FACILITY PROFILE
Twin Rivers Paper Company Inc.
Edmundston, NB

Prepared by:
Authorizations Branch
Department of Environment and Local Government

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BACKGROUND

The origins of the current Twin Rivers Paper Company in New Brunswick can be traced back to a small sawmill founded in 1877 in Rivière de Chute, located near present day Fredericton, by Donald Fraser, an immigrant farmer from Scotland. By 1916, his small lumber business had grown into nine large sawmills in New Brunswick and Quebec.

Pulping operations began in Edmundston in 1917, when the Fraser family constructed a small ammonia-based sulphite mill at the confluence of the Saint John and Madawaska Rivers. Due to increasing demand for paper, and with its own reliable source of pulp, Fraser constructed a two machine paper mill in Madawaska, Maine, in 1925. Although the Edmundston sulphite mill and the Madawaska paper mill have been expanded and upgraded several times, the two mills have continued to operate in this integrated manner for over 100 years.

In 1970, a stone groundwood mill was added to the Edmundston mill complex. In 1972, a secondary effluent treatment system was added in the form of an aerated stabilization basin (ASB) effluent treatment lagoon located approximately 5 kms downriver in Saint-Basile. A pipeline system, delivering pulp and steam to the Madawaska papermill and returning whitewater and condensate to the Edmundston pulp mill evolved over the years. In 1979, a mill modernization and expansion, including chemical recovery and the conversion from ammonia base to magnesium base, was completed. An upgrade to the ASB was completed in 1996 and included the addition of subsurface and pure oxygen aeration. A woodfired co-generating boiler was commissioned in 1996 and produces electrical power for sale to N.B. Power, as well as providing process steam for the Madawaska papermill and the Edmundston pulpmill.

In April 2010, as part of a court supervised financial restructuring proposal, Fraser Papers Inc. restructured the company's core specialty papermaking assets, that being the Edmundston pulpmill, the Madawaska papermill and the Plaster Rock sawmill, into a new company named Twin Rivers Paper Company Inc.

Over the years, Twin Rivers Paper has become a leading manufacturer of lightweight and ultra-lightweight specialty publishing, packaging, label and converting papers, and currently operates the sulphite and groundwood mills in Edmundston, as well as 4 paper machines and an offline coater in Madawaska, Maine. A highly integrated paper company, Twin Rivers Paper also manages a sawmill, purchases the majority of its fiber supplies from Acadian Timber and acquired the paper manufacturing assets of Burrows Paper Corporation in 2016, strengthening its position as a market leader in the lightweight packaging, publishing and label markets. Twin Rivers Paper now operates four paper mills located in New York and Mississippi.

Today, Twin Rivers Paper's Edmundston operation produces approximately 100 tonnes per day of groundwood pulp and 700 tonnes per day of magnesium based sulphite pulp, both of which are pumped to the Madawaska finishing mill for conversion into printing and writing specialty papers.

PRODUCTION PROCESS DESCRIPTION

INTRODUCTION:

Twin Rivers Paper's activities in New Brunswick include the operation of a woodyard, a groundwood pulpmill, a bleached sulphite pulpmill, a chemical recovery facility, a steam and power plant, and a remotely located effluent treatment lagoon in Saint-Basile. A more detailed description of these mill processes is provided below:

WOOD HARVESTING:

The wood supply for the Edmundston mill is provided primarily by 14 area sawmills, including Plaster Rock. Wood supply for these sawmills, supplying Edmundston with residual chips, is provided by Crown Licenses #1,3,8 and 9, small woodlots in NB, industrial forest land in NB and Maine, as well as Crown and private lands in Quebec. The sulphite mill consumes approximately 1.1 million green metric tonnes (GMT) of wood per year of which approximately 95 % of the supply is in the form of residual chips from sawmills, and 5% is whole logs processed into chips at an offsite chip plant. The species of wood used are red, white and black spruce, and balsam fir. The groundwood mill consumes approximately 90,000 tonnes (GMT) of roundwood, consisting of 100 % spruce and fir

WOOD YARD / WOOD PREPARATION:

Woodfiber, in the form of purchased chips and roundwood, is delivered to the mill by truck. The roundwood is purchased debarked and the logs are sent directly to the groundwood process to be made into groundwood pulp. Shorter logs are sent to the chipper to be made into chips for use in the sulphite pulping process.

The chips are either sent directly to the digesters or blown to the chip pile after being dumped from the trucks. They are ultimately sent to the digesters via conveyor belts and after a screening process removing wood dust and slicing oversized chips.

