Exploring the factors influencing environmental performance at Alberta's Kraft Pulp Mills

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Research Questions

How do the……

- Regulatory framework
- Corporate environmental management systems, and
- Social license to operate

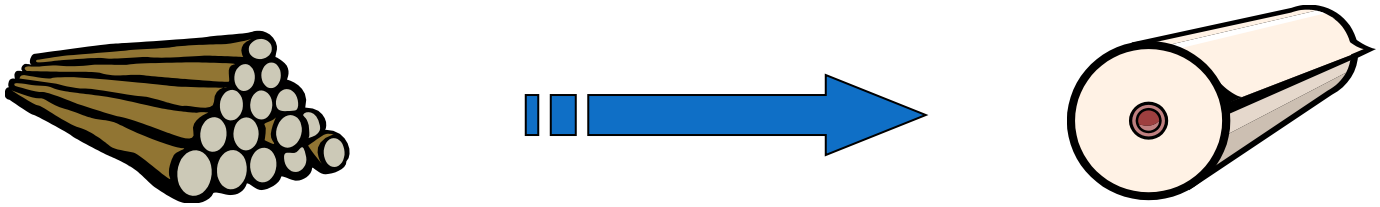
……influence TRS emissions management at Alberta's Kraft Pulp Mills?

Total Reduced Sulphur (TRS)

- Hydrogen sulphide, methyl mercaptan, dimethyl sulphide, and dimethyl disulphide.
- Noxious, rotten-egg odour
  - Odour threshold at low concentrations (1-5 ppb)
- Contributes to overall acidity of the surrounding environment.
- By-product of the Kraft pulping process
- Indicator of environmental performance

Alberta's Kraft Pulp Mills

1. Hinton Pulp, West Fraser Mills Ltd.
   - Operation began in 1957; 380,000 ADt/year
2. Grande Prairie Pulp, Weyerhaeuser Company Ltd.
   - Operation began in 1973; 360,000 ADt/year
3. Peace River Pulp, Daishowa-Marubeni International Ltd.
   - Operation began in 1990; 448,000 ADt/year
4. Al-Pac, Alberta Pacific Forest Industries Inc.
   - Operation began in 1993; 650,000 ADt/year



Methodology

- Identified elements representative of the regulatory, corporate environmental management (EM) and social license factors
- Focused on 5 year period between 2008 and 2012
- Statistical analysis of:
  - Point source emissions data
  - Ambient air monitoring data
- Interviews with mill employees and ESRD staff
- Comparative analysis of:
  - Approval conditions and dispersion modelling results
  - Mill environmental policies, management systems, best practices, and corporate sustainability reporting
  - Public complaints and ambient air quality objective (AAQO) exceedances

