppression system chosen, manual activation of any part of the system must not require operators or Emergency Response Team (ERT) members to enter an area deemed unsafe during a fire in the Direct Contact Evaporator.

Regardless of the means of activation, a manual reset should be required of the fire suppression system.

It is recommended that to provide adequate suppression capacity, with maximum flexibility, one of the following combinations of fire suppression systems should be installed:

- An automatic water spray suppression system, which can also be activated manually.
- An automatic steam suppression system with no alternate steam supply, which can also be activated manually. This system should be backed up by a manual, pre-piped water suppression capability.
- An automatic steam suppression system with an alternate supply of steam, which will pr… the time requir… Alarm temperature.



Riegelwood Mill Incident:

-Key Points:

-Cascade wheel drive chain failure initiated the event.

-Required systems (fire water) activated

-Alarm happened and Deluge tripped automatically

-Dampers activated and fans tripped as needed by Master Fuel Trip

-Jason Hoffman: IP Riegelwood fielded questions about the event.

-They do have caps over the fire protection that blow off.

-Some have stainless cable that hold the nozzles so they don't get into the liquor system.

-System activates on an alarm (probe)

-Thermocouples into the precipitator activated the H-H activation of deluge and MFT

****Should we include verbiage in our document that has caps over the fire protection*** This will be a topic of discussion in Spring 2021 session

Q: What would have happened with fire system in a loss of power?
A: Valve is fail safe open and would have activated fire water on power loss
Q: Is there a manual valve for activation?
A: Yes on the 4th floor. This valve would be accessible during all fire situations.
Q: What is frequency of testing the valve?
A: Annual fire off the system. Not sure if there are monthly or more frequent tests:
(Jason will investigate testing frequency and get back to the committee)
Q: Should we have a more vigorous chain inspection program?
-Comment: Cleaning of Chain for inspection may remove lubrication which would create more issues. This might be a more site specific consideration. No Conclusion made.

Suggested Revisions Review:

-Reviewed Cascade Wheel Shaft failure NDE.
-We are suggesting that 3.7.6 be updated to include NDE language for the wheel shaft.
-Additional language was suggested and reviewed regarding the failure of wheel tube welds on the wheel is an indication of shaft failure.
-Motion to submit verbiage presented to executive committee offered, seconded, and unanimously approved with the subcommittee members.

Questions and Comments:

Q: Are we going to provide further guidance on the fail-safe of the valves and means to alternative means to operate the valves?
A: Our document does have verbiage in 4.1 for manual activation, and safe access during a fire situation. (see above snip)
--The issue came up again of having verbiage about fail-safe states. Should valve be fail safe?
No conclusion made. This should be a f/u item*
-Comment was made that activation of deluge should have a water flow alarm (4.2.1)
-Our document has verbiage about a flow alarm, but the instrumentation list does not:

4.2.1 Water

The following items should be considered when designing a water-based fire suppression system for a Direct Contact Evaporator:

- The system should be an automatic deluge type, with spray nozzles or open sprinklers.
- Any valves, which need to be manually operated to initiate fire fighting, should be located so that they are easily and safely accessed during a fire.
- The nozzles or open sprinklers should be installed at the inlet and outlet and within any cascade evaporator.
- The nozzles should be installed at the inlet and outlet of any ID fans located upstream of the precipitator.
- Nozzle orientation should be such that debris will not collect in or on them.
- Cyclone and separator protection can be provided by a secondary water supply to the wall wetting nozzles. A separate water supply flowing through the process nozzles is another option. As pluggage of process nozzles is a possible cause for the presence of dried solids, and increases the risk for a fire, a separately piped system may provide the more reliable protection.
- At least one nozzle or sprinkler should be provided for every 10 ft. (3 m) of enclosure or duct width between the outlet of the DCE and the inlet of the precipitator. The horizontal area protected by each nozzle should not exceed 100 ft^2 (9.3 m^2) The systems should be designed to deliver at least 0.15 gpm/ft^2 (6mm/min) of horizontal area. Nozzle positions in other-than-horizontal runs of ducts, should be placed to provide proper protection based upon duct orientation and process conditions. Unlike horizontal ducts, 10 ft. (3 m) spacing of nozzles may not be required.
- Water flow alarms should be provided with an annunciator in the recovery control room.

---Discussion on the Instrumentation Guidelines Section D

BLRBAC RECOMMENDED GOOD PRACTICE
Instrumentation Checklist and Classification Guide
for Instruments and Control Systems Used in the Operation of Black Liquor Recovery Boilers
Appendix A

D. FIRE PROTECTION SYSTEM

	Instrument or Control System	Major Function	Operating Modes or Techniques	I	II	Comments
1.	Direct contact evaporator temperature	Warns of high temperature and activates fire protection	High Temperature Alarm High High Temperature Alarm High High Temperature Master Fuel Trip High High Temperature Admit Smothering Media	X X X X		Refer to BLRBAC "Recommend Good Practice Fire Protection in Direct Contact Evaporators and Associated Equipment."
2.	Precipitator outlet temperature	Warns of high temperature and activates fire protection	High Temperature Alarm High High Temperature Alarm High High Temperature Master Fuel Trip High High Temperature Admit Smothering Media	X X X	X	Refer to BLRBAC "Recommend Good Practice Fire Protection in Direct Contact Evaporators and Associated Equipment" and "Recommended Good Practice for Safe Firing of Auxiliary Fuel"

**This should be a f/u item to see if the instrumentation table should be updated as failure to have this alarm resulted in an unnecessary ESP and operator confusion.
-No Further Questions.
Adjournment:
Motion to Adjourn: Seconded, unanimous, carried.
Adjourned 10:31 am Central Time.

7.4 INSTRUMENTATION REPORT –Dave Avery

The instrumentation subcommittee met in cyberspace via WebEx virtual meeting on September 16 at 1:00pm Central time. The meeting began with a welcome screen and participant protocols. An agenda was posted for the assembly outlining the proceedings. The next item covered was a presentation of BLRBAC's Anti-trust statement which was covered with the attendees.
A Membership Roll Call and guest attendance procedure was followed recording 10 members and 31 guest participants for this event. A reading of the fall 2019 minutes occurred with a vote by committee members to accept them as recorded in the fall 2019 BLBRAC minutes. The minutes were accepted as published.
Reviewed last meetings Rapid Drain Valve vendor issues with Rotork's IQ3 actuator selector switch fault condition where the "LOCAL / REMOTE switch has a dead area in between that may cause neither to be selected". This will cause the valve to hold existing position, regardless of commands. Rotork has since addressed this issue with a firmware revision "The solution has been completed but it is a small part of a major firmware upgrade that will be rolled out in the 2nd qtr. 2021. Once all of the various firmware changes are completed, then all of the 3rd party verification begins. This firmware update will be able to be installed in all IQ3 actuators in the field and the new ESD menu will completely bypass the selector (as we thought was already done)". Hopefully 2021 will bring closure to this problem.
A second look was given to the Proposed E&I Qualifications Statement with the objective to establish minimum guidelines for an E&I technician servicing a recovery boiler.

Qualified shall be defined as:

- Understands the recommended good practices of BLRBAC
- Understands the basics of recovery boiler process, operation, control and safety interlocking
- Understands the individual unique and specialized control equipment and systems associated with the recovery boiler such as the solids control, burner management, drum level control, etc.
- Has a working knowledge of all instruments associated with recovery boilers and location of all instruments and devices.
- Competent with the location, use, interpretation, and maintenance of supporting documents.

The following may be considered when determining the above qualifications:

- Understands proper calibration and testing procedures for these instruments
- Has a working knowledge of electrical circuits and relay systems
- Has a working knowledge of microelectronic control systems (DCS, PLCs, etc.)
- Has received basic E&I system "trade school' type training.
- Has received training on specialized systems as developed by the vendor.
- Has participated in an in-house type apprenticeship program.
- Has a level of experience that is commensurate with the importance of recovery operations
- Receives continuous and ongoing refresher training on existing systems as needed
- Receives immediate update training on any new devices or systems.

The Subcommittee agreed to resubmit to the executive committee for review and posting for a membership vote in 2021.
BLRBAC Instrumentation subcommittee Question/Inquiry Management Form was adopted the subcommittee to track our projects, define project scopes, informal and formal request. The form list who it is assigned to, schedule for completion (estimated) and most important the current status through its history. A copy of this form will be sent to executive committee for information sharing.
Revisited the BLRBAC vs NFPA-85 discussion – will submit to the executive committee for review and posting the proposed change to our document's **4.3 Recovery Boiler Safety Systems Applied to Burner Management** - "***For RBSS Burner Management System requirements, users and designers should consult the appropriate standards, codes, and guidelines such as BLRBAC, NFPA, FM, UL, etc***."
Update Drum Level guidance document chapter five is still under development and progressing A WebEx team meeting will be scheduled soon to keep the development of this Guideline on track.

Our final scheduled topic for this meeting was Automated **Interlock Monitoring (AIM)**
Sub-committee member Dave Boudreau gave a presentation for an innovative solution to verifying all interlocks. The solution includes a program that automates a person's actions of reviewing and documenting functional testing of interlocks. The solution offers a safety advantage and improvement of continuous monitoring to detect interlock malfunctions and can notify an Operator of such failures even prior to an unsafe operating condition. The program also collects historical data of which interlocks have been verified to common logic and which have been functionally tested. When combined with yearly instrument calibrations and field verification of final controlled equipment the solution increases the efficiency of verifying and tested all interlocks. A copy of the presentation was also forward to members and guest and can be shared with others upon request."

The meeting was adjourned 3:10 pm Central time.

Final thought while we are currently conducting our business in a different way for now our subcommittee has been and is ready to continue BLRBAC's mission we are here for you, thanks for your patience and looking forward to when we can see everyone in person.

7.5 MATERIAL & WELDING REPORT – Mike Blair

WEBEX SESSION:
The Materials and Welding Subcommittee met in Open WEBEX Session on Monday morning, September 24, 2020.

The meeting was opened with a review of the BLRBAC Anti-Trust Statement.

Attendance
6 members and 26 guests attended the webex session.

There were not enough members to reach quorum (6/17 < 50%), we therefore did not have a regular meeting. Rather, we held casual discussions regarding materials and welding experiences.

Old Business
No quorum.

New Business
No quorum

Members
No quorum

Document Development
No quorum

Presentations
Michael Blair (IP Technology) made a presentation "what's wrong with them pad welds", regarding recent findings after sectioning tubes from Recovery Boiler lower furnaces to examine water side condition of the tubes at pad weld locations.

Discussions

Shawn Driggers (IP Flint River) asked about applicability of Phased Array UT (PAUT) to thin walled tubes such as furnace wall tubes. Question from Dave Fuhrmann (M&M Engineering – Acuren) : thin walled sections or small diameter, the thin section of the materials does not allow much time for sound to travel through tubes,

so, this can reduce discrimination. Thomas Kapperman (ATS): Technology is more prevalent in the refinery industry, still in infancy with regard to power and paper industries. Much of the hardware is geared toward heavier wall piping. PAUT has many of the same issues as RT, directionality to X-rays or sound waves, may show a wide indication from one direction or a paper thin line from another direction. Still largely technician dependent as is RT.

Brent Bourassa (Clearwater) asked about use of PAUT for searching for SACC. Anecdotal discussions suggested that standard shear wave UT might be better to look for SACC around attachment welds, but you would have to know the configuration of the joint before hand to have the correct profile shear wave UT transducer shoes on site.

Dave Fuhrman asked if anybody had experience using laser profilometry to measure OD pitting. Nobody expressed experience. Mike Blair (IP Technology) discussed experience with using IRIS type technology with IRIS rigs that have traveling dams attached to IRIS UT head so that you don't have to floor entire tube. You do however have to cut out a dutchman above or below the area you wish to inspect to provide an opening through which to insert the IRIS rig. Or, the really old school technique, if you can not get a pit gage in to measure the pit depth, take a piece of play dough, press it onto the top of the tube, peel it off and measure the height of the impression.

7.6 **PERSONNEL SAFETY REPORT** – John Fredrickson

The minutes of the last meeting were read and approved by the Committee in a separate closed virtual committee meeting on September 15, 2020. During this meeting, committee members also provided input for the upcoming open meeting on September 17, 2020 including ideas on meeting protocol and content.

The Personnel Safety Sub-committee met in a "virtual" session on Monday, September 17, 2020. There were 8 members (out of 13) plus 32 guests in the virtual Teams session.

Representation at our meeting is captured by the digital tracking at the end of these notes.

The BLRBAC anti-trust statement was read.

WL Gore presented an update on high temp PPE (steam burn protection) and a copy of their presentation was emailed to all invited participants. Others interested in a copy can contact John.Fredrickson@sappi.com .

- Ketan Panse, Jim Ellis, Hailey Felts are contacts at WL Gore.
- Steam splash protection investigation - Gore has completed significant testing, but is still evaluating best PPE option to offer

The committee reviewed the concept of Significant Injuries or Fatalities as a subset of the injuries that are currently tracked (Recordable and Lost Time injuries). Contact John.Fredrickson@sappi.com for a copy of slides from this part of the meeting.

As a first step all agreed as follows:

- The committee will develop / prioritize a list of RB tasks with SIF potential based on experience. To get started, each operating company will share their list of tasks with the committee including example risk assessments if available. From that starting point, a prioritized list of tasks with SIF potential will be generated for consideration.

Open Forum

- COVID-19
  - Many outages occurring despite COVID-19 risks

- LTIFR trends in some companies have improved during the pandemic…Perhaps attention to COVID-19 is making people more aware of all personal risk and increasing attention to everything has improved?
- Manpower issues due to COVID?
  - Focus on social distancing, has caused some extended downtime
- How handling RB audits during COVID restrictions?
  - Remote records reviews, using Teams
  - Online audit meetings
    - Follow up with onsite review with smaller team at later date, possible same week
  - Extensions
  - Remote audit process is missing a very vital component that contributes to reduced risk – Collaboration, knowledge sharing, as well as training opportunities for new leaders and auditors.
- Need to consider alternate staffing options as well as alternate control station options in RB operating teams.
- Vendor POV – Mill requirements for outside contractors/consultants vary widely.

- Question was raised regarding effective firefighting techniques for a fire in a windbox? - no additional suggestions other than water hoses.