GROUNDWOOD PULPING

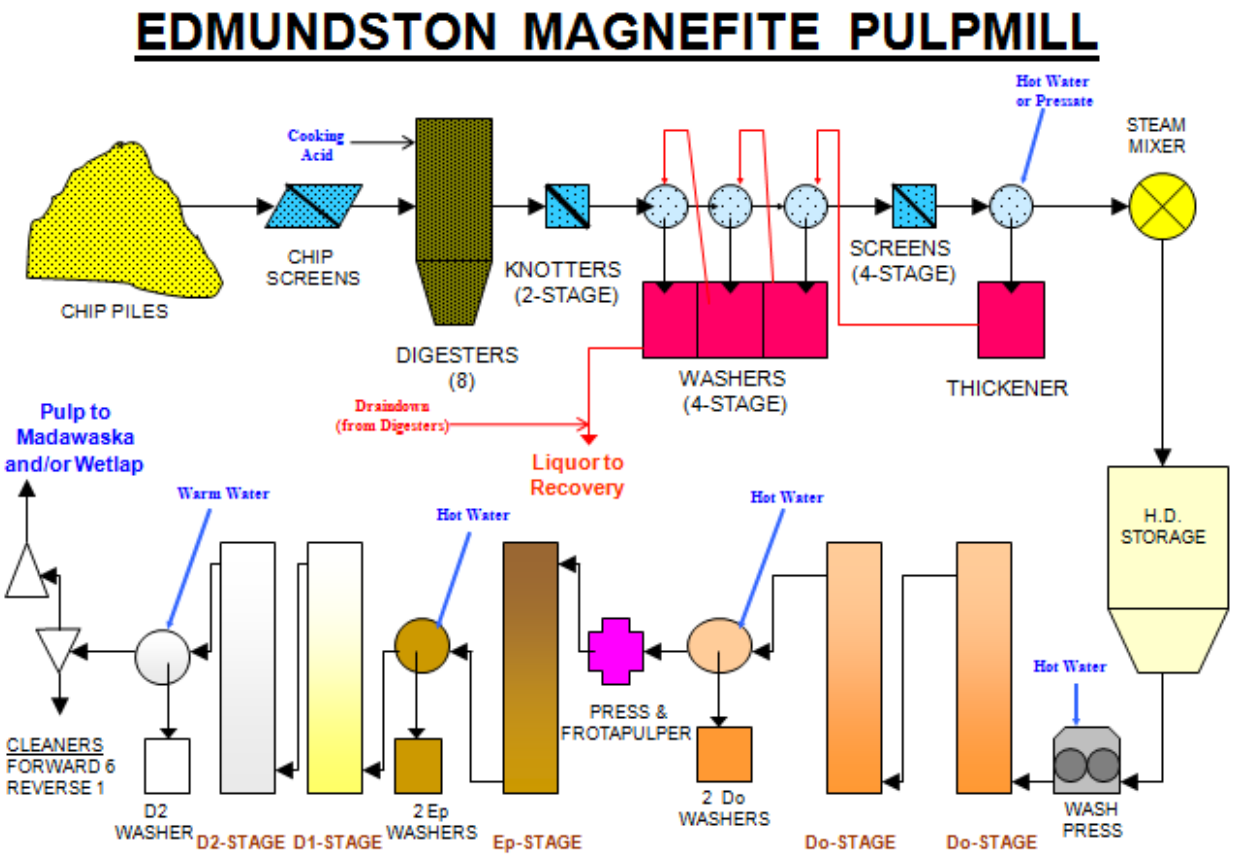
Debarked, four-foot roundwood is fed into grinders and is forced against rotating grindstones causing the wood fibers to be mechanically abraded from the logs. There are six grinders rated at 60 tonnes per day per stone. Groundwood production has averaged 36,000 tonnes per year.

Water is used to cool the stone and to convey the resulting groundwood pulp to the screens where large pieces of wood, fiber bundles, sand and grit are removed.

In October 2007, Twin Rivers Paper began bleaching the groundwood pulp using hydrogen peroxide. A bleaching solution of caustic, hydrogen peroxide and a chelating agent is added to the pulp as it is sent to storage. The screened, cleaned and bleached groundwood pulp is then pumped to the Madawaska paper mill or is sent to a wetlap machine to be de-watered, formed into sheets, baled and stored for future use.

SULPHITE PULPING

The Twin Rivers Paper sulphite pulping operation chemically separates the cellulose fibers in the incoming wood from the glue-like lignin which binds these cellulose fibers together. The cellulose fibers become the sulphite pulp product while the lignin and other non-fibrous materials become the weak red liquor which is concentrated and burned in the recovery boiler. This process flowsheet is shown in the flow diagram below:



Woodchips are conveyed, either directly from transport vehicles or from storage piles, to the eight batch digesters and are mixed with magnesium bisulphite cooking acid. Under high temperature and pressure, and in the presence of the cooking acid, the lignin binding agent is dissolved, releasing the individual cellulose fibers. The resulting spent cooking acid, containing the dissolved organics, such as lignin, is referred to as weak red liquor, and is sent to the chemical recovery operation for energy recovery and chemical regeneration, which is described later in this section.

The pulp from the digesters is then washed to remove the remaining dissolved organics and process chemicals and is screened to remove materials, such as knots and uncooked chips. The coarse screen rejects containing uncooked chips are sent for beneficial reuse. The fine screen rejects are added to the woodwaste stream going to the co-gen boiler.

The washed and screened brown stock pulp is sent to a High density storage tank prior to being bleached. These dissolved organics found in the water from the washing process are returned to the chemical recovery operation and reduces the use of bleaching chemicals in the bleach plant.

BLEACH CHEMICAL PRODUCTION /BLEACHING:

In the bleach plant, the washed and screened pulp is chemically bleached to its final white color and dirt specks are either removed or bleached. The first two stages of this process, chlorination using 100% chlorine dioxide substitution and peroxide reinforced caustic extraction continue to remove residual lignin. Once the pulp is free of lignin, chlorine dioxide in the final two stages brighten the pulp and remove dirt. The bleached pulp is then sent to storage. Before the pulp is transferred to the paper mill in Madawaska for use on their paper machines, the pulp is processed through a 6-stage centri-cleaner system to further remove dirt and impurities. The pulp can also be sent to the wetlap machine to be de-watered, formed into sheets, baled and stored for future use.

The chemicals used in the bleach plant are: chlorine dioxide (ClO_2), caustic (NaOH), sulphuric acid (H_2SO_4) methanol, sodium chlorate ($NaClO_3$) and hydrogen peroxide (H_2O_2). Chlorine dioxide (ClO_2), the main oxidizing agent for the bleaching of the pulp, is unstable, and must be generated on-site. The ClO_2 plant consists of outside chemical storage tanks and piping (sodium chlorate, methanol, hydrogen peroxide and sulfuric acid), a generator reactor in which the chemicals react to produce the ClO_2 gas, and ClO_2 gas absorption and monitoring equipment. The ClO_2 gas is absorbed in cold water and used in the bleach plant as an aqueous solution.

Since 2016, Twin Rivers Paper has implemented systems that have reduced health & safety risks for its employees, the general public and the environment. First, process changes enabled Twin Rivers Paper to discontinue the purchase of chlorine gas and is now Elemental Chlorine Free (ECF). The last rail car of chlorine left the mill in June 2016.

Secondly, in April 2017, Twin Rivers Paper implemented a 14 element Process Safety Management (PSM) system for its chlorine dioxide generation process, from chemical unloading to injection points including air emissions. The PSM system has been developed by The Canadian Society for Chemical Engineering (CSChE) as a voluntary standard for the safe design and operation of facilities handling, using, processing, or storing hazardous materials.

Thirdly, in 2020, Twin Rivers Paper prepared and executed an Environmental Emergency plan for 4 chemicals that are included in the associated Regulation (Chlorine dioxide, hydrogen peroxide, sodium chlorate and fuel oil no 6). Active mitigation systems and onsite Hazmat / First responders training have been implemented to significantly reduce the risks associated with accidental releases.