Results: Regulatory Framework Approval Conditions

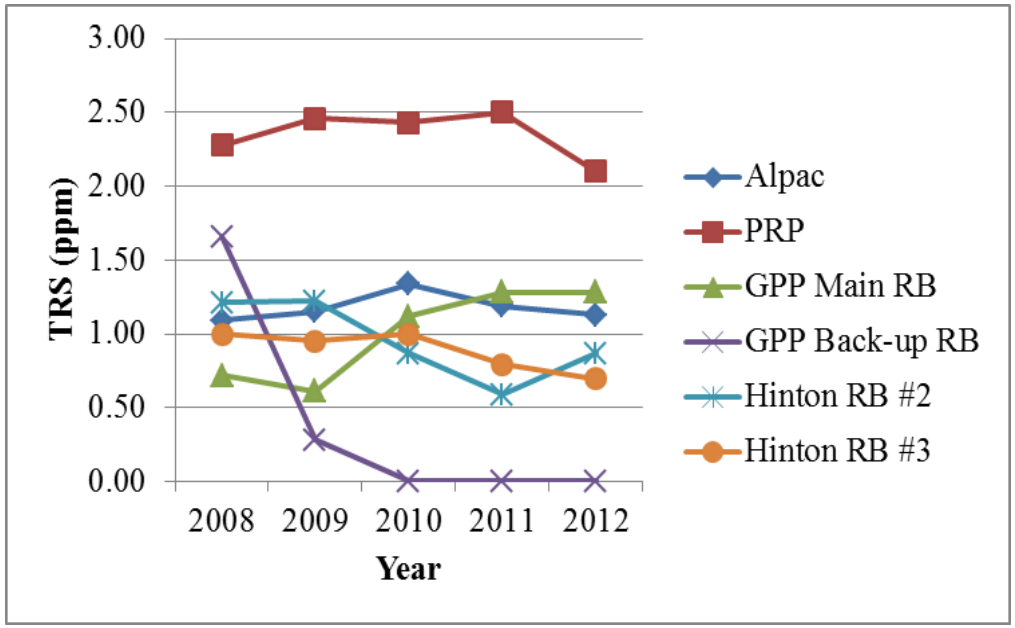
- Mills approvals have similar templates
- Some approval conditions are different
  - All mills except HP are required to have an EMS
  - Different monitoring requirements and limits for the same emission sources
  - Slightly different monthly and annual reporting requirements
- Some approval conditions are vague
  - Method of monitoring venting
  - Identifying and controlling fugitive emissions

Summary of TRS Emission Sources from Alberta's Kraft Pulp Mills

TRS Emission Sources	Alpac	Peace River Pulp		Grande Prairie Pulp	Hinton Pulp	
	2007 - 2016	1998 - 2009	2009 - 2019	2007- 2017	1998 - 2010	2010 - 2020
Recovery Boiler	L/M/C	L/M/C	L/M/C	L/M/C	L/M/C	L/M/C
Second Recovery Boiler				L/M/O	L/M/C	L/M/C
Lime Kiln	L/M/C	L/M/C	L/M/C	L/M/C	L/M/C	L/M/C
Smelt Dissolving tank	L/M/C	L/M/C	L/M/C		M/C	M/C
Bleach Plant	M/C	M/C	C	C		
Brown Stock Stack					M/C	M/C
Lime Slaker/Green Liquor Slaker Scrubber		L/M/C	L/C	L/M/C	M/C	M/C
Condensate Seal Pot Vents	I				M/C	M/C
White Liquor Oxidizer Stack	I	M/I	I		M/I	
Soap Storage Tank Vent		M/I	I			
InfluentTank Vent scrubber				L/I		
LVHC venting	L/I	L/I	L/M/I	L/I	L/I	L/I
IVIC venting					L/I	
HVLC venting	L/I	L/I	L/M/I	L/I	L/I	L/I
Chip Bin NCG venting	I	I	I	L/I	I	I
Condensate Stripper venting	I	L/I	L/I	L/I	L/I	L/I
Industrial Wastewater ponds	C	C	C	C	C	C

L= Limits apply; M= Monitoring requirements; C= Continuous Emissions; I= Intermittent Emissions; O= Offline