- Update on smelt PPE
  - Chicago Protective Apparel (CPA)
    - www.chicagoprotective.com
    - Contact info:
      - Dan Karp, Sales Manager
      - 3425 Cleveland St., Skokie, IL 60076
      - Cell: 847-564-0847, office 847-674-7900
      - Email: dan@chicagoprotective.com
    - Discussion of various fabrics – Repel, Marlan, Oasis
      - Testing data available from University of Alabama for charring, shrinkage, Adherence, Break Out, temperature increases, **time to second degree burn**, etc.
    - New face shield material option – nylon, in addition to polycarbonate (not recommended) and propionate.
    - Customizable designs for PPE (jacket with/without hood, coveralls, pants, radio loops, Velcro or snap closures, pockets, etc.)
      - CPA will bring fabric samples to mill for review, then develop garment that meets mill needs.
    - Options for other pulp mill chemical splash protection (layering of fabrics)
      - H2O2, BL, GL, WL, Sodium Chlorate, NaOH (50%), H2SO4 (93%)
      - Testing data available per ATSM F729-12 – all times acceptable (>15 min)
    - Glove options – inside of hand – leather, back of hand – CarbonX
    - Sold through Grainger, Motion, other distribution vendors

  - WL Gore
    - www.gore.com
    - Contact info:
      - Jim Ellis, Sean McDearmon
      - Multi-hazard garment contacts: Ketan Panse (410-506-5163, kpanse@wlgore.com), Mark Aboff
    - Vulcan buying opportunity:
      - All PO are non-cancelable and non-refundable
      - Orders must be placed by 10/31/19 and should be shipped by Dec 30, 2019 (depending on number or orders)
      - Debra Fitzgerald, dfitzgerald@wlgore.com, 410-506-5279

- Some sites have expanded use of Vulcan PPE around RB for maintenance folks, not just operators
- Vulcan is the only product on the market designed for smelt – it was mentioned that based on experience, others in the market "can work"

❖ Garment for pulp mill chemicals for protection – GORE-TEX PYRAD® multi-hazard garment
- Commercially available – designed for oil / gas industry known hazards.
- Gore would like to better understand broad range of threats/hazards in P&P to meet needs
- NOT FOR SMELT!!.
-

7.7 PUBLICITY & NEWS REPORT – Matt Paine

BLRBAC posted meeting notices on North American industry, such as TAPPI and Pulp[and Paper Canada. Committee continues with virtual meeting format.

Look to broaden the meeting notice to reach Europe and South American Mills

That's all I have, any questions?

7.8 SAFE FIRING OF BLACK LIQUOR REPORT – Vernon Blackard

SFBL Subcommittee Meetings – September 29 Tuesday 8:30 AM (CLOSED) and 01:00 PM (OPEN).

Agenda:

1. Open the meetings. Closed and Open.

2. Review BLRBAC Anti -Trust statement

3. Introduce members. 17 MEMBERS CLOSED AND 51 MEMBER AND GUEST OPEN MEETING.

4. Review and approved the FALL 2019 meeting minutes (NO MEETING SPRING 2020). APPROVED.

5. Reviewed draft document, approved and submit to Executive committee for review and vote next meeting. April 2021 Draft. Drop April 2019 draft from website. See best way to receive comments on the draft documents?

6. New Business –

Items brought up since last meeting.

- FM Guy brought up use of class one igniters instead of flame scanners being used more on RB Aux fuel burners. He wanted to know best way to confirm flame with Class 1 igniter. Several said the flame rods used on them where reliable for monitoring flame. Bruce Knowlen of Aux Fuel also said to check their subcommittee document for reference.

- FM Guy asked about dropping temperature in firing range requirement for black liquor header purge on high (>75% DS) firing. Some overseas mills reported to only alarm for low BL temperature. Have to have firing temperature to get viscosity in range so not really used. We will review our language to see if "OR" statement could be used.

- FM Guy asked about ways to check for possible spout leak on inserted pressurized spouts on the inlet end (cannot visually see leak). Len Erikson and Daniel Franco will work on for next meeting. Some discussion about losing normal range of 1500 spout cooling water conductivity as a trigger and more spout cooling water makeup.

- OSHA requirement for dissolving tanks and Swedish best practice of dissolving tank explosion designs that were presented from GP on Fall 2019 were discussed again. We will review and add discussion in our document for next meeting to vote on. Len, Zack, Sara, Wes, others to work on for next meeting. Discussed others such as AFPA also working on this one.

- Vernon and Joel Byrd will work on revising large tube leak logic after Bogalusa RB21 Event last March. Logic timed out and did not close feedwater control valve on that event.

- No luck loading some smelt water reaction videos in open meetings. WEBEX too slow.

7. CLOSE MEETINGS – CLOSED AND OPEN

7.9 WASTE STREAMS REPORT – Paul Seefeld (Kevin Sapp reporting)

The waste streams subcommittee held a virtual conference at 9:00 on Tuesday September 29th with 10 of 11 members present and 56 (virtual) guests. We read the anti-trust statement. The previous minutes from the October 2019 meeting were reviewed and unanimously approved. As this was a virtual meeting, we decided to provide time at specific points in the discussion to answer questions regarding any of the discussed topics and asked that everyone kept their video and sound off to conserve band width and minimize potential disruptions.

As this was an open virtual meeting with many new guests, the subcommittee reviewed the significant document changes and additions to give the group an outline of the direction of our work. The specific topics discussed were as follows.

- Liquefied methanol destruction
- Continuous igniter permissives
- Chip bin vent collection options
- Dissolving tank vent gasses
- BLOX and CTO vent gasses (in progress)

We completed our review of our chapter 4 modifications to include new sections for BLOX and CTO vent gasses. This required changing some existing section numbers to fit in new topics. The subcommittee is submitting the chapter 4 document to the executive committee for comments or approval. This was planned to be done in the 2020 spring meeting but was postponed. The highlighted changes are as follows

- Verbiage for fiberline oxygen delignification was clarified as to not confuse with black liquor oxidation
- Section 4.2.4 was added for Black Liquor Oxidation vent gas
- Section 4.2.5 was added for CTO acidulation sources vent gas
- Verbiage for DNCG automatic valve shutoff to boiler. We eliminated the requirement for an “automatic” double block and bleed. This was changed to a manual recommendation to assist with maintenance.

Figures 4 and 5 were reviewed. Figure 5 is complete and was submitted to the executive committee for approval in October 2019. Figure 4 needed to be updated to reflect the removal of the automatic double block and bleed valve as noted. Figure 4 will be modified and emailed to the subcommittee members for approval.

We also began the review process of figures 1 and 6. A question was raised by subcommittee member David Frazier regarding the position of transmitting devices on these two drawings and on figure 4. "Can you prove the permissives are satisfied before sending gasses to the boiler for incineration?" This review helped us find examples where instrumentation was represented downstream of the final block valve. There was a recommendation to relocate this instrumentation upstream of the final block valves on the appropriate figures. Similar to figure 4, figures 1 and 6 will be redrawn in Visio. We decided that initial changes are to be made and then the figures will be discussed and modified by the subcommittee during the next meeting.

We ended our discussions on the chapter 4 changes and figures review with no questions from our visitors. The meeting adjourned at 10:10.

7.10 WATER TREATMENT REPORT – Tom Przybylski (report out by Chris Baily)

Met online September 22, 2021 for a 3 hour virtual meeting. !3 of the 18 subcommittee member were in attendance along with 37 guests.

The anti-trust statement was read.

Don Flack will be retiring later this month. He nominated Pete Faulk of GP as his replacement. He was accepted into the subcommittee with no descent.

The meeting minutes from the last meeting were approved with a date correction.

The committee started with the discussion on the status of a chemical cleaning document. We decided not to vote on whether the document was ready to send to the executive committee for review. Instead it will be emailed to the subcommittee members for one final edits with a vote in the Spring 2021 session.

The remainder of the session was dedicated to sampling and testing document. We re-visited the entire definition section and moving those into the SOP guidelines.

Session was adjourned at 2:50 PM.

8. AMERICAN FOREST & PAPER ASOCIATION RECOVERY BOILER REPORT – Wayne Grilliot (See ***Appendix III*** – Slide Presentation)

The American Forest & Paper Association (AF&PA) Recovery Boiler Program was established in 1974 to help identify the root cause of recovery boiler critical incidents and explosions. The AF&PA Recovery Boiler Program assists companies in improving the safety, integrity, and reliability of recovery boiler operations. Recovery Boiler Program membership is open to all companies that operate recovery boilers. Program activities are funded by member company dues.

The Recovery Boiler Program is under the direction of a Steering Committee which includes Karl Morency (Georgia-Pacific), Frank Navojosky (International Paper), Jeff Wagoner (International Paper), and Wes Hill (Georgia-Pacific). The Steering Committee sets Program priorities based on Member Company Input, BLRBAC Incidents, and Industry Needs

The Recovery Boiler Program provides a forum for companies to develop information to help evaluate Safe Operating Procedures, Organization and Training, Maintenance Programs, Specifications and Construction, and Research & Development Programs. Documents developed by the Program include Reference Manuals, Audit Guidelines, Best Practices, Training Aids, Checklists, Textbooks, and Studies. The Program sponsors

R&D projects for Safety Improvements and Process Improvements. This helps drive improvements in Safety, Operations, Maintenance, and Recovery Boiler Integrity.

The AF&PA Recovery Boiler Program has two (2) Standing Subcommittees. The Operation & Maintenance (O&M) Subcommittee is Co-Chaired by Frank Navojosky (International Paper) and Wes Hill (Georgia-Pacific). The Research & Development (R&D) Subcommittee is Co-Chaired by Karl Morency (Georgia-Pacific) and Jeff Wagoner (International Paper). Subcommittee Membership is made up of Representatives from the Member Companies.

In 2018, the AF&PA Recovery Boiler Program was opened to all Canadian Mills that operate Recovery Boilers. We currently have 22 member companies in the AF&PA Recovery Boiler Program. Our membership currently represents 94% of USA and 30% of Canadian Chemical and Semi-chemical pulp production.

Both the Operation & Maintenance Subcommittee and the Research & Development Subcommittee are working to develop best practices around dissolving tank related issues. The Research & Development Subcommittee is sponsoring some very exciting research projects at the University of Toronto. The 4 projects focus on Dissolving Tank key operating conditions and advanced monitoring techniques to further improve safety and reduce operational risks. The program is building on past studies sponsored by the AF&PA Recovery Boiler Program and related research underway at the University, which is currently funded by a consortium of 26 companies. We are very pleased to have Dr. Markus Bussmann of the University of Toronto leading these studies.

Available documents on the AF&PA Recovery Boiler Website include Publications, Studies, Training Aids, Standards, and General Program Information.

AF&PA Recovery Boiler Program Website:
http://www.afandpa.org/our-industry/recovery-boiler-program

9. **TAPPI STEAM & POWER/ENERGY MANAGEMENT REPORT** - Energy Recaust Committee Chair

No report was given at this meeting.

10. **WESTERN CANADA BLRBAC REPORT**

No report was given at this meeting.

11. **ACTIVITIES OUTSIDE NORTH AMERICA REPORTS**

No report was given at this meeting.

12. **OPERATING PROBLEMS SESSION REPORT** –

CLOSING COMMENTS:

CHAIRMAN: David von Oepen: That concludes the Main Committee meeting.
Just a reminder that the next meeting of BLRBAC is going to be April 13& 14 2021. Our spring meeting will be either virtual or in person. If in person the meeting will be at the Crowne Plaza Hotel Atlanta GA.

I'll now entertain a motion to adjourn the meeting! Do I have a second? All in favor? Anybody opposed? The Main Committee Meeting is officially closed. Thank you for coming and we will see you in the spring. Have a safe week.

APPENDIX I
INCIDENT LIST
Recovery Boiler Incident Summaries FALL 2020

ECONOMIZER

FALL 2020-01

Classification: Noncritical
Co, Mill, Location: **Harmac Pacific, Nanaimo, BC**
Unit Data: RB#6,1963, B&W, 5315, Drums - 2, DCE - NO, Floor - Sloped to Front
Unit Size: 3.3 MMlb DS/day, 520000 lb/hr steam, 600 PSIG, 750ºF, 750 PSIG
Design **Incident Date/Time:** August 23, 2019, Earliest Indication: 8/23/2019 at 5 pm
Downtime hrs, leak/total: 53 hours
ESP? **NO**
Leak/Incident Loc: Primary Economizer lower header feeder tube
How discovered: Operator rounds
Wash adjacent tube: YES
Root cause: Flow assisted corrosion. Leak washed from inside of header feed tube on inside of elbow. Awaiting final report analysis on failure
Leak detection:
N
O **Bed cooling enhanc**
N
O **Last full inspection:**
Ap
r-19
Sequence of events: Leak was observed during last rounds of the day shift. Took furnace off liquor firing, went on aux fuel to observe leak. Bed burned out and offline approx. 12 hrs after initial discovery. Economizer water wash and repairs completed. Unit hydro tight and returned to service
Repair procedure: Damaged area was repaired with weld metal build up. Adjacent washed tubes were repaired with weld metal build up
Future prevention: Nondestructive examination of tubes during next opportunity

ECONOMIZER

FALL 2020-02

Classification: Noncritical
Co, Mill, Location: **Harmac Pacific, Nanaimo British Columbia**
Unit Data: RB#5,1953, Combustion Engineering, CA-51126, Drums - 3, DCE - NO, Floor - Decanting
Unit Size: 1.6 MMlb DS/day, 205000 lb/hr steam, 600 PSIG, 750ºF, 675 PSIG Design
Incident Date/Time: September 10, 2019, Earliest Indication: 9/8/2019 at 16:30
Downtime hrs, leak/total: hours
ESP? **NO**
Leak/Incident Loc: Economizer, Leak was from a cracked tube just above the fillet weld joining the tube to the lower inlet header
How discovered: Walkdown, Discovered during routine leak check
Wash adjacent tube: NO
Root cause: Stress Assisted Corrosion (SAC), Previous failures have occurred in the same area. Feedwater enters the economizer at this location and is susceptible to higher oxygen concentrations during startups following maintenance activities. The current understanding of water side cracking in economizers is that the cracking grows primarily during startups due to a combination of two main factors: oxygen in the feedwater - the threshold concentration to support cracking is believed to be 5 ppb
stress - the combined stress of residual stress and transient stressed which develop during start up due to the temperature gradients as the boiler comes up to temperature
During normal operation there should not be enough oxygen to allow cracking and the only significant stress should be residual stress.

Leak detection:

N

O **Bed cooling enhanc**

N

O **Last full inspection:**

Ap

r-19

Sequence of events: Operating crew on night shift observed suspected water in the area of the lower economizer ash hoppers. Inspections throughout the shift could not identify a leak. Day shift crews arrived and continued search for a leak. Compliance stack testing was scheduled and continued since leak was isolated to the economizer. Following the completion of the compliance stack test, unit was taken off liquor firing auxiliary fuel. Further inspection identified water leaking from middle economizer area. Unit was removed from serviced and cooled for cleaning and inspection.

Repair procedure: Tube was removed and plugged. .