CHEMICAL RECOVERY, STEAM PLANT and COGENERATION

The three boilers burn various fuels to produce steam for the pulp and papermill operation, recover cooking chemicals and generate green electricity. Approximately 83% of our fuel are from renewable sources such as biomass, pulping liquors and primary sludge. Bunker C is also used as a back-up or a supplemental fuel. Excess steam is transformed into green electricity and sold to N.B. Power. The three onsite boilers have a total steam generating capacity of 28,512,000 pounds per day of steam which is produced at a pressure of 1250 pounds per square inch.

The chemical recovery operation is an integral part of sulphite pulp manufacturing as it permits the recovery and recycling of the cooking acid chemicals: Sulphur dioxide (SO_2) and magnesium oxide (MgO or “mag”). The Recovery complex consists of the Babcock & Wilcox chemical recovery boiler, No. 5 boiler, which was installed in 1978. The boiler burns 1,000,000 kilograms of red liquor solids per day and can produce up to 368,000 pounds of steam per hour. No.5 boiler is equipped with two S.F. electrostatic precipitators (ESP) operating in parallel and a ball bed flue gas scrubber. The ESP removes MgO particulate matter from the flue gas and a washing system is provided for this recovered magnesium oxide slurry. The scrubber recovers SO_2 from the flue gas and this is supplemented with additional SO_2 produced in a sulphur burner to regenerate the magnesium bisulphite cooking acid.

In the recovery process, weak red liquor from the digesters and the pulp washing process, at approximately 12% solids, is concentrated in multiple effect evaporators to approximately 56% solids. The resulting strong red liquor is then sprayed into the recovery boiler where the organic content in the liquor is burned, releasing energy and producing steam for use in the mill. Upon combustion, the inorganic portion of the strong red liquor produces a flue gas containing MgO and SO_2. As described above, the flue gases pass through ESPs where the MgO is recovered and returned to the process. Following the ESP, the flue gases pass through a wet scrubber, using magnesium hydroxide as the scrubbing medium, and SO_2 is captured and returned to the process.

The resulting acid is clarified and filtered. Greater than 80% of the magnesium and SO_2 are captured and recycled.

Organic vapors from the digesters, evaporators, and from process and tank vents are collected in a non-condensable gas collection system and piped to the recovery boiler where they are burned. SO_2 rich process vents are collected and directed to the recovery boiler scrubber for absorption.

An odor reduction system captures odorous organic vapors from the digester dump tanks vents, the washing & screening seal tank vent and brownstock washer no 1 vent and sends them to the recovery boiler to be burnt which eliminates this source of odor. This system, which has been in operation since July 2014, enabled Twin Rivers Paper to reduce the odor generated from its operation and perceived at ground level by approximately 85% as per the modeling results. Ambient air baseline SO_2 concentration measured at the Cormier ambient air site has dropped compared to pre July 2014 data which confirms the efficiency of the system.

Also located in the steam plant is Combustion Engineering boiler No.3 which is oil-fired and produces up to 265,000 pounds per hour of steam. No 3 boiler only operates as a back-up boiler for emergency purposes or during planned Cogeneration Boiler # 8 (Cogen) shutdowns.

The Zurn-NEPCO cogeneration boiler, designated as No.8 boiler, was commissioned in November 1996 and has a steam rating of 550,000 pounds per hour. This boiler burns mainly purchased woodwaste and low sulphur fuel oil if required, and is equipped with an ESP manufactured by EEC. Most of the steam from this unit is passed through a turbine generator and the resulting electrical power is sold to N.B.Power. Low-pressure steam from the turbo-generator is used by the Edmundston mill and the remaining high pressure steam is used in the Madawaska mill. The cogen boiler consumes 745,000 tonnes of wood waste annually which is delivered by truck from sawmills within a 75 mile radius of Edmundston. The burning of woodwaste has reduced dependency on fossil fuel, reduced SO_2 emissions as boilers now operate oil-free during normal operation.

Approximately 83% of the energy required to operate the facility is derived from renewable sources being biomass and liquor, 15 % is from electricity and only 2 % is from fossil fuel.

MILL WATER SUPPLY

Four water pumps bring water from the Madawaska River to the Edmundston mill. Water from three of the pumps is filtered using gravity sand filters before being used in the mill processes. The fourth River water pump brings the water directly to the steam plant for more thorough cleaning for use as boiler feed water. A fire water pump house is equipped with three pumps, one diesel and two electrical.

SAINT-BASILE FFLUENT TREATMENT SYSTEM

The Twin Rivers Paper pulpmill uses large amounts of fresh water from the Madawaska River and correspondingly large amounts of effluent are generated and must be treated before discharge to the Saint John River. Following onsite primary clarification, approximately 74,000 cubic meters per day of primary treated effluent is pumped via pipeline to Saint-Basile for biological secondary treatment in the ASB. The treated effluent is discharged to the Saint John River through an effluent pipeline which is equipped with diffuser outfall to provide rapid dispersion of the treated effluent in the receiving waters.

POTENTIAL AIR QUALITY IMPACTS

The primary source of air emissions from the Twin Rivers Paper pulpmill are the pulping process itself, the three boilers, the bleachplant and the Saint-Basile ASB. The following list of potential air quality contaminants are associated with these sources and, historically, have been the focus of Approvals issued by the Department:

- SO_2 and particulate matter from No. 3 Combustion Engineering boiler
- SO_2 and particulate matter from No. 5 Babcock and Wilcox Recovery Boiler
- SO_2, particulate matter and nitrogen oxides No.8 Cogen Boiler
- SO_2 and organic compounds from process point sources
- Cl_2 and ClO_2 from the bleachery vents
- Emissions from the Saint-Basile effluent treatment lagoon
- Fugitive ambient dust from material handling and vehicle traffic at the mill

The nature and amounts of releases to the environment from these process areas are described in the following section:

AIR QUALITY COMPLIANCE

The PPR requires that a discussion of relevant air quality information for the period of the current Approval, or 5 years, whichever is longer, be provided to the public. In this case, a summary of the air quality conditions for the Edmundston pulpmill, as per the requirements of the Air Quality Regulation, and an accompanying compliance history for the calendar years 2007 to date is provided below.