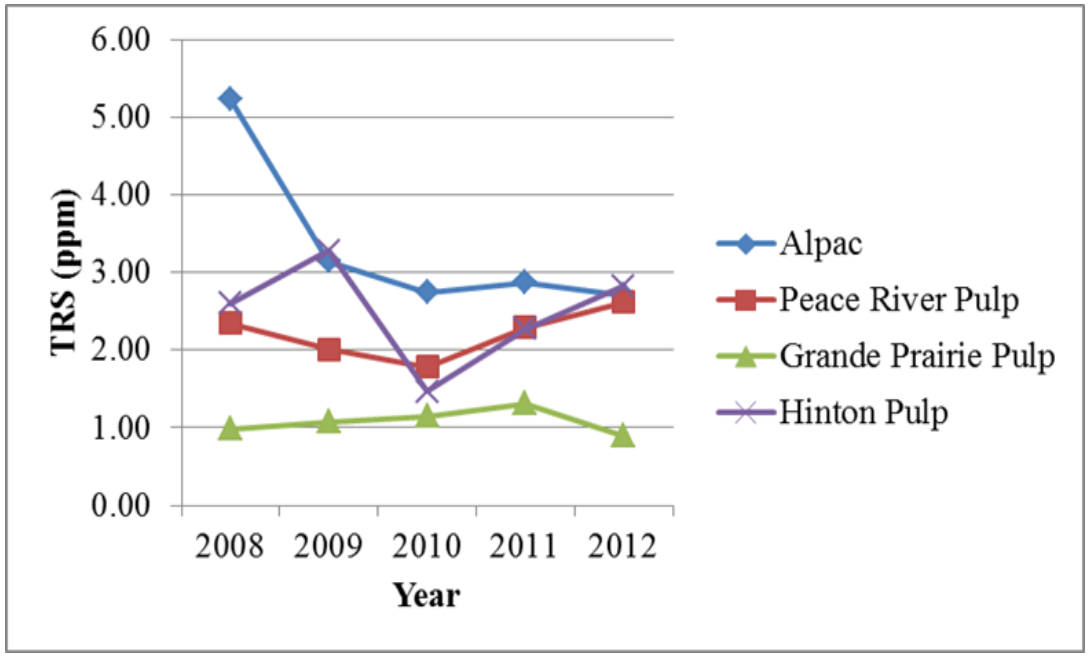
Results: Regulatory Framework; Point Source Emissions Recovery Boiler



- PRP highest mean; significantly different
- Alpac: most exceedances
- Mean emissions from all mills sig. lower than approval limits

Mean Recovery Boiler TRS Emissions in ppm from 2008 to 2012

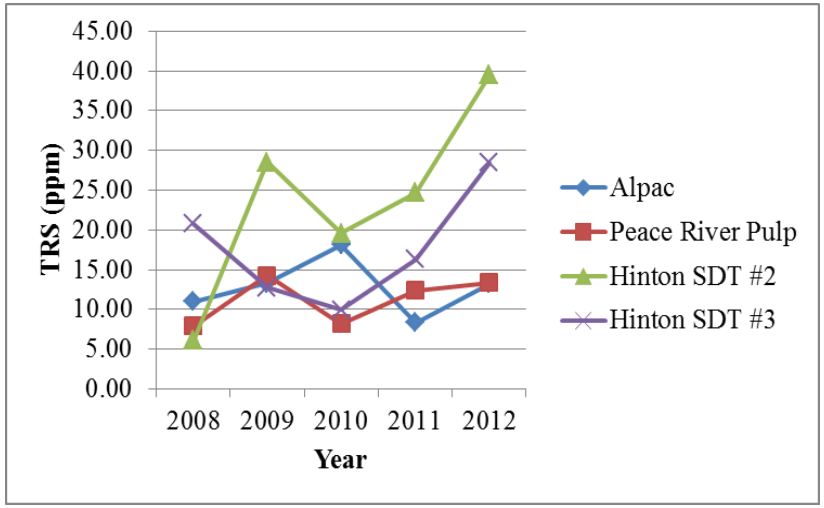
Results: Regulatory Framework; Point Source Emissions Lime Kiln



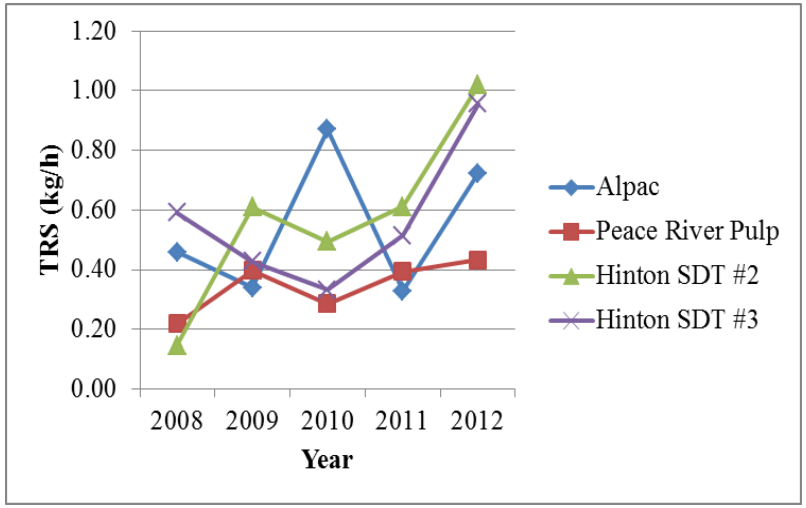
Mean Lime Kiln TRS Emissions in ppm from 2008 to 2012