Future prevention: Continued NDE inspections during annual outages

ECONOMIZER

FALL 2020-03

Classification:	Noncritical
Co, Mill, Location:	**Domtar, Hawesville, Ky**
Unit Data:	RB#4,1997, Andritz, 59072, Drums - 1, DCE - NO, Floor - Decanting
Unit Size:	2.7 MMlb DS/day, 415,880 lb/hr steam, 1250 PSIG, 860ºF, 1250 PSIG Design
Incident Date/Time:	July 28, 2019, Earliest Indication: 3/22/2018 at 8:00 PM
Downtime hrs, leak/total:	27.5 Hours Liquor Out to Liquor In
ESP?	**NO**
Leak/Incident Loc:	Economizer, Pin hole at the edge of an old pad weld. The leak was ground out and re-welded
How discovered:	Walkdown,
Wash adjacent tube:	NO
Root cause:	Weld Failure,
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Sep-18
Sequence of events:	On 7/28/19 12:30 PM field operator on routine boiler walkdown found water in the No. 1 economizer ash hopper. No indication was found on trends or in decreased chemical residual in the boiler. We pulled liquor to open doors and identify the location of the leak. We pulled liquor at 10:00 PM on 7/29/19 made the repair and were back on liquor 3:20 AM 7/31/19.
Repair procedure:	The leak was ground out and re-welded
Future prevention:	

ECONOMIZER

FALL 2020-04

Classification:	Noncritical
Co, Mill, Location:	**Green Bay Packaging, Arkansas Kraft Division / Morrilton, AR**
Unit Data:	RB#2,1975, Combustion Engineering, 20973, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	2,300,000 MMlb DS/day, 395,200 lb/hr steam, 615 PSIG, 702ºF, 715 PSIG Design
Incident Date/Time:	November 16, 2019, Earliest Indication: 11/16/2019 at 12:00
Downtime hrs, leak/total:	25.08 hours, liquor to liquor
ESP?	**NO**
Leak/Incident Loc:	Economizer, rear economizer, 5th floor, tube #1, approximately 3' above IK27
How discovered:	Walkdown, -
Wash adjacent tube:	NO
Root cause:	Thinning External, Ambient air leakage due to compromised skin casing above IK 27 on recovery boiler rear economizer. (B&W section). Ambient air moisture condensed on the tube causing oxidation. This caused pre-mature corrosion which led to thinning of the tube. This skin casing was repaired during the 2019 recovery outage. Due to this area being inaccessible to inspection, there was no way to identify any potential problems. Possible water contamination due to IK27 being idle for 1 month. IK was idle because canopy was twisted leaving the unit inoperable. The isolation and poppet valve appeared to have allowed steam leakage into the lance tube, which in turn condensed in the tube. Because the recovery boiler is a negative pressure boiler the cooler condensate would have been pulled in the economizer leakage area. This additional moisture would have accelerated the corrosion to this Tube as it is directly above IK 27.
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Sep-19
Sequence of events:	2019.11.16 - 11:30 – potential leak discovered in economizer on routine walkdown - 12:00 – leak confirmed, controlled shutdown of recovery boiler commenced - 12:38 – liquor out - 13:30 – fire out - 20:15 – boilermakers onsite - 20:40 – start effort to pinpoint leak - 22:15 – leak pinpointed to Tube #1, west side rear economizer, approximately 3' above IK27 - 23:45 – repair work begins

2019.11.17

- 01:29 – locks off for hydro
- 03:10 – economizer full, start 400 PSIG hydro
- 03:45 – leak discovered on upper plug
- 04:50 – 2nd repair completed
- 05:25 – economizer full, start 2nd 400 PSIG hydro
- 05:42 – dry hydro
- 07:50 – gas fire in boiler
- 13:43 – 1st liquor gun in boiler

Repair procedure: Cut out 12" of tube at top header and installed plug. A 2-pass weld procedure was utilized for the plug weld. One down and one over. Dye-penetrant NDE performed. Same procedure for bottom plug. Boiler hydro to 400 psig.

Future prevention: On 2020 Annual, will remove skin casing above and below IK27 for tube inspection on the economizer. When skin casing is removed on the 2020 annual, will cut sample from tube #1 that encompasses failure and analyze further. Will replace any defective skin casing that is identified.

ECONOMIZER

FALL 2020-05

Classification: Noncritical

Co, Mill, Location: **Domtar Kamloops Mill**

Unit Data: RB# 2, 1972, B&W Canada, BWC8810, Drums - 2 Drum, DCE - No, Floor - Sloped Floor, Composite Tubing

Unit Size: 5.5, running at 4.9 MMlb DS/day, 760 000 lb/hr steam, 600 PSIG, 721ºF, 771 PSIG Design

Incident Date/Time: 01/05/2020 Morning. Earliest Indication: Water in the Economizer Hopper Conveyor

Downtime hrs, leak/total: 43 hours

ESP? No

Leak/Incident Loc: Economizer, East Side, Row 1 Tube 9 (very outside row, leak faced outwards spraying against casing.

How discovered: Water in the Economizer Hopper Conveyor, caused hard cake which tripped out the airlock feeder.

Wash adjacent tube: No, leak sprayed against the casing as it was on the farthest East row

Root cause: Defective weld from 1991 Manufacturing

Leak detection: No

Bed cooling enhanc No

Last full inspection: October 2019 Fall Shutdown

Sequence of events: On 01/05/2020 Water was observed in the Economizer Hopper Conveyor. Initially a sootblower in the vicinity was suspected to be the cause, the poppet valve on this unit was changed but water continued to be observed. On the following Nightshift other sootblowers in the vicinity were cycled to determine if they were the sources. Results were inconclusive. The next Dayshift afternoon 01/06/2020, No.2 Recovery was taken off liquor, this reduced saltcake loading in the Economizer and made it possible to observe the water entering the Economizer Hopper Conveyor. On 01/07/2020 an outage for repair was planned. Critical trends were analyzed. No changes in Furnace Draft (-0.5 inH2O) or Economizer draft (average of -6.4 inH2O), ID Fan Loading (average 410 RPM) or Feedwater to steam balance were observed, Feed-Steam to Process-Sootblowers Steam had a discrepancy of 56 Mlb/H this is within normal ranges for operation. Recovery was running at 4800 Mlb/Day and had a steaming rate of 700 Mlb/H. By 15:50 the Kamyr was down and Recovery was off liquor at 19:13. During that Nightshift Lockouts were put in place. Hydrostatic testing took place at 10:30-11:00 on 01/08/2020. Leak was located on the 5th Floor East side of the Economizer near No.5 Access Door. Leak was on the furthest East Row facing the casing of the boiler. Engineering Managed CIMS and Acuren on Repair. CIMS spent the dayshift removing cladding insulation and a section of casing to gain access to the leak location. By the end of Dayshift, the extent of the leak was determined, and the weld repair started. Weld repair was completed on the Nightshift and warm up of the Recovery started the next day at 01/09/2020 4:42, Recovery was online at 10:30 and on Liquor at 14:00. Ramping up the Mill continued through the Nightshift. Recovery Reach full rate on liquor at 01/10/2020 8:00.

Repair procedure: Ground out porous weld material (the defect) and rewelded.

Future prevention: Next shutdown will inspect the Economizer to look for more manufacturing defects

ECONOMIZER

FALL 2020-06

Classification: Noncritical
Co, Mill, Location: **WestRock, Mahrt, AL**
Unit Data: RB#2,1989, Tampella, 337, Drums - 1, DCE - NO, Floor - Decanting
Unit Size: 3.75 MMlb DS/day, 561,800 lb/hr steam, 890 PSIG, 825ºF, 1100 PSIG Design
Incident Date/Time: January 17, 2020, Earliest Indication: 1/16/2020 at 10:50pm
Downtime hrs, leak/total: 33.1 hours
ESP? **NO**
Leak/Incident Loc: Economizer, The leak was at bottom header to tube weld. Element 39, Tube J **How discovered:** Walkdown, Operator discovered wet saltcake in the #1 ECON (cold) conveyor.
Wash adjacent tube: NO
Root cause: Weld Failure, weld porosity
Leak detection: YES
Bed cooling enhanc NO
Last full inspection: Mar-19
Sequence of events: At 10:50pm on Thursday January 16th, an operator found wet saltcake in the #1 ECON (cold) conveyor. Due to the location of the leak and all other boiler conveyors being dry, the boiler was brought down in an orderly shutdown. Liquor out at 1:00am on Friday January 17th. Fire out at 2:26am, bed was completely burned out. Boiler cooldown curve was followed and boiler waterwash started at 11:18am. IKs were used only in the #1 and #2 ECON sections. Wash completed at 2:00pm, boiler LOTO and leak identified, weld repaired, PT'd and boiler hydro tested. Boiler lit off at 2:20am on Saturday January 18th and boiler on liquor at 10:04am.
Repair procedure: Weld was ground out and weld repaired. Weld PT completed and boiler hydro tested
Future prevention: Additional inspection and mag particle testing in this area during Mar 2020 shutdown.

ECONOMIZER

FALL 2020-07

Classification: Noncritical
Co, Mill, Location: **WestRock, Mahrt, AL**
Unit Data: RB#2,1989, Tampella, 337, Drums - 1, DCE - NO, Floor - Decanting
Unit Size: 3.75 MMlb DS/day, 561,800 lb/hr steam, 890 PSIG, 825ºF, 1100 PSIG Design
Incident Date/Time: January 22, 2020, Earliest Indication: 1/22/2020 at 8:30am
Downtime hrs, leak/total: 32.9 hours
ESP? **NO**
Leak/Incident Loc: Economizer, The leak was on a previous weld repair at fin attachment located at the bottom header. Element 4, tube A. The previous repair was done in 2003.
How discovered: Walkdown, Operator discovered wet saltcake in the #1 ECON (cold) conveyor.
Wash adjacent tube: NO
Root cause: Weld Failure, weld porosity
Leak detection: YES
Bed cooling enhanc NO
Last full inspection: Mar-19
Sequence of events: At 8:30am on Wednesday January 22nd, an operator found water dripping from the #1 ECON (cold) hopper and wet saltcake in the conveyor. Due to the location of the leak and all other boiler conveyors being dry, the boiler was brought down in an orderly shutdown. Liquor out at 10:19am, Fire out at 10:55am, bed was completely burned out. Boiler cooldown curve was followed and boiler waterwash started at 7:00pm. IKs were used only in the #1 and #2 ECON sections. Wash completed at 11:00pm, boiler LOTO and leak identified, weld repaired, PT'd and boiler hydro tested. Boiler lit off at 2:15am on Thursday January 23rd and boiler on liquor at 7:14pm.
Repair procedure: Weld was ground out and weld repaired. Weld PT completed and boiler hydro tested
Future prevention: Additional inspection and mag particle testing in this area during Mar 2020 shutdown.

ECONOMIZER

FALL 2020-08

Classification:	Noncritical
Co, Mill, Location:	**Georgia-Pacific, CSO, Cedar Springs, GA**
Unit Data:	RB#3, Contract PR160, Drums - 2., DCE - NO., Floor – Sloped to rear
Unit Size:	3.5 MMlb DS/day, 497,500 lb/hr steam, 880 PSIG, 900ºF, 1025 PSIG Design
Incident Date/Time:	December 9, 2019, Earliest Indication: 12/09/2019 at 10:00 AM
Downtime hrs, leak/total:	102 hours
ESP?	**No**
Leak/Incident Loc:	Economizer.
How discovered:	Operator walkdown.
Wash adjacent tube:	No
Root cause:	The failure was likely a result of lack of fusion when this weld was made during fabrication and had finally reached the point of failure
Leak detection:	Yes
Bed cooling enhanc	No
Last full inspection:	October 2019
Sequence of events:	At approximately 6:00 PM on December 9, 2019, operator reported seeing water in the north economizer ash hopper outlet. The water was in liquid state, not in a stream or spray. Access doors above the area were opened and steam was noted. Sootblower steam was shut off, but the leak was still observed after some time. There was a change in the mass balance starting at 10:00 AM, with an observed change of 8Klb/hr (16gpm). However, noise in the signal caused the loop counter to reset. The loop counter alarms at 8, but due to the resets, the counter reached a maximum of 4. Thus, there was no alarm for the leak. The TRASAR system did not show a response. Shut down procedure began at 7:00 PM. Liquor was removed from the boiler at 8:00 PM. The bed was burned out and auxiliary fuel removed from the boiler at 6:30 AM. Access door on the north east corner of the economizer were opened for inspection, and a weeping leak was discovered on a weld line on the 10th tube from the north (right). After cool down and water wash, a hydro was not performed, and it was agreed upon that the observed leak was sole source.
Repair procedure:	Pin hole leak was ground through and welded over.
Future prevention:	The repaired area will be removed and replaced during the next annual maintenance outage.

ECONOMIZER

FALL 2020-09

Classification:	Critical #917
Co, Mill, Location:	**International Paper, Eastover Mill, Eastover, South Carolina**
Unit Data:	RB#1,1984, CE, 31381 V2RE, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	2.35 MMlb DS/day, 348,900 lb/hr steam, 1500 PSIG, 900ºF, 1670 PSIG Design
Incident Date/Time:	November 1, 2019, Earliest Indication: 10/21/2019 at 1:00 AM
Downtime hrs, leak/total:	58 hrs
ESP?	**NO**
Leak/Incident Loc:	Economizer, Tube-to-Upper header welds on Rear Side of Front Right Economizer
How discovered:	Walkdown. Operator noticed water dripping in front of an observation door while he was inspecting an economizer hopper.
Wash adjacent tube:	YES
Root cause:	Fatigue, The location and appearance of the cracking is consistent with bending fatigue.
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Oct-18
Sequence of events:	Field operator was doing his field walkdown and when he opened the east inspection door of the front economizer wet bottom hopper, he noticed some water dripping down in front of the inspection door. He called for assistance from the senior operator. The senior operator proceeded to walk down the boiler with the sootblowers off. Operator heard and saw steam and water spraying from the upper front economizer section. Steam and water were blowing directly to the rear of the boiler. No steam or water was observed spraying to the front of the boiler. The senior operator called the Recovery Boiler APM @ home @ 01:21 (11/1) and discussed the situation. Since the water and steam was blowing away from the furnace and the boiler wasn't showing any other physical signs of water entering the furnace (noise, popping, black spots), the decision was made to transition the boiler from liquor to oil, burn out the bed and shut down the boiler. The RB APM got to the mill @ 03:00 and operations had the boiler halfway transitioned. The APM continuously monitored the leak throughout the transition/shut down sequence to make sure the water did not start spraying toward the boiler. The salt cake on the front side of the front

economizer tubes remained dry throughout the shutdown sequence. The boiler was shut down @04:40. Boiler was cooled down using the FD fans. Boiler did have a Mass Balance leak detection system active but was not trusted at this time. The system was a new system generated in house to replicate the old system that was part of the old “Provox” system. The new system was generating false alarms due to it reacting to boiler control relief vents opening slightly or steam header swings. System did alarm during this event. These new leak detection system for both boilers have been “tuned” and are more reliable.

Repair procedure: Cut out sections of two Economizer tubes and installed four tube plugs. Two plugs were installed in the lower Front Right Economizer Header and two plugs were installed in the Upper Front Right Economizer header.

Future prevention: During future Outages, perform visual inspections of accessible Economizer tubes near upper and lower tube-to-header welds with a focus on tubes near the center of each Front and Rear Economizer module. Perform follow-up NDE to the extent possible and make repairs as warranted.

ECONOMIZER

FALL 2020-10

Classification: Noncritical

Co, Mill, Location: **International Paper, Port Wentworth, GA**

Unit Data: RB#3,1979, B&W, PR-190, 2017 Andritz rebuild, Drum - 1, DCE - NO, Floor - Decanting

Unit Size: 5.1 MMlb DS/day, 708,000 lb/hr steam, 1250 PSIG, 950^{o}F, 1566 PSIG Design

Incident Date/Time: September 5, 2019, Earliest Indication: 9/5/2019 at 8:30 PM

Downtime hrs, leak/total: 38 hrs, 21 min

ESP? **NO**

Leak/Incident Loc: Economizer, Feed Water Header. Cracked at connection between #1 module left supply tube and feed water header.

How discovered: Walkdown, Water was identified in the Economizer Conveyor during an operator pre-startup walk down.

Wash adjacent tube: NO

Root cause: Fatigue, Combination of thermal and mechanical fatigue. Thermal fatigue caused by changes in feed water temperatures from start-ups/shutdowns over the years. Mechanical fatigue caused by header moving as it travels into the boiler (excessive mechanical cycling).