COMPLIANCE with APPROVAL I-10081:

1. **Emergency and Non-Emergency Reporting:**
   Twin Rivers Paper is required to report to the Department environmental emergencies and environmental non-emergencies that occur at the mill.

   Section 12(1) of the AQR requires that any violation of an Air Quality Approval be reported immediately to the Minister. The Environmental Emergency and Environmental Non-Emergency Reporting sections of the Approvals clarify this requirement by designating contact numbers other than the Minister and by specifying the types of events that must be reported as emergencies and as non-emergencies.

   During the review period, Twin Rivers Paper has reported Environmental Emergencies and Environmental Non-Emergencies to the Department as required.

2. **Annual Sulfur Dioxide (SO_2) and Particulate Matter (PM) Emission Caps and Annual Air Quality Report:**

   Twin Rivers Paper must limit the emissions from all combustion and process sources at the mill to less than 2000 tonnes per year of SO_2 and to less than 250 tonnes per year of PM. Twin Rivers Paper must submit an annual report of SO_2 and PM emissions, as well as various other annual data as is discussed in other Sections of this Facility Profile.

   Twin Rivers Paper submits the Annual Air Quality Reports as required and this information is summarized below:

   Annual SO_2 Emissions:

   In the Canada-Wide Acid Rain Strategy for Post 2000, the Province of New Brunswick committed to reducing its SO_2 emission cap by 30% from 175k tpy to 122.5k tpy in 2005 and by 50% to 87.5k tpy for the year 2010 and on. In order to enable the province to manage SO_2 emissions and to meet the Provincial cap, all large SO_2 emitters have been assigned individual SO_2 caps.

   The Edmundston pulpmill was originally assigned a cap of 4000 tonnes per year, and in 1992, the total emission of SO_2 from the mill complex was 3571 tonnes. Substantial SO_2 emission reductions resulted from the Process Point Source SO_2 Reduction Program, completed over the years 1993 to 1995, and the startup of the woodwaste fired co-generating boiler in late 1996. Twin Rivers Paper SO_2 cap was lowered to 3000 tonnes per year in February 1999 and to the current 2000 tpy in August 2008. Twin Rivers Paper now operates at less than half of its former SO_2 emissions.

The Table below summarizes SO_2 emissions over the 15-year reporting period and demonstrates that Twin Rivers Paper operates in compliance with its annual SO_2 emission cap with a 33% emission reduction over the past 15 years:

YEAR	Annual SO_2 Limit (t)	Actual SO_2 Emission (t)
2022	2000	Not yet available
2021	2000	1261
2020	2000	1114
2019	2000	1181
2018	2000	1161
2017	2000	1280
2016	2000	1101
2015	2000	1283
2014	2000	1303
2013	2000	1512
2012	2000	1276

Annual PM Emissions:

Twin Rivers Paper must limit PM emissions from the 3 boilers at the mill to less than 250 tonnes per year and must report annual PM emissions in the Annual Air Quality Report. The Table below summarizes the annual PM emissions reported by Twin Rivers Paper since 2007 and demonstrates that Twin Rivers Paper operates in compliance with its annual PM emission cap:

Year	Annual PM Limit (t)	Actual Mill Total PM Emissions (t)
2022	250	Not yet available
2021	250	80.5
2020	250	125.2
2019	250	111.6
2018	250	107.5
2017	250	95.2
2016	250	111.8
2015	250	125.3
2014	250	44.6
2013	250	52.4
2012	250	108.1

Annual GHG Emissions:

New Brunswick has recently released a new Climate Change Action Plan for 2022-2027, Our Pathway Towards Decarbonization and Climate Resilience, in which the Province remains committed to its 2030 GHG reduction target of 10.7 Mt (46% reduction from 2005 emission levels) and has committed to reach net-zero GHG emissions by 2050.

The federal government implemented a carbon pricing program in 2019 to reduce greenhouse gas (GHG) emissions from industry and throughout the economy. In 2020, the Federal government accepted the Provincial Carbon Pricing Program which came into effect Jan 1st 2021. More recently, the NB Carbon Pricing Program has been strengthened as a result of the federal government's new commitments on reducing GHG emissions. Under the NB Carbon Pricing Program, industrial facilities like Twin Rivers Paper will be required to reduce their GHG emission intensity by 18% by 2030. Twin Rivers Paper is also required to report its annual GHG emissions in the Annual Air Quality Report and the Table below summarizes those emissions since 2007.

Over the years, Twin Rivers Paper has taken a leadership position in reducing its GHG emissions which has contributed to the province in meeting its 2020 GHG emission reduction goal. To date, the facility has reduced its GHG emissions by 85% since 1990.

Year	Total Mill GHG Emissions (kt)
2022	Not yet available
2021	42.6
2020	38.0
2019	27.6
2018	42.6
2017	36.6
2016	64.6
2015*	58.3
2014*	54.1
2013*	51.6
2012*	52.8

*emission factors were not available prior 2012.

3. **<u>Non-Condensible Gas Systems:</u>**
   Twin Rivers Paper is required to operate Non-condensable Gas Collection Systems No.1, No.2 and No.3 and to report the minutes per month of the emissions from those systems if they are vented to atmosphere.

   Non-condensable Gas Collection System No.1 collects organic and sulfur dioxide rich gases from the weak liquor tanks, the heavy liquor tanks, the acid condensate tank, the acid storage tank, and the acid clarifier, and directs these gases to the windbox of No.5 Recovery Boiler where organic compounds are destroyed by combustion and where SO_2 is removed in the recovery boiler scrubber.

   Non-condensible Gas Collection System No.2 collects organic and sulfur dioxide rich gases from the digester area and directs these gases to the No.5 Recovery Boiler scrubber where SO_2 is removed.

   Non-condensible Gas Collection System No.3 collects organic and sulfur dioxide rich gases from the evaporator seal tanks, with the collected gases being directed to the windbox of No.5 Recovery Boiler.

   From time to time, for operational reasons, it is necessary to vent these gases directly to atmosphere. This practice is referred to as “off-gas venting”. An example is when the Recovery boiler trips or is not in operation, the gas can’t be burnt and are vented to atmosphere until normal operation resumes.