- Alpac highest mean
- All emissions sig. different
- HP: most exceedances
- Mean emissions from all mills sig. lower than approval limits

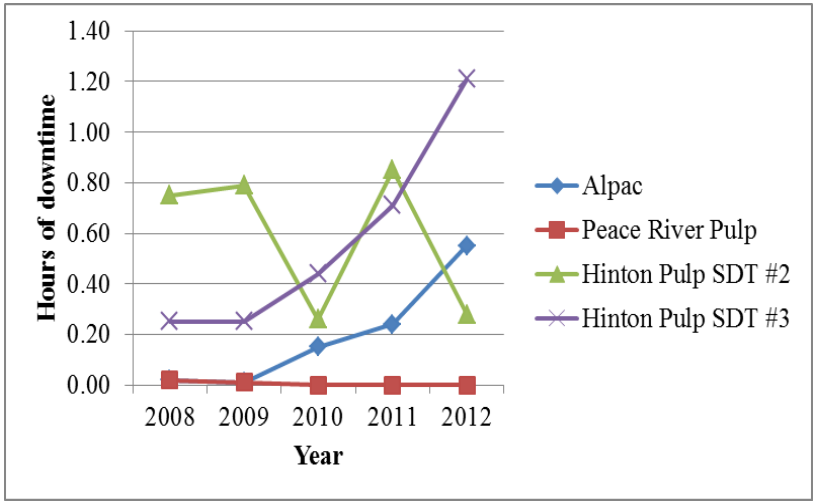
Results: Regulatory Framework; Point Source Emissions; SDT



Mean Monthly Smelt Dissolving Tank Emissions in ppm



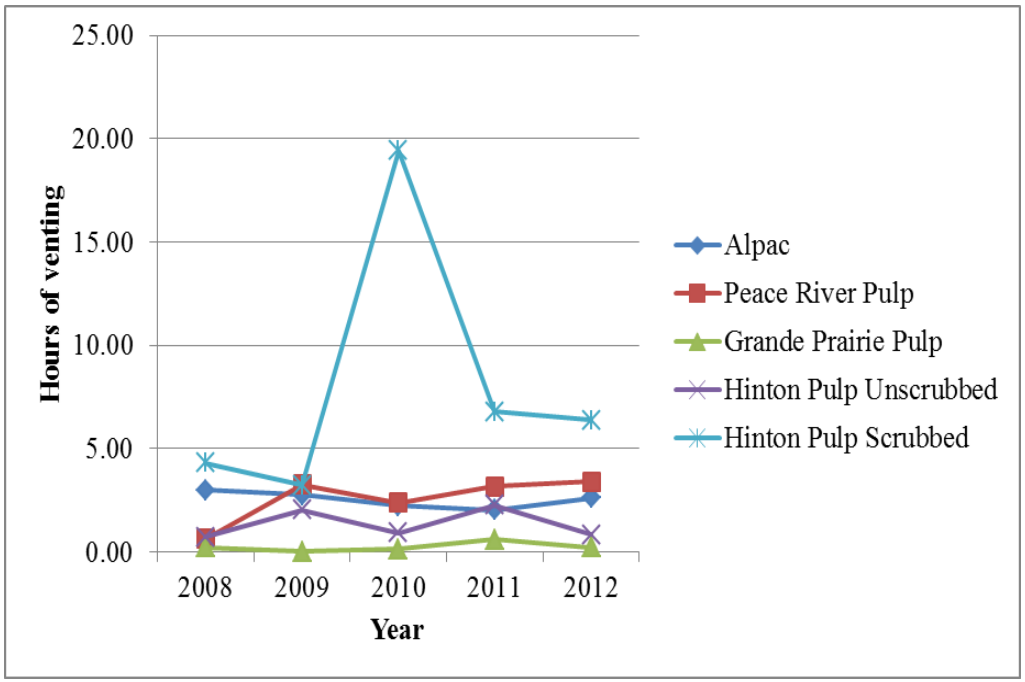
Mean Monthly Smelt Dissolving Tank Emissions in kg/h