Leak detection: NO

Bed cooling enhanc NO

Last full inspection: Mar-18

Sequence of events:
09/02/2019
20:12 – RB Liquor out to shut down for hurricane
23:43 – RB Fire out
09/03/2019
11:00 – Steam Drum 0 pressure
09/05/2019
20:30 – Water noticed in Economizer hopper during pre-startup checklist
09/06/2019
01:00 – Lockouts for repairs complete
15:00 – PT/leak repairs started
20:30 – PT/leak repairs completed
21:00 – Waterside unlock started/ lining up RB for hydro
21:00 – RB Hydro started
09/07/2019
00:25 – RB Hydro complete
03:15 – Fireside / waterside locks off
08:30 – Fire in
10: 51 – Liquor in

Repair procedure: Leaking tube was ground out at the weld and rewelded over to repair leak. Tube successfully passed PT test and hydro.

Future prevention: Tube section feeding economizer header to be replaced on next annual outage. Working with Andritz to reduce mechanical fatigue on this section.

Classification: Noncritical
Co, Mill, Location: **International Paper, Container Board Mill, Bogalusa, LA**
Unit Data: RB#21,1989, B&W, PR211, Drums - 1, DCE - NO, Floor - Sloped to rear
Unit Size: 3.3 MMlb DS/day, 504,600 lb/hr steam, 875 PSIG, 825°F, 1050 PSIG Design
Incident Date/Time: August 15, 2019, Earliest Indication: 8/15/2019 at 2:45 AM
Downtime hrs, leak/total: 47.08
ESP? **NO**
Leak/Incident Loc: Economizer, Economizer #2, 6th tube,1st Platen off wall below IK46
How discovered: Walkdown, Field operator found water in west collection conveyor during rounds
Wash adjacent tube: NO
Root cause: Thinning External, external corrosion, severe casing corrosion/deterioration
Leak detection: NO
Bed cooling enhanc NO
Last full inspection: May-19
Sequence of events: On August 15th the B shift field operator discovered water in the west collection conveyor while making rounds. The field operator then inspected the east collection conveyor closest to the boiler and found no water presence. With water presence isolated to the rear of the boiler, operator fired auxiliary fuel to maintain a reduced steam rate and stopped liquor firing to allow further inspection for verification of leak source. Initially, IK condensate was suspected as the source of water found in the conveyor. Inspected IK's for leakage and found no leakage. At approximately 6:14 a.m., the leak was identified in the north section of the #2 economizer above the 7th floor. A bed burnout and orderly shutdown following SOP-0025-RBG commenced. Lagging and boiler casing were removed for access. Approximately 8' tube section and surrounding membrane were removed between the 7th and 8th floor. Brown and Root installed a new tube section, membrane, and boiler casing. Boiler was then hydrostatic tested following tube repair on August 17 @ 6:30 a.m. Boiler drum was lowered to operating level and startup SOP-0027-RBG was followed to bring boiler back online.
Repair procedure: Brown and Root removed boiler casing for access to failed tube. Approximately 8' tube section and surrounding membrane were removed between 7th and 8th floor north side of boiler. New tube section, membrane, and boiler casing were installed
Future prevention: During outage water wash, direct the hydroblast crew to add emphasis in this area to insure salt removal.

ECONOMIZER

FALL 2020-12
Classification: Noncritical
Co, Mill, Location: **Domtar, Hawesville, Ky**
Unit Data: RB#4,1997, Andritz, 59072, Drums - 1, DCE - NO, Floor - Decanting
Unit Size: 2.7 MMlb DS/day, 415,880 lb/hr steam, 1250 PSIG, 860°F, 1250 PSIG Design
Incident Date/Time: June 18, 2020, Earliest Indication: 6/18/2020 at 7:00 AM
Downtime hrs, leak/total: 31.2 Hours Liquor Out to Liquor In
ESP? **NO**
Leak/Incident Loc: Economizer,
How discovered: Walkdown,
Wash adjacent tube: NO
Root cause: Other, Old grind mark
Leak detection: NO
Bed cooling enhanc NO
Last full inspection: Mar-20
Sequence of events: Leak was found during walk down by operator 6/18/20 at 7:00 am. Water was seen in the ash conveyor in the #2 economizer ash hopper. No indication via trends. Pulled liquor at 9 am of that same day. Opened doors to determine location of leak. Repair was made the night of 6/18-19 and liquor was put back in at 4:10pm 6/19/20.
Repair procedure: The leak was ground out and re-welded
Future prevention:

ECONOMIZER

FALL 2020-13

Classification: Noncritical
Co, Mill, Location: **Domtar, Hawesville, Ky**
Unit Data: RB#4,1997, Andritz, 59072, Drums - 1, DCE - NO, Floor - Decanting
Unit Size: 2.7 MMlb DS/day, 415,880 lb/hr steam, 1250 PSIG, 860ºF, 1250 PSIG Design
Incident Date/Time: June 28, 2020, Earliest Indication: 6/28/2020 at 9:30 PM
Downtime hrs, leak/total: 42.5 Hours Liquor Out to Liquor In
ESP? **NO**
Leak/Incident Loc: Economizer,
How discovered: Walkdown
Wash adjacent tube: NO
Root cause: Unknown, Believe to be something from original fabrication/installation
Leak detection: NO
Bed cooling enhanc NO
Last full inspection: Mar-20
Sequence of events: Leak was discovered in economizer during a walkdown at 10 pm 6/28. Inspection of feedwater flow trends indicated that leak must have occurred sometime around 9:30 pm 6/28. Liquor was pulled at 3:30 am 6/29. Repair was made and boiler passed hydro at 4:18 am 6/30. Liquor was put back in the boiler 6/30 10pm.
Repair procedure: The leak was ground out and re-welded
Future prevention:

ECONOMIZER

FALL 2020-14

Classification: Noncritical
Mill & Location: **International Paper, Riverdale Mill, Selma, AL**
Unit Data: RB#2,1981, Combustion Engineering, 28679, Drums - 2, DCE - NO, Floor - Decanting
Unit Size: 2.7 MMlb DS/day, 450,000 lb/hr steam, 1500 PSIG, 875ºF, 1720 PSIG Design
Incident Date/Time: May 1, 2019, 15:30
Downtime hrs, leak/total: 41 hrs Liq-Liq
ESP? **NO**
Leak/Incident Loc: Economizer, First Water Pass Economizer, center row of tubes, Left Hand most tube on Left Hand most module (vertical tube closest to the LHSW).
How discovered: Walkdown, The First Pass Economizer developed a tube leak and was found by operator on walk down rounds at 15:30 on May 1st, 2019. Operation went into immediately normal shutdown to repair leak.
Wash adjacent tube: NO
Root cause: Fatigue, Contributing factors were determined to be: Salt cake build up under sootblower; Tube has vertical from header run from header to bundle, no stress relief bends; Per IP-PT, typical failure type and location for B&W style 'mini header' due to heat transfer and hydraulic pumping not reaching outer ends of header. Condensate dripping from sootblower directly above the header at failed tube location, and 24 Years old, approaching end of life (typical 25-30 years life span)
Leak detection: YES
Bed cooling enhanc NO
Last full inspection: May-18
Sequence of events: We were bringing the boiler back online from a Chill & Blow the day before. Liquor was back in the boiler. The First Pass Economizer developed a tube leak and was found by the operator on walk down rounds at 15:30 on May 1st, 2019. Operation immediately went into normal shutdown to repair leak. First spray pulled at 16:15, May 1st, 2019. First spray back in the boiler 09:15, May 3rd, 2019. Looking at PI, the Leak Detection program indicated the separation, but did not alarm. Boilermakers were already onsite for prep on another outage and moved equipment to the unit by 17:30. Bed was burned out at approximately 20:00. Boiler lagging and insulation removed during cooldown and boiler depressurization, leak location identified at 23:00. Waterside LOTO continued until complete at 05:00 on MAY 2nd, 2019. Area was cleaned and crack in tube identified. There were no signs of wash on adjacent tubes. Crack was ground out and PT performed to verify all of crack was removed. Weld repairs began at 07:45. Root pass was PT ‘d and passed; final pass was PT’d and passed. Tube repairs were complete at 10:20. Boiler was filled for post repair hydro. Dry hydro called at 20:00. Boiler was turned over to operations for startup. Fire in boiler at 01:15 on MAY 3rd, 2019. First spray back in the boiler at 09:15 on MAY 3rd, 2019.

Repair procedure:	Crack appears to be at tube side toe of the tube to header weld header. Crack was ~ ¼" above the tube to header weld and propagated ~ 1/3 to 7/16 of the way around the tube more to the left front of the tube. No damage found on adjacent tubes when PT' d and no visual washing observed. Crack was grounded out and checked to be free of cracks prior to weld repair.
Future prevention:	We have put the replacement of the first Pass Economizer on the Mill Strategic Capital plan for the next 3-5 years for replacement. Maintain and inspect the sootblower condensate system.

ECONOMIZER

FALL 2020-15	
Classification:	Noncritical
Co, Mill, Location:	**International Paper, Mansfield Mill, Mansfield, LA**
Unit Data:	RB#1,1981, B&W, PR-199, Drums - 2, DCE - NO, Floor - Sloped to rear
Unit Size:	3.74 MMlb DS/day, 486k lb/hr steam, 1250 PSIG, 915ºF, 1475 PSIG Design
Incident Date/Time:	February 22, 2019, Earliest Indication: 2/22/2019 at 2:00 PM
Downtime hrs, leak/total:	54hrs
ESP?	**NO**
Leak/Incident Loc:	Economizer, 2 tube leaks in economizer module 2; tube #42 and #43 from the east.
How discovered:	Walkdown, During an operator round water was discovered coming down an economizer ash hopper wall.
Wash adjacent tube:	YES
Root cause:	Weld Failure, Bad original B&W shop weld, previous plug caused extra stress on flawed original tube to header weld.
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Apr-18
Sequence of events:	At around 2:00 PM on 2/22/19, it was noticed that the leak detect system started drifting. An operator then noticed water in the wet hopper. ESP was not needed.
Repair procedure:	Plugged 1 tube and welded up old plug on the header.
Future prevention:	We have increased NDE scope in this area during annual outages until the econ is replaced.

ECONOMIZER

FALL 2020-16	
Classification:	Noncritical
Location:(Mill, city, ST)	**Georgia Pacific, Palatka, Florida**
Unit:	#4 Recovery Boiler, 1976, CE, Contract #22974, 2-drum, long flow economizer
Unit Size:	5.0 MM lb ds/day; 850,000 lb/hr steam at 1250 psig, 900°F, 1500 psig design
Incident Date:	7/17/2019
Downtime hrs, leak/total:	48 hours
ESP?	**No**
Leak/Incident Loc:	Economizer
How discovered:	Manufacturing Engineer – post trip walkdown.
Wash adjacent tube:	No
Root cause:	Pinhole -
Leak detection:	Yes
Bed cooling enhance:	No
Last full inspection:	October 2018
Sequence of events:	The operator was performing his normal round and saw a wet area in the rear Economizer ash hopper. The operator opened additional doors on the economizer hopper and on the side of the economizer. The operator determined the leak was in the top of the economizer and there was no possibility of spraying back to the generating bank. The boiler was taken down in an orderly manner
Repair procedure:	The window surface was ground and re-welded.
Future prevention:	The mill is developing a plan for economizer replacement

ECONOMIZER

Classification:	Noncritical
Co, Mill, Location:	**Georgia Pacific, Palatka, Florida**
Unit Data:	RB#4 Recovery Boiler, 1976, CE, Contract #22974, 2-drum, long flow economizer., DCE -NO., Floor - Decanting.
Unit Size:	5.0 MM lb ds/day; 850,000 lb/hr steam at 1250 psig, 900°F, 1500 psig design
Incident Date/Time:	November 7, 2019
Downtime hrs, leak/total:	60.32 Hours
ESP?	**NO**
Leak/Incident Loc:	#1 Economizer tube 50-1.
How discovered:	Boiler walkdown
Wash adjacent tube:	NO
Root cause:	Oxygen pitting combined with high residual stresses.
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	May 2019.
Sequence of events:	Tube leak found by operators during a walkdown. The boiler was taken offline in a controlled fashion.
Repair procedure:	The area was ground out and rewelded. The weld consisted of a multi-pass fillet weld. The final welds were visually examined, and Dye penetrant tested.
Future prevention:	Evaluating economizer replacement

ECONOMIZER

FALL 2020-18	
Classification:	Noncritical
Co, Mill, Location:	**Georgia Pacific, Palatka, Florida**
Unit Data:	RB#4 Recovery Boiler, 1976, CE, Contract #22974, 2-drum, long flow economizer., DCE -NO., Floor - Decanting.
Unit Size:	5.0 MM lb ds/day; 850,000 lb/hr steam at 1250 psig, 900°F, 1500 psig design
Incident Date/Time:	January 20, 2020
Downtime hrs, leak/total:	45.85 Hours
ESP?	**NO**
Leak/Incident Loc:	#1 Economizer tube 38-1. Failed at the top edge of the lowest fin on the tube pointing to the rear of the economizer. Elevation was the same as the sootblower on the 4th floor above the hoppers. A second leak was found on #1 Economizer tube 51-3 on the west side attachment weld
How discovered:	Boiler walkdown after unit tripped on high furnace pressure
Wash adjacent tube:	NO
Root cause:	Oxygen pitting combined with high residual stresses.
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	May 2019.
Sequence of events:	4:41pm Recovery Boiler Tripped on high draft pressure. Leak was found during subsequent boiler walkdown.
Repair procedure:	The area was ground out and rewelded. The final welds were visually examined and Dye penetrant tested.
Future prevention:	Evaluating economizer replacement

ECONOMIZER

FALL 2020-19

Classification:	Noncritical
Co, Mill, Location:	**Georgia Pacific, Palatka, Florida**
Unit Data:	RB#4 Recovery Boiler, 1976, CE, Contract #22974, 2-drum, long flow economizer., DCE -NO., Floor - Decanting.
Unit Size:	5.0 MM lb ds/day; 850,000 lb/hr steam at 1250 psig, 900°F, 1500 psig design
Incident Date/Time:	February 4, 2020
Downtime hrs, leak/total:	40.1 Hours
ESP?	**NO**
Leak/Incident Loc:	#1 Economizer tube 39-1. Failed at horizontal scallop bar weld facing #2 Economizer.
How discovered:	Boiler walkdown after boiler trip
Wash adjacent tube:	NO
Root cause:	Oxygen pitting combined with high residual stresses.
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	May 2019.
Sequence of events:	The tube leak was found on a boiler walk down. The Recovery boiler was brought down in a controlled manner with no incident.
Repair procedure:	The weld was ground into the pin hole to clear pinhole and rewelded. inspected by means of PT.
Future prevention:	Evaluating economizer replacement

RISER, TUBE ABOVE ROOF TUBES

FALL 2020-20

Classification:	Critical #918
Co, Mill, Location:	**WestRock, LA Tuque Mill, La Tuque, Québec**
Unit Data:	RB4, Alstom, 1964, CA-64134, Drums - 2, DCE - Cascade, Floor - Decanting
Unit Size:	1.3 MMlb/day, 725 psig
Incident Date/Time:	August 31, 2019, Earliest Indication: 8/31/2019 at 1h15 pm
Downtime hrs, leak/total:	6 Days
ESP?	**NO**
Leak/Incident Loc:	Roof, Very minor leak on weld between wall tube and water header
How discovered:	Walkdown,
Wash adjacent tube:	NO
Root cause:	Weld Failure, It was found later to be a pin hole in a faulty weld probably due to a lack of penetration between a wall tube and water header.
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Nov-18
Sequence of events:	A minor leak was detected by an operator while making his visual walkdown inspection of the boiler at the very top in the penthouse area. The operator noticed a very small amount of water/steam coming out between the insulation protection. Since the leak was very minor and because of the location of the leak the operator decided not to ESP the boiler. The on-duty supervisor was called in to back up the decision and it was decided to shut the boiler down normally.
Repair procedure:	The faulty weld was cleaned and repaired according to standards
Future prevention:	

ABOVE ROOF, ATTEMPERATOR

FALL 2020-21

Classification: Noncritical

Co, Mill, Location: **Verso Wisconsin Rapids**

Unit Data: RB# 1, 1967 CE, 1166, Drums - 2, DCE - Yes., Floor - Decanting

Unit Size: 1.6 MMlb DS/day, 200,000 lb/hr steam, 1275 PSIG, 900ºF, 1450 PSIG Design

Incident Date/Time: 5/22/2020/ 0130 Earliest Indication:5/21/2020. at 2130

Downtime hrs, leak/total: 89 hours, 20 minutes

ESP? **NO**

Leak/Incident Loc: Initially on Attemperator where it penetrates penthouse, additional leak found HTSH (Secondary SH) platen 14 tube 18. Crack at CE hard tie weld.