   During the Characterization Study, done as part of the Air Emission Action Plan in April 2010, the quantity and nature of off-gas emissions were determined. It was determined that off-gas venting can be a potentially significant source of emissions to the atmosphere. Digester off-gases were measured at 324 kgs/hr of SO_2 and 2.4 kgs/hr of VOCS. The evaporator off-gases were measured at 24 kgs/hr of SO_2 and 0.6 kgs/hr of volatile organic compounds (VOCS).

   The mitigating factor regarding off-gas venting is that it is an infrequent event. The number of hours per year that off-gas venting took place is tabulated below:

YEAR	Hours of off-gas venting
2022*	186
2021	205
2020	108
2019	185
2018	216

2017	106
2016	60
2015	41
2014	231
2013	581
2012	292

* includes Jan to Oct data

4. **<u>No. 3 Power Boiler Opacity meter:</u>**
   Twin Rivers Paper is required to operate an opacity meter on Boiler No.3.

   Boiler No.3 is equipped with an opacity meter as required.

5. **<u>No. 3 Power Boiler Particulate Calculation:</u>**
   Twin Rivers Paper is required to calculate the annual particulate emissions from No.3 Power Boiler.

   No.3 Power Boiler is an oil only boiler firing Bunker C fuel oil and is equipped with centrifugal dust collectors. Calculating PM emissions from oil consumption and using emission factors, such as EPA AP-42, is considered sufficiently accurate for this type of installation and no stack tests are required on No.3 Boiler. In 2008, No.3 boiler was designated by Twin Rivers Paper as a stand-by boiler and has only operated sporadically since then as shown by the oil consumption data below.

   The Table below shows the calculated particulate emissions from No.3 Power Boiler:

Year	No.3 Boiler Calculated PM (tonnes/year)	No.3 Boiler Oil Consumption Imperial gallons
2021	7.8	872,253
2020	4.2	490,569
2019	2.8	453,914
2018	1.7	495,383
2017	1.3	203,755
2016	1.4	236,827
2015	2.7	405,864
2014	3.0	490,128
2013	1.5	239,781
2012	1.6	272,082

6. **<u>No.8 Woodwaste Boiler Bark Quality:</u>**
   Twin Rivers Paper is not permitted to burn salt-laden woodwaste in No.8 Co-Gen boiler.

   The chlorine in salt-laden woodwaste can participate in the formation of chlorinated dioxins and furans. The Canada-Wide Standard for dioxins and furans sets limits on dioxins and furan emissions from coastal pulpmills that burn salt-laden woodwaste. Salt laden bark would normally only be encountered at coastal mills where logs are floated to the mill in salt water. This has never been the practice at the Edmundston mill and salt laden bark has never been burned at this facility. The Condition was included in the Approval to reinforce the Province's support of the CWS for Dioxins and Furans.

7. **<u>No. 5 Recovery Boiler SO_2 Limit and SO_2 Monitor:</u>**
   Twin Rivers Paper must limit SO_2 emissions from No. 5 Recovery Boiler to less than 500 parts per million (ppm) and must measure and report these emissions.

   The combustion of liquor in the recovery boiler generates SO_2. The recovery boiler is equipped with a ball-bed scrubber, using magnesium hydroxide as the scrubbing solution, to capture SO_2 and return it to the cooking liquor cycle.

   The Approval limits the maximum allowable concentration of SO_2 in the boiler exhaust gas to 500 ppm at stack conditions for any one hour average. The recovery boiler is equipped with a continuous SO_2 emissions monitor (CEM) to measure average hourly emissions. During normal operation, SO_2 emissions are generally met by a wide margin.

Year	Recovery Boiler SO_2 Emissions		
	Approved 1-hour Limit (ppm)	Annual Average emissions (ppm)	Number of exceedences of 1 hour /500 ppm limit
2022 *	500	118	4
2021	500	114	3
2020	500	119	2
2019	500	116	0
2018	500	116	0
2017	500	129	0
2016	500	129	7
2015	500	136	2
2014	500	138	0
2013	500	123	2
2012	500	112	1

*includes Jan to Nov data

8. **<u>No. 5 Recovery Boiler PM Limit, Testing and Reporting:</u>**
   Twin Rivers Paper must limit PM emissions from No. 5 Recovery Boiler to a maximum of 100 milligrams per cubic meter (mg/m^3) and must measure and report these emissions.

   When strong red liquor, containing the spent magnesium bisulfite cooking liquor from the digesters, is burned in the recovery boiler, MgO particulate matter is generated. The MgO is recovered for re-use in the two parallel recovery boiler ESPs. Small amounts of MgO that pass through the ESPs are further captured in the wet scrubber. The amount of PM emitted from the scrubber, to the atmosphere, must be controlled to less than 100 mg/m^3 of stack gas.

   Two stack tests per year are required on the recovery boiler stack except, if the first test is below 60 mg/m3, the second test is not required. The Table below shows the results of stack tests on this boiler:

Year	Recovery Boiler		
	Approved Limit (mg/m3)	Actual Emission (mg/m3)	Actual Emission (kg/hour)
2022	100	32.3	6.8
2021	100	25.3	4.7
2020	100	32.8	9.1
2019	100	26.9	5.6
2018	100	36	7.1
2017	100	28	5.9
2016	100	21	3.6
2015	100	14.1	2.7
2014	100	11.5	2.7
2013	100	16.6	3.6
2012	100	15.4	4.1

9. **<u>No. 8 Co-Gen Boiler Opacity Meter:</u>**
   Twin Rivers Paper is required to operate an opacity meter on boiler No. 8 Co-Gen Boiler.

   Boiler No.8 Co-Gen Boiler is equipped with an opacity meter as required.

10. **<u>No. 8 Co-Gen Boiler Particulate Limit, Testing and Reporting:</u>**
    Twin Rivers Paper must limit PM emissions from No. 8 Co-Gen Boiler to a maximum of 100 milligrams per cubic meter (mg/m^3) and must measure and report these emissions.