Mean Monthly Smelt Dissolving Tank Scrubber Downtime

- Downtime seems to correlate with emissions
- HP SDT#2: highest emissions concentration, mass loading and downtime
- No limit exceedances
- Mean emissions sig. lower than limits

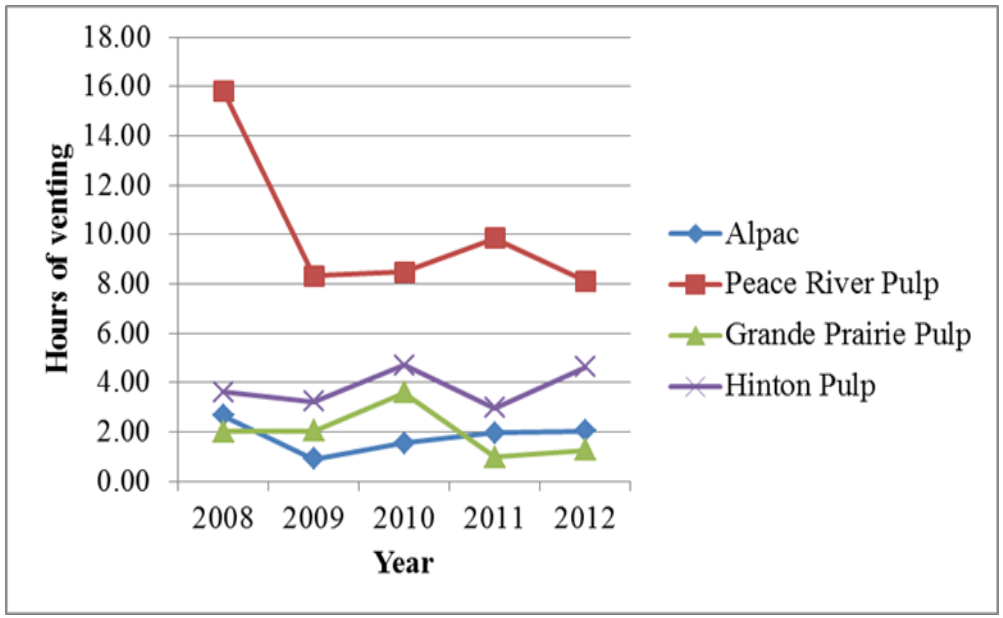
Results: Regulatory Framework; Point Source Emissions Low Volume High Concentration (LVHC) Venting



Mean Monthly LVHC Venting Hours from 2008 to 2012

- HP: Scrubbed and Unscrubbed venting; no limits on Scrubbed venting
- PRP: highest mean venting, approval exceedances
- Different limits
- Mean venting sig. lower than limits