How discovered: Walkdown, Operator heard leak in penthouse, SH leak found on hydrostatic test.

Wash adjacent tube: No indication of it.

Root cause: Undetermined, Tube sent to M&M engineering for evaluation.

Leak detection: No

Bed cooling enhanc No

Last full inspection: June 20/2019

Sequence of events:

- 0000- Operators began to experience intermittent KO's of #2 TR (Leading Edge TR for West Field)
- 0145- Operator making a round could hear a whistling Southeast corner of the penthouse 6th floor R1.
- 0230-While investigating, he attached a rag to a pole, and found a location on the top of the penthouse where it was blowing out at a hanger penetration.
- 0300- Operations contacted Recovery Manager to come in. They were told to start an orderly shutdown, and began bed burnout, remove liquor, also installed bed temp. probes.
- 0400- Recovery Manager arrived and went up to investigate with operator. Confirmed there is a whistling in the penthouse where the attemperator penetrates the penthouse South wall.
- 0430- Valved out the attemperator, but no change in the sound was observed.
- 0440- All fire pulled from boiler to cool bed to bellow 800F.
- Boiler does not have a DCS system, so is very limited on being able to trend. One trend does show a drop in superheater outlet temperature. Orderly shutdown began at 0315.
- 1640- Bed temps below 800F
- 1715- Began backfill through superheaters.
- 1800- Leak identified. Attemperator line approx. 2" into the penthouse. On a socket weld where the line flairs from 3" to 2"
- 1900- Locked out for repairs.

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- 0300- Repairs were complete on attemperator and hydrostatic tested to 1200psi. Leak observed, water leaking in the superheater section.
- 0400- Boiler wash using sootblowers started, and complete fire, and waterside lockouts under way.
- 2200- Hand/ polish wash for entry.

5/24/2020

- 0200- Scaffolding started. Have to go up from floor access suspected leak location.
- 0900- Scaffolding completed.
- 0930- Backfill Boiler.
- 0945- Leak identified in HTSH (Secondary SH) platen 14, tube 18.

5/25/2020

- 0330- Repairs, and X-ray complete on new Dutchman, Waterside unlocked for backfill, and hydro.
- 0715- Boiler had dry hydro @1250psi, held for 15 minutes, then dropped below 500 for internal inspection.
- 0730- Remove scaffolding, and Brick door.
- 1000- Unlock complete Boiler.
- 1300- Fire in.
- 2200- R1 on Liquor.

Repair procedure: Removed tube at crack, 18" Dutchman installed. Original material was SA209 .165 wall. Dutchman material is T22 .203 Wall.

Future prevention: MT Inspection of 10% of CE hard tie welds during July 2020 outage.

SUPERHEATER

FALL 2020-22

Classification:	Noncritical
Co, Mill, Location:	**Green Bay Packaging, Arkansas Kraft Division / Morrilton, AR**
Unit Data:	RB2,1975, Combustion Engineering, 20973, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	2,300,000 MMlb DS/day, 395,200 lb/hr steam, 615 PSIG, 702ºF, 715 PSIG Design
Incident Date/Time:	September 13, 2019, Earliest Indication: 9/13/2019 at 14:54
Downtime hrs, leak/total:	Found on 2019 Annual Outage during hydro.
ESP?	**NO**
Leak/Incident Loc:	Superheater, platen #8, tube 13 & platen #9, tube #20
How discovered:	Hydro Test, 400# hydro. discovered on internal inspection
Wash adjacent tube:	NO
Root cause:	Fatigue, stitch weld failure
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Sep-18
Sequence of events:	Found on hydro
Repair procedure:	Weld was burred out and a base metal restoration was performed. Dye penetrant test performed on repair.
Future prevention:	Annual NDE

SUPERHEATER

FALL 2020-23

Classification:	Noncritical
Co, Mill, Location:	**Canfor Pulp Limited, Northwood RB5, Prince George, BC**
Unit Data:	RB#5,1982, CE, 79120, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	3.45 MMlb DS/day, 558,800 lb/hr steam, 652 PSIG, 752ºF, 800 PSIG Design
Incident Date/Time:	December 5, 2019, Earliest Indication: 12/5/2019 at 1035
Downtime hrs, leak/total:	264.62 hours (11 days 37 minutes)
ESP?	**NO**
Leak/Incident Loc:	Superheater, severed superheater hanger tube external to furnace (penthouse), orderly shutdown initiated, no ESP completed.
How discovered:	Walkdown, Click here to enter text.
Wash adjacent tube:	NO
Root cause:	Fatigue, Mechanical
Leak detection:	NO
Bed cooling enhanced:	NO
Last full inspection:	Nov-18
Sequence of events:	#5 Recovery Boiler was operating on natural gas only as the Black Liquor Evaporator System for this boiler was down for maintenance. RB5 had been taken off liquor December 4th at 1020am. During the course of the boiler walk down at ~8am December 5th, noise and high heat in the area above the boiler from a suspected superheater platen leak was found. This was later identified as a severed superheater hanger tube. The boiler gas system was tripped, and an 8 hour cool down period prior to water washing was started. As the boiler was on gas only with no smelt bed for 18+ hours, no Emergency Shutdown Procedure (ESP) was required. At 2:00pm December 9th following the hanger tube repairs, prior to the boiler going online or firing liquor, a tube leak was discovered in the superheater section on the 8th floor. When the LH (East) door was opened it appeared that the leak was close to the bottom of the high crown seals at roof tube elevation on the superheater. There was no evidence of water in this location or the lower furnace. The boiler was again taken down for cooling and repairs. The leak was confirmed as a superheater hanger tube separation below the high crown seal. Further leaks were found during the subsequent hydro in the superheater section at the tube tie welds: 3 locations on the front platens, 8 on the middle platens, and 1 on the rear platens.
Repair procedure:	Replace tube section with butt welds above and below high crown seal.
Future prevention:	Not yet determined.

SUPERHEATER

Classification:	Noncritical
Co, Mill, Location:	**Evergreen Packaging, LLC; Pine Bluff Mill; Pine Bluff, Arkansas**
Unit Data:	RB#3,1960, Babcock & Wilcox, PR-60, Drums - 2, DCE - Cyclone, Floor - Sloped to Front
Unit Size:	1.17 MMlb DS/day, 202,000 lb/hr steam, 1,275 PSIG, 900ºF, 1,425 PSIG Design
Incident Date/Time:	September 16, 2019, Earliest Indication: 9/16/2019 at 01:56
Downtime hrs, leak/total:	93.75
ESP?	**YES**
Leak/Incident Loc:	Superheater, Secondary outlet, Platen 3, Tube 4 & 5, Upper hairpin
How discovered:	Walkdown, Loud noise heard; inspected unit and discovered tube leak
Wash adjacent tube:	NO
Root cause:	Fatigue, initiated as fatigue crack along the intrados of the bend
Leak detection:	NO
Bed cooling enhanc	YES
Last full inspection:	Jan-19
Sequence of events:	2019.09.16 01:56 – Boiler ESP initiated. ESP functioned without issue. 05:56 – 4 hour waiting period expired. 06:00 – Contractor in to apply bed cooling enhancement medium. 11:00 – Bed cooling enhancement medium application complete. 12:15 – Water wash begin. 2019.09.17 01:00 – Water wash complete 01:20 – Start effort to locate leak. 01:50 – Leak confirmed SSH Outlet 04:40 – Scaffold install begin 06:15 – Leak pinpointed and marked 07:00 – Scaffold install end, hairpin cut lines established 07:45 – repair work begin 18:00 – adjacent tube UT complete 2019.09.18 06:30 – X-ray on tube #5 failed. Saw cut out bad weld, prep, and re-weld. 13:00 – X-ray tube #5 failed. Results showed porosity in fill and cap. Ground out fill and cap and re-welded. 18:00 – X-ray on tube #5 passed. 19:00 – Tongue & Grove clip install begin. 01:00 – PT on Tongue & Groove clips passed. 2019.09.19 01:05 – unlock for hydro 06:23 – boiler at 1,000 PSIG for hydro 06:35 – dry hydro 12:35 – gas fire in boiler 23:41 – boiler online 2019.09.20 00:20 – 1st liquor gun in boiler
Repair procedure:	Replaced Tube 4 & 5 upper hairpin, installed 18” Dutchman on tube #4, and replaced six tongue & groove clips. X-Ray NDE performed on three (3) pressure-part welds. Dye-penetrant on six (6) tongue & groove clip welds. Boiler hydro to 1,000 psig.
Future prevention:	

SUPERHEATER

FALL 2020-25

Classification:	Noncritical
Co, Mill, Location:	**Domtar Kamloops Mill**
Unit Data:	RB#2,1972, B&W, BWC8810, Drums - 2, DCE - NO, Floor - Sloped to Front
Unit Size:	5.5 Running at 5.0 MMlb DS/day, 760,000 lb/hr steam, 600 PSIG, 721ºF, 771 PSIG Design
Incident Date/Time:	March 23, 2020, Earliest Indication: 3/23/2020 at 6:00
Downtime hrs, leak/total:	78 hrs
ESP?	**NO**
Leak/Incident Loc:	Superheater, Tube No.8 of Platen 19, in the crossover tube from the 1st and secondary Superheaters
How discovered:	Walkdown, heard a roaring noise that was not normally present.
Wash adjacent tube:	NO
Root cause:	Fatigue, small pitting defect
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Oct-19
Sequence of events:	On 03/23/2020 Morning, Operators Observed Noise on the 10th Floor or the Recovery. Recovery Boiler Critical Trends. Critical trends show at 6:08 a drift in the Steaming Rate and Feedwater ratio. ID fan Speed increase and an increase in the Economizer draft, (furnace draft would have shown as increased if ID fan had not increased). Sootblowers in the area were isolated for further troubleshooting. Leak was deemed to be in the 10th floor region of the superheater. As per RM 90-0190 the risk of water entering the furnace was low and it was decided to carry out an orderly shutdown of the Recovery. Recovery was offline by 9:34 and the bed burnt out by 11:52 Shutdown activities progressed through Dayshift and Nightshift By Morning of 03/24/2020 CIMS was onsite. Water could be observed coming down from the Superheater region above the 10th floor doors. Entry to Recovery started 13:30 for scaffolding, by 16:30 exact leak location had been determined. Repair started and continued through the Nightshift By the afternoon of 03/25/2020 the repairs were complete and Hydrotesting took place at 19:00 De-locking started after successful hydrotest. At 03/26/2020 5:19 Recovery Boiler was the warm up curve, startup activities progressed through the dayshift. Difficulties getting TGC onboard delayed firing of liquor to 17:00 Mill startup progressed through Nightshift At 03/27/2020 Recovery was back to 4900 Mlb/day Firing rate.
Repair procedure:	Cut out and weld in a new section of tube
Future prevention:	Inspect for defects

SUPERHEATER

FALL 2020-26

Classification:	Noncritical
Co, Mill, Location:	**International Paper, Prattville Mill, Prattville AL**
Unit Data:	RB#2 ,1980, CE, 20278, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	3.2 MMlb DS/day, 510,000 lb/hr steam, 1500 PSIG, 900ºF, 1740 PSIG Design
Incident Date/Time:	September 15, 2019, Earliest Indication: 9/15/2019 at 11:00 AM
Downtime hrs, leak/total:	130.93
ESP?	**YES**
Leak/Incident Loc:	Superheater, Outlet Tubes of Tertiary Superheater (Final Stage)
How discovered:	Walkdown, Click here to enter text.
Wash adjacent tube:	NO
Root cause:	Molten salt corrosion

Leak detection: YES
Bed cooling enhanc NO
Last full inspection: Apr-19
Sequence of events: Sunday, September 15 at 11 am, Boiler Tender was making routine rounds around the #2 Recovery Boiler and heard an unusual noise coming from the 3rd floor (firing level) of the boiler. The Boiler Tender called the Control Room Recovery Boiler Operator to turn off the sootblowers. Once the Sootblowers were shutdown, the Boiler Tender made a walkdown of the boiler checking for indications of a leak. The Boiler Tender could not detect the sound below or above the firing level of the boiler. The Boiler Tender then called the Control Room Operator to come out to the 3rd floor to see if he too could hear the sound. The Control Room Operator listened and validated the sound. Immediately following, the decision to ESP was made and #2 Recovery Boiler was ESP'd at 11:12 am. Steam & Power Management waited the four-hour safety window and then made a thorough walkdown of the boiler to give the all clear. All ESP items had functioned correctly. The Bed was cooled for 16 hours and then the boiler was filled to verify/locate the leak. Shortly after the boiler had begun filling and before any pressure was applied, water could be seen in the lower furnace. A walk down of the boiler identified the leak location in the Superheater Section between floors 7 & 8. Initially, the exact location of the leak could not be determined from exterior examination. Scaffold decking was built across the screen tubes on the 7th floor and then built up to access the leak location. Once scaffold was built, the boiler was filled a second time to pinpoint the exact leak location and the leak was found in the Tertiary Superheater Location Platen 22 Tube 11. With support from IP Technology and the Boiler Inspector, repair plans were developed, and the Boiler Repair Contractor began work. Visual inspection of the Tertiary Superheater Platens showed tubes 9-12 to have heavy exfoliation (Tubes 9-12 are the Superheater Outlet tubes). Adjacent tubes were examined and due to thinning, Dutchman were also installed on Platen 23 Tubes 9 & 12. Repairs took approximately 4.5 days to complete and the boiler was back on-line on 9/20/19 at 10:00 pm. Leading up to the event, there was no indication of steam and water separation, furnace pressure on the boiler did not change; ID Fan speed remained the same; no indications of a leak on the chemical mass balance or the water mass balance programs. At time of the ESP, the boiler was steaming at a rate of 450,000 lbs/hr and firing 285 gpm of 69% solids BL. On the morning of Friday, September 13th, RB2 tripped following a #2 Turbine Generator trip (#2 TG tripped due to both Hydraulic Pumps failing).
Repair procedure: Cut out low thickness tube and replaced with Dutchmen
Future prevention: Replace Tubes 9 -12 on 28 platens of tertiary superheater section. The SH replacement is planned for 2022.