No.8 Co-Gen boiler was commissioned in 1996 and burns purchased and self-generated woodwaste, primary clarifier sludge and uses low sulfur Bunker C fuel oil as an auxiliary fuel to produce electrical power for sale to N.B.Power as well as to supply process steam to the Edmundston and Madawaska mills. This boiler is equipped with an EEC ESP for the removal of PM. The residual PM in the flue gas must be limited to a maximum of 100 milligrams per cubic meter (mg/m^3). Two stack tests per year are required on the Co-Gen Boiler except, if the first test is below 60 mg/m3, the second test is not required. The Table below shows the results of stack testing of the Co-Gen Boiler:

Year	Co-Gen Boiler		
	Approved Limit (mg/m3)	Actual Emission (mg/m3)	Actual Emission (kg/hour)
2022	100	12.6	3.2
2021	100	17.5	4.3
2020	100	17.4	5.5
2019	100	21.1	7.6
2018	100	16	5.3
2017	100	16	5.1
2016	100	27	9.5
2015	100	32	12
2014	100	6.5	2.2
2013	100	6.4	2.4
2012	100	7.0	2.3

11. <u>No. 8 Co-Gen Boiler NOx Limit, Monitoring and Reporting:</u>

Twin Rivers Paper must limit the emission of Nitrogen Oxides (NOx), expressed as nitrogen dioxide (NO2), from No. 8 Co-Gen Boiler to less than 160 kilograms per hour (kg/hr) when firing bark or combination fuels and to less than 140 kg/hr when firing oil only and must measure and report these emissions.

The combustion of woodwaste and fuel oil generates NOx. The production of NOx can be minimized by boiler design. Boiler No.8 is equipped with low NOx burners which allow the boiler to meet the "Thermal Power Generation Emissions – National Guidelines for New Stationary Sources". No.8 Co-Gen Boiler is equipped with a NOx CEM and that data is provided monthly to the Department. The Table below summarizes the NOx readings from the Co-Gen Boiler:

Year	Co-Gen Boiler NOx		
	Approved Limit (kgs/hr)	Maximum 1-hr kg/hr	Average 1-hr kg/hr
2022*	160/140	86.5	66.4
2021	160/140	97.2	59.5
2020	160/140	97.3	69.5
2019	160/140	97.1	69.7
2018	160/140	104	73
2017	160/140	122	78
2016	160/140	139	85
2015	160/140	117	80
2014	160/140	157	74
2013	160/140	125	85
2012	160/140	137	86

*includes Jan to Oct data

12. <u>No. 8 Co-Gen Boiler Low Sulfur Fuel:</u>
Twin Rivers Paper is required to burn low sulfur fuel in the Co-Gen Boiler.

Twin Rivers Paper is required to burn fuel oil with a % sulfur content of less than 0.5 %. The table below shows the % sulfur of the fuel oil burned in the Co-Gen over the reporting period:

Year	Approved % S Limit	Average Actual % S
2022 ytd	0.5 %	Not yet available
2021	0.5 %	0.52
2020	0.5 %	0.53
2019	0.5 %	0.54
2018	0.5 %	0.54
2017	0.5 %	0.43
2016	0.5 %	0.43
2015	0.5 %	0.47
2014	0.5 %	0.44
2013	0.5 %	0.44
2012	0.5 %	0.44

In January 2018, regular sulfur oil was mistakenly transferred in the Low sulfur oil (LSO) tank, increasing the % sulfur concentration to 0.54% which is above the limit of 0.5% as per our Approval to Operate.

It was demonstrated that the overall additional sulfur release to atmosphere, if the oil is all consumed in the Cogen, would be negligible and only representing an additional 0.03% above the 2017 mill annual SO_2 emission. Approval by NBDOELG was obtained to consume the oil in the Cogen and regular updates was requested.

Due to several factors (viscous nature of the material, no mixing in the tank, low usage during warmer months, close proximity of the % sulfur concentration of the received LSO vs the limit), it is understood that it will be a slow process to reduce the % sulfur concentration in the tank to less than 0.5%.

13. **No. 8 Co-Gen ESP Operation:**

Twin Rivers Paper is not approved to operate the No.8 Co-Gen Boiler ESP in "energy saving mode".

Energy saving mode is an operating mode that reduces the electrical consumption in the Co-Gen ESP. Based on opacity readings in the outlet stack, the electrical power to the ESP is reduced in 2 of the 3 ESP cells. If opacity increases to 6%, the electrical power is restored to the normal level. This practice was linked to PM fallout episodes and this feature was removed and the ESP now operates on full power at all times.

14. **Burning Miscellaneous Materials:**

Twin Rivers Paper is approved to burn miscellaneous materials in the mill's boilers.

Twin Rivers Paper is approved to burn in the mill's boilers the following miscellaneous materials: small quantities of oily waste, spilled oil, commercial absorbents approved by the Industrial Processes Section, oily rags, bark or sawdust used to absorb spilled oil, such as might result from regular maintenance work or the cleanup of small spills, boxboard core waste such as might be produced from normal trim operations, used oil providing the used oil is burned in accordance with the *Used Oil Regulation,* I-joist waste, poultry litter and mdf waste. The quantity of these materials is small compared to the 800,000 tonnes of woodwaste that is burned annually and the nature of the materials is such that no change in mill emissions would be expected. No I-joist waste, mdf waste or poultry litter has ever been burned at the mill.

15. **Maine Agreement:**

Twin Rivers Paper is required to notify the Department if Boilers No.6 and No.7, located in Madawaska Maine, are operated other than as allowed under the Maine Agreement.

The Title 5 Permit, issued by the State of Maine, regulates the operation of boilers No.6 and 7 at the Madawaska Maine papermill. Under that agreement, boiler No.7 is not permitted to operate and Boiler No.6 may only operate at 30% of its rated annual capacity, that being 3.378 musg per year. The boilers have complied with the Maine Agreement over the reporting period as shown below:

Year	No.6 Boiler musg	No.7 Boiler
2022	Not yet available	Abandoned
2021	861,877	Abandoned
2010	372,628	Abandoned
2019	420,721	Abandoned
2018	177,551	Abandoned
2017	151,709	Did not operate
2016	163,548	Did not operate
2015	345,545	Did not operate
2014	12,288	Did not operate
2013	217,642	Did not operate
2012	43,768	Did not operate.

16. **Operation of Bleachplant:**

Twin Rivers Paper must operate a ClO_2 and Cl_2 CEM on the chlorine dioxide generator stack and must report the generator emissions to the Department in the Monthly Report. Starting in 2009, emissions from the generator must be limited to 4.0 kgs/hr of each gas. The other sources of ClO_2, Cl_2 and chloroform at the bleach plant were required to be measured by September 2009. The average ClO_2 and Cl_2 readings and the kg total release in tonnes must be reported in the annual report.

The Edmundston pulp mill includes a bleach plant using chlorine, chlorine dioxide, hydrogen peroxide, caustic and hypochlorite to bleach the pulp. Potential point sources in the bleach plant include: the chlorination stage washers, the chlorination stage seal tank, the east and west chlorine dioxide tower vents, the Bingham Box vent, the hypochlorite tower vent and the chlorine dioxide generator tail gas scrubber.

In 2016, to prevent exceedances, an active mitigation program was installed to stop the generation of chlorine dioxide before an exceedance would occur. The program installed stops the ClO2 generation if the hourly average exceeds 3.6 kg/hr. This proactive approach, at the expense of production, was a success as we only had one exceedance since 2017.

Date from the ClO2 Generator CEM over the reporting period has been:

Year	ClO2 Generator Avg. Cl2/ClO2 (ppm)		ClO2 Generator Avg. Cl2/ClO2 (kgs/hr)		ClO2 Generator Cl2/ClO2 (t/year)		Number of Exceedences of 4 kg/hr limit
	Cl2	ClO2	Cl2	ClO2	Cl2	ClO2	
2022*	476	482	1.6	1.6	13.6	14.4	0
2021	471	498	1.6	1.8	14.2	16.1	0
2020	402	435	1.4	1.5	12.2	13.5	1
2019	374	372	1.3	1.4	11.2	11.9	0
2018	384	348	1.3	1.3	11.8	11.1	0
2017	313	284	1.0	1.0	8.9	8.4	0
2016	419	425	1.7	1.8	14.7	15.7	6
2015	324	307	1.4	1.3	12.0	11.7	1
2014	347	371	1.6	1.6	12.4	13.8	1
2013	285	352	1.3	1.5	11.2	13.5	0
2012	326	391	1.4	1.8	12.4	15.5	1

*includes Jan to Oct data

17. <u>Ambient Air Quality Monitoring:</u>

Twin Rivers Paper is required to operate two ambient monitoring stations and a meteorological station.

A station is located on the mill's property next to Rice street, known as Cormier monitoring station due to its proximity of the old Cormier School. This station has an ambient SO_2 monitoring station that provides the one hour, 24-hour running average and annual average reading for SO_2 expressed in µg/cubic meter (in ppb as of Jan 1 2019) at standard conditions and a $PM_{2.5}$ monitor configured to provide the 24 hour average $PM_{2.5}$ reading based on the midnight to midnight time period and the annual 98th percentile value.

Another station is located near the Saint Mary's Academy operate's ambient SO_2 monitoring equipment providing one hour, 24-hour running average and annual average reading for SO_2 expressed in µg/cubic meter at standard conditions (in ppb as of Jan 1 2019).

Both ambient air monitoring stations are equipment with continuous feedback to the mill and provides hourly average to the NB Environmental Department air monitoring portal.

18. <u>Saint-Basile ASB Air Quality Monitoring:</u>

Twin Rivers Paper must operate the Saint-Basile ASB such that the maximum permissible ground level concentrations of hydrogen sulfide (H_2S) as listed in Schedule B of the Air Quality Regulation are not exceeded.

Overloaded, or poorly designed or operated, effluent treatment lagoons can be sources of odorous emissions. Through the 80's and early 90's, the Saint-Basile lagoon system was acknowledged to be a source of local odor. The Saint-Basile system underwent a significant upgrade in 1993 through 1996 in which the surface aeration in cells No. 1 and 2 were replaced with a fine bubble sub-surface system reinforced with pure oxygen. The system flow configuration was converted from Cells 1, 2 and 3 in series to Cells 1 and 2 in parallel and in series with Cell 3. These improvements, combined with a reduction in load from the mill, has reduced anaerobic activity and the generation of H_2S, resulting in a perceived reduction in odor intensity.

Of the air contaminants expected to be present in the ambient air near the effluent lagoon, only SO_2 and H_2S are regulated under the *Air Quality Regulation*. In 2005, ambient monitoring was done at the ASB to confirm that the AQR was being respected. The maximum 1-hr reading was 12.6 µg TRS/m3 compared to the AQR limit of 15 for H_2S. The highest 24 hr reading was 5.6 µg TRS/m3 compared to the AQR limit of 5µg of H_2S/m3. These elevated readings were taken on the berm of the ASB and not at the property fenceline. The study concluded that, due to dispersion of these substances, and that TRS and not H_2S had been measured, the regulated levels of the Air Quality Regulation were being respected and that unregulated substances were present only at low concentrations.

In 2010, a follow-up study was done to confirm the 2005 readings, and in particular the 24 hour readings. At monitoring site #1, which was located directly on the east ASB berm, TRS levels exceeded the H_2S limit in the AQR for hourly and daily average values. At location #2, the closest residence northeast of the lagoon on Route 144, the daily and hourly TRS values did not exceed the H_2S limits of the AQR.

19. <u>Monthly Air Quality Report:</u>

Twin Rivers Paper is required to submit a Monthly Air Quality Report to the Department.

Twin Rivers Paper submits Monthly Reports as required.

COMPLIANCE with the *AIR QUALITY REGULATION*

20. <u>Smoke Density Standards:</u>

Twin Rivers Paper must operate the Edmundston pulpmill such that the Smoke Density requirements of Part II of the Air Quality Regulation are not exceeded.

In New Brunswick, visible emissions (black smoke) are regulated via Part II of the *AQR*, also known as the Smoke Density Standards. Part II describes a system of "degrees of blackness" of the emissions and compliance with Part II can only be determined by a trained observer by visually comparing the plume to the Smoke Density Chart.

To assist the steam plant operators in complying with this requirement, the No.3 Boiler, and No.8 Go-Gen boiler are equipped with opacity meters. The primary purpose of this meter is to serve as an operating tool for the steam plant operators in controlling the emissions from the boiler, however, the meter, can also serve as a means of inferring the Company's compliance with the Smoke Density Standard. Units with wet scrubbers, such as the No.5 Recovery Boiler are not normally equipped with opacity meters.

21. <u>Ambient SO_2 Standard:</u>

Twin Rivers Paper must operate the Edmundston pulpmill such that the maximum permissible ground level SO_2 concentrations listed in Schedule B of the Air Quality Regulation are not exceeded.