BOILER BANK

FALL 2020-27
Classification: Critical #919
Co, Mill, Location: **WestRock, West Point, VA**
Unit Data: RB#4, 1976, Combustion Engineering, 21975, Drums - 2, DCE - Cascade, Floor - Decanting
Unit Size: 2.7 mmlb ds/day, 427 klbs/hr steam, 1225 psig, 900 F, 1360 psig Design
Incident Date/Time: July 31, 2019, 10:15 am Earliest Indication: 7/31/2019 at 9:15 am
Downtime hrs, leak/total: 55.75 hrs'55.75 hrs
ESP? **YES**
Leak/Incident Loc: Boiler Bank, Generating bank, left side wall tube #2
How discovered: Walkdown, 1st Assistant was making his walkdown and noticed small amount of steam or dust coming out from behind insulation on the front wall in the vicinity of the generating bank
Wash adjacent tube: NO
Root cause: Stress Corrosion Cracking (SCC), Tube was not cut out so root cause cannot be verified
Leak detection: NO
Bed cooling enhanc NO
Last full inspection: Apr-19
Sequence of events: July 31, 2019:
o 9:15 am: The First Assistant, while making his rounds, notice what he believed to be a small amount of steam or dust escaping from under the boiler insulation on the left wall right below the steam drum. He notified the Recovery Operator who then requested assistance from Power Plant supervision with trying to determine source of steam/flue gas. At 9:30 am Power Plant Superintendent and Assistant Superintendent arrived on the boiler and started assisting with the investigation. The thought at that time, was that a soot blower was leaking by. Two soot blowers were identified as being the possible source of the vapor (IK 37 or IK 45). Steam was shut off from IK 37 and vapor did not stop. Steam was then shut off to all soot blowers and vapor could still be seen coming from under the insulation. In addition, while the soot blowers were cut

	off what sounded like a small steam leak could be heard. It was at this time 10:15 am that decision was made to perform an ESP. o 10:15 pm: (Following 12 wait period) boiler building was re-entered and ESP walkdown was completed—all ESP actions functioned as required. August 1, 2019 o 5:30 am -- Boiler was filled for hydro and hydro pressure was starting to be applied. A leak on Generating Bank left sidewall tube #2 (counted from the front of the boiler) was located. Leak was discovered when boiler pressure reached 100 psi. o Leak was repaired using weld metal buildup. o 5:00 pm – dry hydro was completed August 2, 2019: o 6:00 am – Boiler was lit off o 5:45 pm – Boiler was online
Repair procedure:	Performed (1) weld repair to the #2 left side generating bank side wall tube, tubes are counted from front to rear of the boiler. The repair is located 2 inches above the buck stay on the 8th floor elevation. WPS# GT-Pl Rev-1, Preheat 50 deg, Material SA 178A
Future prevention:	Skin casing will be removed on both side of boiler at this location and alignment tab to tube welds will be inspected during the next annual outage.

BOILER BANK

FALL 2020-28	
Classification:	Critical #920
Co, Mill, Location:	**IP, Orange, TX**
Unit Data:	RB#2,1967, B&W, PR-108B, Drums - 2, DCE - Cyclone, Floor - Sloped to Front
Unit Size:	2.7 MMlb DS/day, 254,000 lb/hr steam, Operating: 850 PSIG, 835ºF, MAWP: 975 PSIG
Incident Date/Time:	December 8, 2019 @ 10:00 am Earliest Indication: 12/8/2019 at 4:00 A.M.
Downtime hrs, leak/total:	127 hours
ESP?	**NO**
Leak/Incident Loc:	Generating Bank Row 51 Tube 23
How discovered:	Operator on normal round heard a noise they could not identify
Wash adjacent tube:	YES
Root cause:	Other, Near drum corrosion close to sootblower lane.
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Jul-19
Sequence of events:	At approximately 4:00 a.m. on 12/8/2019, boiler was firing at 210 gpm and steaming app. 225 kpph. During steady state operation, the operator, during a normal walkdown, heard a noise he could not identify. Investigation by the night shift FLL and senior operators could not determine the source and could not determine whether it was a leak. The RBLI did not indicate any issues. There were no mass balance alarms. The water tests were normal and not trending down. The situation was communicated to the day shift crew. The day shift FLL and senior operators also went thru the trouble shooting process and could not identify the sound or determine if there was a leak. They suspected the sound to be coming from the area of the economizer. The decision was made to stop firing liquor and shutdown the boiler to determine if there was a leak. All fuels were removed at 10:00 am on 12/8/2019. When all fuels were removed from the boiler, a small leak was identified in the generating bank near the right wall.
Repair procedure:	The lower portion of the leaking tube was removed from the mud drum and a Dutchman was installed. Near drum testing was performed on tubes surrounding the failure area due to visual erosion present. A total of twenty-five tubes were identified which were at or below t-min in two clusters surrounding sootblower lanes close to the right-hand sidewall. The identified tubes were either plugged or removed from the mud drum and Dutchmen installed.
Future prevention:	Inspection and scheduled repairs.

BOILER BANK

Classification:	Critical #921
Co, Mill, Location:	**Evergreen Packaging, LLC; Pine Bluff Mill; Pine Bluff, Arkansas**
Unit Data:	RB#2,1958, Babcock & Wilcox, PR-37B, Drums - 2, DCE - Cyclone, Floor - Sloped to Front
Unit Size:	1.17 MMlb DS/day, 202,000 lb/hr steam, 1,275 PSIG, 900ºF, 1,425 PSIG Design
Incident Date/Time:	September 20, 2019, Earliest Indication: 9/20/2019 at 05:55
Downtime hrs, leak/total:	66.1
ESP?	**YES**
Leak/Incident Loc:	Boiler Bank, Mud Drum – Row 5 Tube 27, R6 T26, R7 T28, & R8 T32
How discovered:	Boiler Trip, Boiler tripped at 05:35 on low drum level. On walkdown, water was observed to be discharging from around the mud drum.
Wash adjacent tube:	NO
Root cause:	Thinning External, Near-drum thinning
Leak detection:	NO
Bed cooling enhanc	YES
Last full inspection:	Mar-18
Sequence of events:	2019.09.20 05:35 – Boiler tripped low drum level. 05:47 – Purged and relit boiler. 05:55 – Water discovered to be discharging from around mud drum. Water was running on the cool side of the generating bank above the mud drum. The water was flowing into the ash hopper. ESP initiated 05:55. All ESP devices indicated proper operation. 09:32 – Boiler inspected and deemed safe for entry. 10:00 –10:15 – Contractor in to apply bed cooling enhancement medium 11:30 – Bed cooling enhancement medium application complete. 13:45 – Water wash begin. 2019.09.21 23:45 – Water wash complete. 02:25 – Begin effort to locate leak(s) 03:25 – Leaks pinpointed and marked. Three (3) leaks discovered. Row 5, Tube 26; Row 6 Tube 25; Row 7, Tube 27. 06:00 – IK23 discovered to have bent lance and rubbed several tubes in the IK lane. UT tubes with rub marks. No issue detected. 10:00 – Repair work begin. 21:00 – Repair work complete. 21:30 – PT pass. 2019.09.22 00:00 – Boiler full, start hydrostatic test 01:45 – Pin hole leak discovered Row 8 Tube 32 near mud drum. 05:00 – Second repair effort begin 06:30 – Repair complete 07:35 – PT pass. 08:30 – Begin filling boiler for hydro 11:15 – Dry hydro 14:26 – Gas fire established 21:56 – Boiler to operating pressure 23:41 – First liquor gun in the boiler
Repair procedure:	Locate Leaks, Grind interior of drums around leaking tubes; PT the prep around where plugs will be installed; Pre-heat to 350F; weld plugs into drum; PT the final welds; hydrostatic test
Future prevention:	Replace a portion of cold-side Gen Bank at next I&R Outage (2020).

BOILER BANK

Classification:	Noncritical
Co, Mill, Location:	**WestRock, West Point, West Point Va.**
Unit Data:	RB#5, B&W PR-219, 1992, Drums - 1, DCE - NO, Floor - Sloped to rear
Unit Size:	3,000,000 MMlb DS/day, 497,000 lb/hr steam, 1200 PSIG, 900^{o}F, 1225 PSIG Design
Incident Date/Time:	March 26, 2020, Earliest Indication: 3/26/2020 at 8 am
Downtime hrs, leak/total:	0/155
ESP?	**NO**
Leak/Incident Loc:	Boiler Bank, Leaks were discovered while cooling boiler prior to water wash. While 2nd assistant was setting boiler up for the water wash he noticed water in the generating bank ash hopper. Opened boiler doors and determined that there were leaks on 3 different tubes in the last row of the long flow generating bank outlet tubes
How discovered:	Walkdown, 2nd assistant noticed water in the generating bank ash hopper
Wash adjacent tube:	NO
Root cause:	Thermal Fatigue, The leaks were caused from tensile stress from the membranes. The cracks appear to have been caused by multiple stress events.
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Apr-19
Sequence of events:	At 9:30 pm on March 25th, 2020 #5 RB was taken offline for a scheduled water wash outage. At approximately 8 am on March 26th, 2020 as the 2nd Assistant was setting the boiler up for the water wash, he noticed water coming out of the generating bank ash conveyor. A walkdown of the boiler was conducted and water was found in the flue gas pass between the generating bank and the front most economizer section. Boiler was water washed, locked out, and scaffolding installed in the pass adjacent to the leaks. A hydro was attempted but was aborted at 150 psi due to the amount of water leaking out of the tubes. At 150 psi drum pressure three leaks were located. These leaks were in the lower membrane attachment welds on tube #1, #28, & #29. Note: During hydro water was noticed on nose arch and after further investigation a leak was identified on a front screen tube. This leak will be discussed in a separate report. Visual inspection and penetrant testing was completed on the remaining 85 generating bank rear baffle wall tubes. Cracks (no leaks) were found in two additional tubes #27 & #88. Decision was made to remove leaking sections and sections that had crack indications. Sections of tubes 1, 27, 28, 29, & 88 were removed and sent out for analysis. Tube sections were reinstalled, and a successful hydro was completed at 6 pm on March 30th, 2020
Repair procedure:	Tube sections replaced
Future prevention:	During the upcoming annual outage scaffolding will be installed in the flue gas pass between the generating bank outlet and the first economizer inlet at a location that will provide access to the area of the recent tube failures. The visual inspector will perform a visual inspection of the membrane to tube weld on all 88 rear wall baffle tubes. Inspector may have to utilize a borescope to perform the visual inspection of the back side of the tube to membrane welds. Any suspect areas will be tested (PT).

BOILER BANK

FALL 2020-31

Classification:	Critical #922
Co, Mill, Location:	**International Paper, Prattville, AL, USA**
Unit Data:	RB#1,1967, CE, 1965, Drums - 2, DCE - Cascade, Floor - Decanting
Unit Size:	2.47 MMlb DS/day, 320,000 lb/hr steam, 900 PSIG, 830ºF, 1040 PSIG Design
Incident Date/Time:	June, Earliest Indication: 6/3/2020 at 13:00
Downtime hrs, leak/total:	13
ESP?	**NO**
Leak/Incident Loc:	Boiler Bank Leak at plugs in Mud Drum from added Sootblower Lane
How discovered:	Hydro Test, Hydro Test Prior to and Following Major Outage
Wash adjacent tube:	NO
Root cause:	Other, Corrosion in weld between Mud Drum and Plugs
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Jun-20
Sequence of events:	On June 1, 2020 at 0900, RB1 was taken down for its major outage. Following the typical shutdown sequence of events (Bed Cooldown, Waterwash, Scaffold, etc.), a preliminary Hydrostatic Test at the front end of the outage was performed. During walkdown and inspection of the boiler, a leak from one of the existing Mud Drum Plugs was found. The leak occurred at tube hole #14 on row #16 from left counting the LHSW as row one. (Note: There is no access to the top of the Mud Drum where the plugs are located and visual inspection of the top of the Mud Drum can only be performed at a distance by accessing an adjacent Sootblower Pass. It is also worth noting that the 150 total Mud Drum Plugs are the result of two rows of Generating Bank tubes being removed to make room for an additional Sootblower Pass.). Once the boiler was drained and lockout-tagout complete, the Boiler Inspector was able to perform a thorough inspection of the Mud Drum Plugs from the inside of the Mud Drum. Based on visual inspection, the Boiler Inspector identified 84 plugs needing to be addressed. The decision was made by the mill to address all the plugs that were noted on the punch list, which consisted of three priority groups. The plugs were faced off to remove the corroded part of the weld then welded back to the existing weld. Dye Penetrant Testing was performed following the plugs being faced off and after the new weld was applied. When all plug repairs had been made, a Hydrostatic Test was performed, and 7 plugs were found to be leaking. The same repair method was used, and repairs were made to the 7 leaking plugs. Once the repairs were completed, the boiler was Hydrostatically Tested a 2nd time. The 2nd Hydrostatic Test revealed 1 plug leaking. Following the 2nd Hydrostatic Test, visual inspection and PT was performed on all the previously repaired plugs in the Mud Drum and any flaw was addressed. The boiler was Hydrostatically Tested a 3rd time and again revealed 2 leaking plugs. The plugs leaking this time were plugs that had not been repaired previously and the decision was made to completely remove all the weld and reweld the plug to the drum. Following the repairs, the boiler was Hydrostatically Tested a 4th time and was successful. It is possible that the existing welds were disturbed while the repairs to the 84 plugs were being made creating the additional leaks that were observed.
Repair procedure:	Plugs were faced off to remove corrosion then welded back to the existing weld
Future prevention:	The plan on the next annual outage will clean and grind the welds between the plug and the drum surface, machine the plug from inside the drum to get a clean plug surface and build the weld back from the plug to the drum. We will review this with technology and finalize our plan before we bid the job for the outage in June 2021.

BOILER BANK SCREEN, REAR WALL SUPPORT TUBE

FALL 2020-32

Classification:	Critical #923
Co, Mill, Location:	**WestRock, West Point, West Point Va.**
Unit Data:	RB#5, B&W PR-219, 1992, Drums - 1, DCE - NO, Floor - Sloped to rear
Unit Size:	3,000,000 MMlb DS/day, 497,000 lb/hr steam, 1200 PSIG, 900^{o}F, 1225 PSIG Design
Incident Date/Time:	March 26, 2020, Earliest Indication: 3/26/2020 at 11 am
Downtime hrs, leak/total:	0/155
ESP?	**NO**
Leak/Incident Loc:	Furnace Screen, Leak was discovered while boiler was under hydro fill pressure. During walkdown water was observed on the nose arch. This leak was located just above the gusset to tube weld on an upper nose arch tube which rolls out of plane and is used for support for the rear wall of the furnace.
How discovered:	Hydro Test, During hydro (at hydro fill pressure) walk down water was observed on the nose arch.
Wash adjacent tube:	NO
Root cause:	Stress Assisted Corrosion (SAC), The leak appears to have been caused by fatigue initiating in the area of undercutting at the toe of the seal weld. There was slight stress assisted corrosion on the ID of the tube noted.
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Apr-19
Sequence of events:	At 9:30 pm on March 25th, 2020 #5 RB was taken offline for a scheduled water wash outage. At approximately 8 am on March 26th, 2020 as the 2nd Assistant was setting the boiler up for the water wash, he noticed water coming out of the generating bank ash conveyor. A walkdown of the boiler was conducted and water was found in the flue gas pass between the generating bank and the front most economizer section. Boiler was water washed, locked out, and scaffolding installed in the pass adjacent to the leaks. A hydro was attempted but was aborted at 150 psi due to the amount of water leaking out of three generating bank tubes. These leaks are discussed in a separate report. During the attempted hydro water was noticed on the nose arch. Boiler was hand washed and scaffolding installed to allow further investigation. Once access was made into upper furnace a leak was identified on a front screen tube. Visual inspection of the front screen tube (#92) showed two (2) leaks in the tube just above the seal weld with the support lug welds. Tube was removed and a new section installed.
Repair procedure:	Tube section replaced
Future prevention:	During the upcoming annual outage, the refractory around the 28 nose arch tubes that are used for rear wall support will be removed to allow for the areas around the gusset to tube weld to be cleaned. Once cleaned these areas will be inspected visually and with PT. Also, the boiler manufacture has been contacted to see if there are any recommended design changes to this tube attachment.