Schedule B of the *AQR* sets maximum permissible ground level concentrations for SO_2 of 900 µg/m^3 for a 1-hour average, 300 µg/m^3 for a 24-hour period and 60 µg/m^3 for the annual average. In 2019, reporting requirements changed to parts per billion and the new maximum persmissible ground levels concentrations for SO_2 are 339.3 ppb for a 1-hour average, 101.1 ppb for a 24-hour period and 20.22 ppb for the annual average.

Ambient SO_2 levels have been measured continuously at the Cormier School for decades and at the St. Mary's Academy monitoring station since August 2002 and summaries of this ambient SO_2 data are submitted to the Department each month. Data for the reporting period are shown below:

Ambient SO_2	Cormier School (ppb)				St. Mary's Academy (ppb)			
YEAR	Max 1-hr	Max 24-hr	Annual Average	#exceedences	Max 1-hr	Max 24-hr	Annual Average	#exceedences
2022*	656	55	4.9	1	24	30	0.6	0
2021	358	41	4.4	1	86	21	0.7	0
2020	153	23	2.4	0	174	49	0.7	0
2019	252	51	2.6	0	86	14	0.8	0
	(ug/m3)				(ug/m3)			
2018	470	75	6.2	1	42	51	1.2	0
2017	2150	98	5.7	1	82	12.0	3.0	0
2016	535	44	5.0	0	19	4.0	3.0	0
2015	1404	96	5.8	3	136	19.5	3.6	0
2014	794	114	9.3	0	141	14.7	3.9	0
2013	1282	242	20.5	1	335	36	4.8	0
2012	619	224	18.2	0	100	30	4.4	0

* includes Jan to Oct data

As an historical note, in 1992, prior to the completion of the Process Point Source SO_2 Reduction Program, the annual ambient SO_2 reading at the Cormier School was 65.8 µg/m^3. By 2001, this had been reduced to 31.2, and in 2011 the annual ambient SO_2 reading was 22.3.

In June 2011, the City of Edmundston requested that the Cormier air monitoring site be moved from its current location. Twin Rivers Paper verified with NBDOELG and after receiving approval, it was moved on Twin Rivers Paper closer next to the entrance of the pulp mill. Since then, concentration values of SO_2 (max 24 hr and annual average) have been similar to higher than before, suggesting that its new location measures ambient air SO_2 concentrations that are not as diluted.

Since the installation of the odour reduction project in July 2014, ambient air SO_2 concentrations have dropped significantly as noticed in the Maximum 24 hr and Annual average SO_2 concentration measures at Cormier ambient air monitoring site (see table above).

22. Ambient $PM_{2.5}$ Monitoring:

Twin Rivers Paper is required to operate a $PM_{2.5}$ analyzer at the Cormier School and must report the collected data to the Department.

Twin Rivers Paper replaced the Cormier School Hi-Vol, which measures TSP, with a continuous $PM_{2.5}$ analyzer in June 2014. The purpose was to begin collecting data in preparation for Canada Wide Standard which came into force in 2010. For comparison with data currently

being collected, the CWS standard is 30 µg/m3 averaged over a 24-hr period and based on the annual 98th percentile measurement, averaged over 3 consecutive years.

Twin Rivers Paper reports the $PM_{2.5}$ data to the Department each month and this data is summarized below:

YEAR	$PM_{2.5}$ Maximum 24 hr Reading µg/m3	# 24 hour readings > 30 µg/m3	98th percentile µg/m3	Annual Average µg/m3
2022*	**34**	**1**	**23.8**	**8.6**
2021	**33**	**1**	**17.9**	**7.8**
2020	**22**	**0**	**15.8**	**7.1**
2019	**24**	**0**	**18.0**	**7.3**
2018	**28**	**0**	**19.7**	**8.6**
2017	**29.6**	**0**	**19.3**	**8.6**
2016	**23**	**0**	**16.8**	**7.9**
2015	**32.5**	**1**	**19.8**	**8.5**
2014	**23**	**0**	**19.9**	**10.6**
2013	**38**	**2**	**16.0**	**7.0**
2012	**20.2**	**0**	**20.3**	**15.5**

*includes Jan to Oct data

ENFORCEMENT

Enforcement options used by the Department of Environment are outlined in the Department's Compliance and Enforcement Policy. These may include but are not limited to: schedules of compliance, verbal and written warnings, orders, and prosecutions. Although not specifically outlined in the Policy, it is also possible to amend approvals with more stringent conditions, both during its valid period or at the time of renewal, to address specific compliance issues or to improve the environmental impact of the facility. There is also a regulation under the *Clean Air Act* that allows for the issuance of "administrative penalties" for minor violations as an alternative to traditionally used enforcement options.

A review by the Department found that there were no enforcement actions taken within the reporting period under the *Air Quality Regulation – Clean Air Act*.

PUBLIC OUTREACH

Given Twin Rivers Paper's downtown Edmundston location, communication with stakeholders is an important and integral part of the Twin Rivers Paper environmental management program. To this end, Twin Rivers Paper has been actively involved in a number of local and provincial environmental committees starting in the mid 90's when Twin Rivers Paper participated on the regional Air Resources Management Area (ARMA) Committee. Since then, Twin Rivers Paper has continued to be active on local committees including the Environmental Advisory Committee which is made up of citizens, businesses, municipal and mill representatives and which meets bi-annually.

Since 1996, Twin Rivers Paper has operated a toll free phone line (1-888-937-2737) for public environment related inquiries, complaints, questions and ideas. Today, that direct phone line continues to provide convenient access to company staff for the public.

Twin Rivers Paper shares information with and provides mill tours to various groups such as the Teachers Association, University and College students. Twin Rivers Paper employees have engaged in a partnership with the Notre-Dame elementary school in 2011 to assist their science teachers in making their classes more interesting by providing concrete examples of how science is applied in the industry and by giving presentations to the students.

Twin Rivers Paper has enhanced its external communication process in 2016 and engaged in a series of events to increase awareness of its environmental performance. Information was made available to the public via formal communication lines (newspaper, radio, web site, televised Edmundston City council meetings) and also in the form of Open House type meetings where people had the opportunity to be heard and obtain answers to their questions.

REFERENCES

1. Application Form Requesting Approval – Twin Rivers Paper, November 24, 2017
2. Point Source Emission Testing Reports – Twin Rivers Paper, various dates.

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