UPPER FURNACE, ABOVE HIGHEST AIR ENTRY

FALL 2020-33

Classification:	Critical #924
Co, Mill, Location:	**Domtar, Nekoosa, WI**
Unit Data:	RB#14, 1991, CE, 89101, Drums - 1, DCE - NO, Floor - Decanting
Unit Size:	1.80 MMlb DS/day, 264,000 lb/hr steam, 1500 PSIG, 900^{o}F, 1720 PSIG Design
Incident Date/Time:	January 11, 2020, Earliest Indication: 1/11/2020 at 3:20:45am
Downtime hrs, leak/total:	Total hours off liquor: 86
ESP?	**YES**
Leak/Incident Loc:	Upper Furnace, above air entry, Right hand side wall tube, above nose arch, 2 feet below roof.
How discovered:	Control Room, 1st indication was low drum level alarm.
Wash adjacent tube:	NO
Root cause:	Mechanical Damage, Impact from IK lance tube
Leak detection:	YES
Bed cooling enhanc	YES
Last full inspection:	Oct-19
Sequence of events:	The recovery crew was on their 4th night of a 7 night 10pm – 6am shift. Recovery conditions were normal with the boiler only firing black liquor (60 KPPH black liquor flow at 22 PSI and 254 degrees, 256 KPPH steam flow). At about 3:20am, both the Recovery Operator and the Recovery Helper were in the control room when they heard a loud roar (similar to a safety relief valve lifting). The Recovery Operator noticed on the Boiler room liquor gun floor camera that the boiler was blowing back. He looked at the IKs and they were still in service. He also noticed that the drum level was dropping. Shortly thereafter, the low drum level alarm sounded (3:20am and 45 seconds). The Recovery Operator looked at the feedwater pump to see if it was still running which it was. He also looked at the ID fans and noticed that they had picked up (from 50% to 78%). The boiler then tripped on low drum level at 3:21am and16 seconds. They looked at the recovery bed cameras and did not notice any disruptions in the bed. Another look at the Boiler room liquor gun floor camera revealed that water was coming from above and washing all over the floor. The Operator and the Helper agreed that they should ESP the boiler which the Operator did at 3:22am and 16 seconds. After initiation of the ESP, the Recovery Operator filled out the Post ESP checklist and indications from the control room were that everything functioned correctly. After the mandatory 12 hour wait period, the boiler was walked down and found the source of the leak which was a wall tube rupture on the 11 ½ floor directly opposite of #4 IK. Upon inspection of the IK, it was noticed that the Lance tube had pulled out of the gearbox and was resting close to the boiler while the gearbox was back at its home position. During the Post ESP walkdown, all ESP functions were checked and verified that they all were successful. The bed was cooled by Southland about 22 ½ hours after the ESP. Most of the bed had burned out except for a couple piles in the rear corners of the boiler. Due to the area around the leak being clear of saltcake and having safe access from a nearby access door, the decision was made to repair the tube prior to a waterwash. Following a 3-foot Dutchman repair to the ruptured tube, a full waterwash was performed to allow for a more thorough Post ESP inspection. A boiler inspection and successful hydro were completed on January 13th at 6:00pm with no further damage being identified. A gas fire was established in the boiler on January 14th at 2am and liquor was fired in the boiler at 5:20pm.
Repair procedure:	3-foot Dutchman
Future prevention:	Under investigation

LOWER FURNACE, BELOW HIGHEST AIR ENTRY

FALL 2020-34

Classification:	Critical #925
Co, Mill, Location:	**Harmac Pacific, Nanaimo**
Unit Data:	RB#6,1963, B&W, 5315, Drums - 2, DCE - NO, Floor - Sloped to Front
Unit Size:	3.3 MMlb DS/day, 520000 lb/hr steam, 600 PSIG, 750^{o}F, 750 PSIG Design
Incident Date/Time:	April 10, 2019, Earliest Indication: 4/10/2019 at 3 pm
Downtime hrs, leak/total:	No Down time- discovered upon Hydrostatic test
ESP?	**NO**
Leak/Incident Loc:	Lower Furnace, below highest air entry, Left hand corner tube near bottom of abandoned load burner air duct attachment weld
How discovered:	Hydro Test, During internal hydro inspection water was observed weeping from a membrane attachment weld. The water was wiped off and reinspect during the hydro inspection when the water had re-appeared
Wash adjacent tube:	NO
Root cause:	Stress assisted corrosion, SAC
Leak detection:	NO
Bed cooling enhanc	NO
Last full inspection:	Apr-19
Sequence of events:	Found on hydro
Repair procedure:	Tube section was removed and replaced with new
Future prevention:	Nondestructive examination of tubes during next opportunity

LOWER FURNACE, BELOW HIGHEST AIR ENTRY

FALL 2020-35

Classification:	Noncritical
Co, Mill, Location:	**Canfor Pulp Limited, Northwood Mill, Prince George, BC**
Unit Data:	RB#1,1966, Combustion Engineering, Contract #CA-64127, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	4.00 MMlb DS/day, 658,000 lb/hr steam, 656 PSIG, 752^{o}F, 750 PSIG Design
Incident Date/Time:	May 2, 2020, 0800 hours
Downtime hrs, leak/total:	The boiler was down for a production curtailment at the time of the discovery
ESP?	**NO**
Leak/Incident Loc:	Lower Furnace, below highest air entry, Right Wall, Tube #62, 7.5” above floor elevation
How discovered:	Walkdown. The boiler was laid up wet for the curtailment April 23rd. It required water addition to refill starting April 24th on a shift to shift basis. Initially thought to be valves leaking by, but continued once all fully isolated. Full boiler walkdown discovered presence of water on east dissolver skirting behind right front spout.
Wash adjacent tube:	NO
Root cause:	Thermal Fatigue, leak located as a suspected mechanical damage site when boiler was converted to a seal welded furnace. The Tube cracked on the back side of the round bar, at the hot side of the tube. Suspect thermal fatigue (hidden damage, see sketch below).
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Nov-18
Sequence of events:	The boiler was laid up wet for the curtailment April 23rd. It required water addition to refill starting April 24th on a shift to shift basis. Initially thought to be valves leaking by, but continued once all fully isolated. Full boiler walkdown discovered presence of water on east dissolver skirting behind right front spout. The boiler systems were locked out for entry into the East Dissolving Tank. Once cleaned out, scaffolding was built to access what was thought to be the leak location. Dissolver right front spout, associated skirting/casing, and pressure parts removed to access suspected leak location. Leak pinpointed between Tube 61 and 62. Tube 62 had a window cut to identify leak, at this point thought to be the cold side attachment weld. Initial water side PT did not confirm leak location. PT was then applied to the external tube tangent and dye was pulled through to the water side at the round bar landing location. The crack was blended out, revealed 0.114” remaining wall thickness and was weld overlaid to the same thickness as the surrounding tube area. Window were welded back on cold side of tube. Tubes 61 and 62 to be pupped in the September 2020 shutdown. Hydrostatic testing completed May 8th and confirmed no leaks.
Repair procedure:	Repaired by weld metal build-up
Future prevention:	Tube will be removed and replaced during the September 2020 shutdown

BOILER BANK SCREEN, REAR WALL SUPPORT TUBE – SMELT-WATER EXPLOSION

FALL 2020-36

Classification: RB Explosion #164

Co, Mill, Location: **International Paper, Container Board Mill, Bogalusa, LA**

Unit Data: RB21, B&W, PR-211, Drums - 1, DCE - No, Floor - Sloped to rear

Unit Size: 3.3 MMlb DS/day, 504,600 lb/hr steam, 875 PSIG, 825°F, 1050 PSIG Design

Incident Date/Time: March 3, 2020 @11:19 a.m. Earliest Indication: March 3, 2020 @ 10:46 a.m.

Downtime hrs, leak/total: 713 hrs

ESP? **YES**

Leak/Incident Loc: Tube failure/rear wall screen tube number 15, at top of nose arch, elev 139' 9" to 141' 9".

Injuries: **NO injuries**

How discovered: Master Fuel Trip - Field operator investigation found water in collection conveyor.

Wash adjacent tube: No

Root cause: Fatigue at closure plate weld

Leak detection: Nalco system - Trasar

Bed cooling enhanc Yes

Last full inspection: May 15, 2019

Sequence of events: March 3rd RB21 shut down on a master fuel trip at 10:46 a.m. The BMS indicated that the trip was due to high furnace pressure. The field operator and assistant superintendent proceeded to the boiler to investigate the trip while the operator started resetting/restarting equipment to gain permissive for restart. Initial troubleshooting caused the team to suspect that a draft tap was plugged. The crew cleared the draft taps and continued to investigate as the operator began the process of starting up. The operator restarted fans at 10:59 a.m. and continued the attempt to regain permissives. From the point of the trip through 11:04 am, the feed water valve was wide open and the boiler was making up at a rate of 664 kpph. At 11:04 am drum level finally reached a positive value and the feed water valve cut back but did not close. At 11:12 the outside operator found water in the collection conveyor. This information was radioed to the control room without indicating that the water was observed under the generating bank hopper and not under either of the economizer hoppers. Field personnel proceeded to investigate to determine if the source of the water was an IK or if the leak location was in the critical or non-critical section of the generating bank. At 11:16 am the inspection door on top of the generating bank hopper was opened and water was observed coming down from the center of the generating bank, not along the walls. Feed water is still being supplied to the boiler at an average 366 kpph since reestablishing drum level. Field personnel continued to try to pinpoint the leak location. At 11:19 am the boiler furnace rapidly over-pressurized (An explosion was heard) and the operator immediately ESP'd the boiler.

06:26:26	RB Leak Indication software issues a Trasar alarm
8:02:48	RBLI issues a Mass Balance alarm
9:35:00	15-minute rolling FW/Steam Differential exceeds 50 kpph
10:46:40	Master Fuel Trip on High Furnace Pressure, >+4"
10:47:25	High Feed water flow prevents Large Leak Logic trip
10:48:02	First FW/Steam Differential alarm issues at 300 kpph
10:48:23	Drum level finally reaches low trip point, 58 seconds too late for large leak logic
11:04:19	Drum level positive, FW flow reduces, but not to zero
11:11:40	Upward trend in FW/Steam Differential reported to operator
11:12:00	Water observed coming from the ash hoppers
11:16:00	Water observed in the center of the Generating Bank
11:19:47	Explosion occurred
11:20:03	ESP initiated

Later inspection found that a tube failure occurred at rear wall screen tube number 15, at top of nose arch, elevation between 139' 9" to 141' 9". When the tube ruptured, feed water reached the furnace and resulted in a smelt-water reaction. As a result of the incident, the boiler experienced expansion damage in the furnace and at the generating bank front wall.

Brown and Root performed repairs as directed by B&W to correct damages caused by the over-pressurization. A new tube segment was installed to replace the failed tube. Boiler was then hydrostatic tested following tube repair on 3/25/2020. Additional tube repairs were made based on inspection findings. Boiler was hydrostatic tested on 3/29/2020. Boiler drum was lowered to operating level 4/1/2020, and startup procedure SOP-0027-RBG was followed to bring boiler back online.

Repair procedure: Brown and Root removed & replaced damaged tube.

Future prevention: Improve training and tools on large leak identity. Provide clear definition for ESP expectations.

BOILER BANK SCREEN, REAR WALL SUPPORT TUBE

FALL 2020-37

Classification:	Critical #926
Co, Mill, Location:	**International Paper, Container Board Mill, Bogalusa, LA**
Unit Data:	RB#20, Original 1964, B&W, Rebuilt 1980, Original PR68, Rebuilt (1980) PR202, Drums - 2, DCE - Cyclone, Floor - Decanting
Unit Size:	2.8 MMlb DS/day, 388,000 lb/hr steam, 850 PSIG, 825^{o}F, 1050 PSIG Design
Incident Date/Time:	07/21/2020 @ 10:25a.m.
Downtime hrs, leak/total:	78 hrs
ESP?	**Yes**
Leak/Incident Loc:	Hanger Tube #3 in from right - North side of Boiler
How discovered:	Boiler Leak Detection Alarms
Wash adjacent tube:	No
Root cause:	Stress crack
Leak detection:	Nalco system - Trasar
Bed cooling enhanc	Yes
Last full inspection:	March 17, 2019
Sequence of events:	The #20 recovery boiler was off liquor for a cyclone boil at the event time. This boiler has a decanting floor/bottom and holds a smelt pool after spouts cease to flow. Primary Symptoms: - An increase in feed water flow rate without a corresponding increase in steam flow rate. Events: - RBLI Trasar Leak Alarm 7/21/2020 4:03 am; RBLI Trasar Leak Alarm Counter 7 – Alarm cleared on its own and the counter reset minutes later - RBLI Trasar Leak Alarm 7/21/2020 8:41 am; RBLI Trasar Leak Alarm Counter 10 –Alarm cleared on its own and the counter reset minutes later - No mass balance alarms have issued, but there is more activity on the system (counts building and clearing) then there had been before the first Trasar alarm. - Operating team begins investigating source of Trasar alarms, 7/21/2020 8:44 am - Team observes a shift in Feed water/Steam differential that has sustained since approximately 7/21/2020 3:23 am - Abnormal drum level swings occur at 7/21/2020 10:23 am - Operator believes he has a leak and ESP's the boiler 7/21/2020 10:25 am - Confirmed there was a tube leak 7/21/2020 3pm (Hanger Tube #3 in from right)
Repair procedure:	Brown and Root repaired damaged tube.
Future prevention:	Inspect hanger tube connections during annual outage

INTERNATIONAL INCIDENTS

ECONOMIZER

FALL 2020x1171

Co, Mill, Location:	**ZAO International Paper. Svetogorsk**
Unit Data:	RB#3,1981, TAMPELLA ,, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	1.6 MMlb DS/day, 264,000 lb/hr steam, 550 PSIG, 824ºF, 711 PSIG Design
Incident Date/Time:	March 3, 2019, Earliest Indication: 3/3/2019 at 13:00
Downtime hrs, leak/total:	24
ESP?	**NO**
Leak/Incident Loc:	Economizer, Leak on #35 panel, 1 stage
How discovered:	Walkdown, the RB-3 operator found moisture in the ECON #1 hopper
Wash adjacent tube:	NO
Root cause:	Thinning External, Corrosion was caused by residual sulfate
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Jun-18
Sequence of events:	March 3, 2019 13:00 RB-3 operator found a moisture in the ECO#1 hopper. Following the procedure, the boiler was switched to oil for burning out the bed. The following are the actions taken: - burning the bed - 6 hrs.; - Shutdown and cooling down the boiler - 5 hrs., the temperature was controlled with the portable thermocouples; - Washing the heating surfaces (ECO#1) - 3 hrs.
Repair procedure:	The platen was plugged, as it wasn't possible to reach the failed tube. Repair method – TIG welding. Basic material - P265GH, 60.3x5mm. Welding material - OK Tigrod 12.64 (ESAB)
Future prevention:	To check the boiler operation procedure. Reduce a carryover

ECONOMIZER

FALL 2020x1172

Co, Mill, Location:	**ZAO International Paper. Svetogorsk**
Unit Data:	RB#3,1981, TAMPELLA ,TAMPELLA, Drums - 2, DCE - NO, Floor - Decanting
Unit Size:	1.6 MMlb DS/day, 264,000 lb/hr steam, 550 PSIG, 824ºF, 711 PSIG Design
Incident Date/Time:	March 18, 2020, Earliest Indication: 3/18/2020at 09:00
Downtime hrs, leak/total:	23
ESP?	**NO**
Leak/Incident Loc:	Economizer, Leak on #22 panel, 1 stage
How discovered:	Walkdown, the RB-3 operator has found moisture in the hopper
Wash adjacent tube:	NO
Root cause:	Thinning External, Corrosion was caused by residual sulfate
Leak detection:	YES
Bed cooling enhanc	NO
Last full inspection:	Jun-19
Sequence of events:	March 18, 2020 09:00 the RB-3 operator found a moisture in the ECO#1 hopper. Following the procedure, the boiler was switched to the oil for burning the bed. The following actions are: - burning the bed - 6 hrs.; - Shutdown and cooling down the boiler - 5 hrs., the temperature was controlled with the portable thermocouples; - Washing the heating surfaces (ECO#1) - 3 hrs.
Repair procedure:	Installed a dutchman ~ 500mm. Repair method – TIG welding. Basic material - P265GH, 60.3x5mm. Welding material - OK Tigrod 12.64 (ESAB). Also repaired the tube to header weld to the tube next to it.
Future prevention:	Improve boiler washing procedure and make sure that area is clean.

APPENDIX II

ESP POWER POINT PRESENTATION

Diagrams have been embedded in
The ESP report above.

APPENDIX III

AF&PA Presentation

AMERICAN FOREST & PAPER ASSOCIATION
RECOVERY BOILER PROGRAM
STATUS UPDATE

BY

WAYNE GRILLIOT
October 7, 2020

BLRBAC MEETING

AF&PA Recovery Boiler Program

The **AF&PA Recovery Boiler Program** was

established in 1974

- Identify the root cause of recovery boiler critical incidents and explosions
- Assist companies in improving the safety, integrity, and reliability of recovery boiler operations
- Membership is open to all companies that operate recovery boilers
- Activities are funded by member company dues

AF&PA Recovery Boiler Program

- The Recovery Boiler Program is under the direction of a **Steering Committee**
  - **Frank Navojosky** – International Paper
  - **Wes Hill** – Georgia-Pacific
  - **Jeff Wagoner** – International Paper
  - **Greg Burns** – Georgia-Pacific

- The Steering Committee sets the priorities based on:
  - Member Company Input
  - BLRBAC Incidents
  - Industry Needs

AF&PA Recovery Boiler Program

Documents developed by the Program:

- **Reference Manuals**
- **Audit Guidelines**
- **Best Practices**
- **Training Aids**
- **Checklists**
- **Textbooks**
- **Studies**

AF&PA Recovery Boiler Program

- The Program sponsors R&D projects for:
  - **Safety Improvements**
  - **Process Improvements**
- Improvements in:
  - **Safety**
  - **Operations**
  - **Maintenance**
  - **Recovery Boiler Integrity**

AF&PA Recovery Boiler Program

- Two Standing Subcommittees
  - **Operation & Maintenance Subcommittee**
    - **Frank Navojosky** – International Paper (Co-Chair)
    - **Wes Hill** – Georgia-Pacific (Co-Chair)
  - **Research & Development Subcommittee**
    - **Jeff Wagoner** – International Paper (Co-Chair)
    - **Greg Burns** – Georgia-Pacific (Co-Chair)
  - **Subcommittee Membership**
    - Representatives from the Member Companies

Membership

- In 2018, the Recovery Boiler Program was opened to Canadian Mills
- In 2019, the Recovery Boiler Program was opened to South American Mills
- The AF&PA Recovery Boiler Program
  - **24 Member Companies**
  - **95% of the USA & 38% of Canadian Chemical & Semi-Chemical pulp production capacity**
  - **Our 1st South American Member joined this year!**

Operational Safety Seminars

- The **O&M Subcommittee** sponsors the **Recovery Boiler Operational Safety Seminars**
  - Main Objective – Safe Operation of Recovery Boilers
  - Three (3) Safety Seminars were held in 2019
    - 116 participants representing:
    - 18 companies
    - 37 mills
  - April 23-24 & May 14-15, 2019 - Atlanta Airport Marriott
  - Nov. 14, 2019 – Richmond, BC – River Rock Hotel
    - After the Fall Western Canada BLRBAC Meeting
- Operators, supervisors, superintendents, maintenance professionals, engineers, and managers attended

Operational Safety Seminars

- Attendees receive valuable information and insights from the dialogue among the attendees and monitors of the seminars
- The tabletop exercises help operators and supervisors make the important decision **when to ESP a Recovery Boiler**
  - The six (6) case studies used are based on actual recent Recovery Boiler Incidents
- Over 3,800 people have attended the seminars since they were started in 1985

Operational Safety Seminars

- As more senior operators and supervisors retire, **training continues to increase in importance**
- Companies are finding these seminars to be an important part of their **safety & training programs**
- We continue to recommend that all companies and mills seriously consider sending people to these valuable seminars

Operational Safety Seminars

- **2020 Recovery Boiler Operational Safety Seminars will be on-line in a virtual format, due to Covid-19**
  - October 20-21, 2020 (10:30 am – 3:30 pm) **Eastern Time**
  - November 17, 2020 (7:30 am – 5:00 pm) **Pacific Time**
  - December 9, 2020 (7:30 am – 5:00 pm) **Eastern Time**
  - Safety Seminar Monitors
    - **John Andrews**, BLRBAC ESP Subcommittee Chairman
    - **Dean Clay**, BLRBAC ESP Subcommittee Secretary
  - **Only $200** per attendee for member companies
  - $400 per attendee for non-member companies
  - Attendance is limited – **Register Early!**

Annual Conference & Meetings

2020 AF&PA Recovery Boiler Annual Conference & Committee Meetings

- February 4-5, 2020 @ the Atlanta Airport Marriott Hotel
- Great attendance, with a good mix of:
  - **Operating Companies**
  - **Manufacturers**
  - **Research Specialists**
  - **Vendors**
  - **Insurers**

Annual Conference & Meetings

- **Objective:** Keep the members and the recovery boiler community informed about:
  - **New developments**
  - **Industry Best Practices**

- Presentations included:
  - **New equipment & process technology**
  - **New research developments**
  - **Industry best practices**
  - **AF&PA Recovery Boiler Program activities & projects**
  - **Industry ESP & Incident History**
  - **BLRBAC activity update**
  - **TAPPI Energy, Recovery & Recaust Committee Report**
  - **Updates from the Canada, Sweden, Norway, and Finland Recovery Boiler Committees**

Annual Conference & Meetings

- **2021 AF&PA Recovery Boiler Annual Conference & Committee Meetings** were planned for **February 2-3, 2021**
- This event may change depending on the status of Covid-19. Information to follow
- Normally, 1st Tuesday & Wednesday each February at the Atlanta Airport Marriott Hotel
- The Conference is open to everyone interested in Recovery Boilers

Smelt Dissolving Tank Studies

- The **O&M and R&D Subcommittees** are both working to develop best practices around dissolving tank related issues
- The **R&D Subcommittee** is sponsoring some important research projects at the University of Toronto for improved safety and reduced operating risk of Dissolving Tanks
  - The 4 projects focus on:
    - **Dissolving Tank key operating conditions**
    - **Advanced monitoring techniques**
- The program is building on prior AF&PA studies and related research underway at the University of Toronto, funded by a consortium of 26 companies

Best Practices

- The **O&M Subcommittee** developed the **"Recovery Boiler Functional Checks Example Document"**
  - The document is posted on the AF&PA Recovery Boiler Program Website & is available to everyone
  - We encourage all mills to review the document
- The **O&M Subcommittee** is currently working to formalize recommendations from the "Dissolving Tank Survey and BLRBAC Incidents Study" completed by Dr. Tom Grace
  - It will be finalized at the next meeting in 2021
- Next **O&M Subcommittee** Project
  - **Impact of extended run time on Recovery Boilers:** operations, maintenance, risk, areas of concern, and criteria for allowing extensions

Kraft Recovery Boilers “Blue Book”

- **The AF&PA R&D Subcommittee sponsored the publication of the new Kraft Recovery Boilers textbook**
- **Dr. Honghi Tran** of the University of Toronto led the effort to author the new book
- Dr. Tran and 7 other world-renowned recovery boiler experts completed the 16 chapters of the new book
- AF&PA & TAPPI worked together to publish & sell the new book – Now available through TAPPI Press!!!
- The new Kraft Recovery Boilers textbook is also being used in **TAPPI’s Kraft Recovery Operations Course**

Technical Editor & Chapter Author

HONGHI TRAN obtained his B.Sc. and M.Eng. from Shizuoka University in Japan, and his PhD from the University of Toronto in 1982. Honghi is Frank Dottori Professor of Pulp and Paper Engineering and Director of the Pulp & Paper Centre in the Department of Chemical Engineering and Applied Chemistry. He helped establish and direct consecutively 12 large industrial research consortia, focusing on issues related to energy and chemical recovery in kraft pulp mills. Honghi has authored or co-authored over 300 refereed papers and has 8 patents. Honghi has chaired the TAPPI Kraft Recovery Course since 2006. He was named a TAPPI fellow in 2000, PAPTAC fellow in 2015, and Canadian Academy of Engineering Fellow in 2016. Honghi received numerous prestigious awards including the 2013 PAPTAC's John S. Bates Gold Medal and the 2017 TAPPI Gunnar Nicholson Gold Medal. He was inducted to the Paper Industry International Hall of Fame in 2017.

Chapter Authors

TERRY ADAMS was an independent technical consultant to the pulp and paper industry in the area of chemical recovery until he retired in 2017. He obtained a B.Sc. from the University of California at Santa Barbara, a M.Sc. from the University of Michigan, and a Ph.D. from Drexel University with a specialty in combustion. Terry has worked as a Professor at the University of British Columbia, a Combustion Scientist at Weyerhaeuser Co., and since 1986 an independent consultant with a client base of over a hundred mills. He co-authored Kraft Recovery Boiler Physical and Chemical Processes, TAPPI Press, published in 1988 with Dr. Jim Frederick, and is the editor and co-author of Kraft Recovery Boilers, TAPPI Press, published in 1997.

Chapter Authors

MIKKO HUPA is a Chemical Engineering Professor at the Åbo Akademi University (ÅAU) in Turku, Finland. Mikko has supervised more than 40 PhD Theses and authored or co-authored more than 350 journal papers in the areas of high temperature chemistry, biomass and black liquor combustion and gasification, and fluidized bed combustion. Mikko has wide experience as an industrial consultant on issues of chemical aspects of combustion and energy processes. He has served as President of the International Flame Research Foundation, an international organization on industrial combustion with 250 member organizations in nearly twenty countries around the world. Mikko was named a TAPPI Fellow in 2005. Since 2015 he has worked as the President of his university ÅAU.

WILLIAM J. (JIM) FREDERICK, Jr. received his BS, MS, and PhD degrees in Chemical Engineering from the University of Maine. Jim has been active in kraft chemical recovery since 1975, both in industry, research, and consulting. Jim has been active with both TAPPI and the AIChE Forest Products Division throughout his career. He received the AIChE Forest Products Division's award in 1998, and he was named a TAPPI Fellow in 2007. He co-authored the book Kraft Recovery Boiler Physical and Chemical Processes (American Paper Institute, 1988), was a contributing author to Kraft Recovery Boilers (TAPPI Press, Atlanta, 1997). He is the lead author on a new book, Black Liquor Evaporation, to be published by TAPPI in 2019.

Chapter Authors

THOMAS M. GRACE obtained a B.S. in chemical engineering at the University of Wisconsin and a Ph.D. from the University of Minnesota. He was a faculty at the Institute of Paper Chemistry (now IPST at Georgia Tech) for 22 years, and an adjunct professor at the University of Toronto for 15 years. He formed T. M. Grace Company in 1988, consulting on recovery boilers and chemical recovery. Tom has a long involvement with BLRBAC and the AF&PA Recovery Boiler Committee, investigating recovery boiler explosions for 25 years. He authored many papers and book chapters on chemical recovery. Tom was awarded the TAPPI Gunnar Nicholson Gold Medal in 2001 and inducted to the Paper Industry International Hall of Fame in 2003.

ANDREW K. JONES is a Senior Engineering Fellow at International Paper (IP) where he fosters the implementation on new process innovations. Previously he was the recovery boiler SME. He has been with IP since 1997. Previously he worked for ABB/Combustion Engineering leading an R&D group. He received his PhD from the Institute of Paper Chemistry in 1989. Andy is active in TAPPI, having led the Engineering Division, and was conference chair for the TAPPI PEERS conference. He won the TAPPI Engineering Leadership and Service Award in 2004. He was the conference chair for the ICRC (International Chemical Recovery Conference). Andy was named a TAPPI Fellow in 2016 and he received the Engineering Division Technical Award and Beloit Prize in 2018.

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W.B.A. (SANDY) SHARP is a consultant specializing in solving corrosion and materials problems in pulp and paper mills and chemical plants. He has master's degrees in Metallurgy and in Corrosion from Cambridge and London Universities in the U.K. and a Ph.D. in Chemistry from the University of Ottawa. Sandy's materials engineering experience includes 28 years leading corrosion control efforts within Westvaco (now WestRock). He has published 62 technical papers in refereed journals. He developed TAPPI's short course on solving corrosion problems and has won TAPPI's Joachim Leadership and Service Award and Engineering Division Award. Sandy is a TAPPI Fellow, a Materials Technology Institute Fellow, and the first NACE (Corrosion Engineers' Association) Fellow from the pulp and paper industry.

DOUGLAS SINGBEIL holds a BSc in Chemistry and an MSc in Metallurgy from the University of British Columbia. He began his career with FPInnovations (formerly Paprican) in 1982 as a research scientist. He has since served in numerous roles, including Corrosion Group Leader, Research Leader for Bioenergy & Corrosion, Research Manager for Process Engineering, and is currently Industrial Sector Leader for BioProducts. Over his career, Doug has addressed corrosion in recovery and biomass boilers, digesters and other process equipment. He has authored/co-authored more than 60 papers. He received awards for several of these, including the 1998 and 2004 ISCPPI Walter Mueller Awards and 2005 PAPTAC Weldon Medal. He was appointed a Fellow of NACE International in 2009.

Recovery Boiler Program Information

- AF&PA Recovery Boiler Program Website:
  http://www.afandpa.org/our-industry/recovery-boiler-program
- Recovery Boiler Program General Information
- Information on Available Documents
  - Publications
  - Studies
  - Training Aids
  - Standards

Contact Information

- AF&PA Website:

  http://www.afandpa.org

- AF&PA Recovery Boiler Program Website:

  http://www.afandpa.org/our-industry/recovery-boiler-program

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Questions?

Thank You!