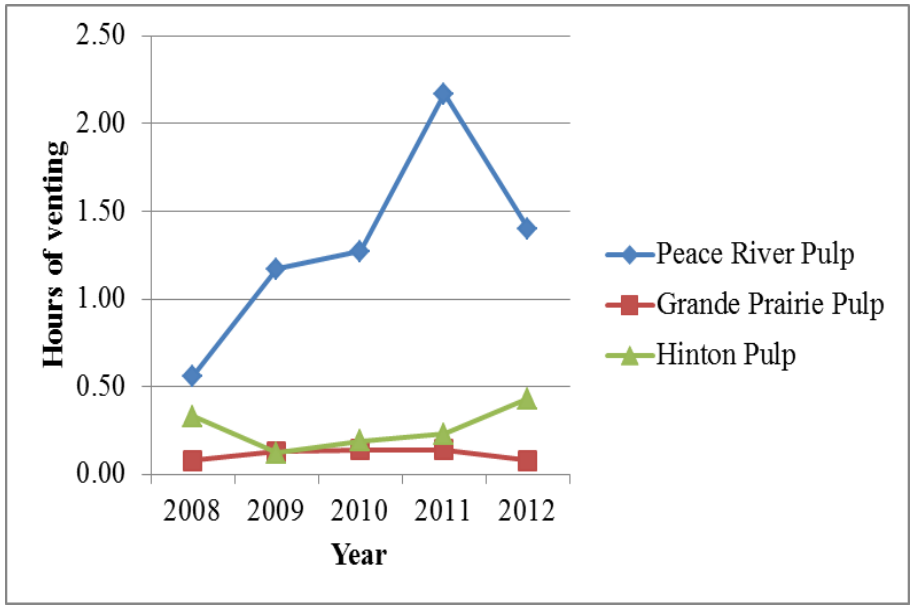
Results: Regulatory Framework; Point Source Emissions High Volume Low Concentration (HVLC) Venting



Mean Monthly HVLC Venting Hours from 2008 to 2012

- PRP: sig. higher mean venting; approval exceedances
- Different limits
- Mean venting sig. lower than limits

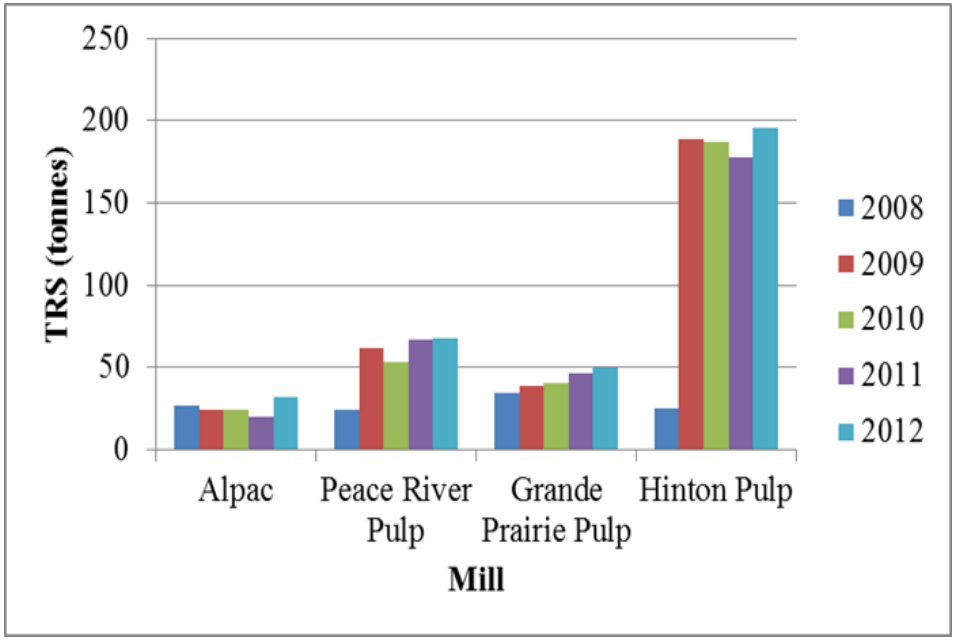
Results: Regulatory Framework; Point Source Emissions Condensate Stripper Venting



Mean Monthly Condensate Stripper Venting Hours

- Alpac does not have a Condensate Stripper
- PRP: sig. higher venting; one limit exceedance
- Different limits at mills
- All mean venting sig. lower than approval limit

Results: Regulatory Framework; Point Source Emissions National Pollutant Release Inventory (NPRI)



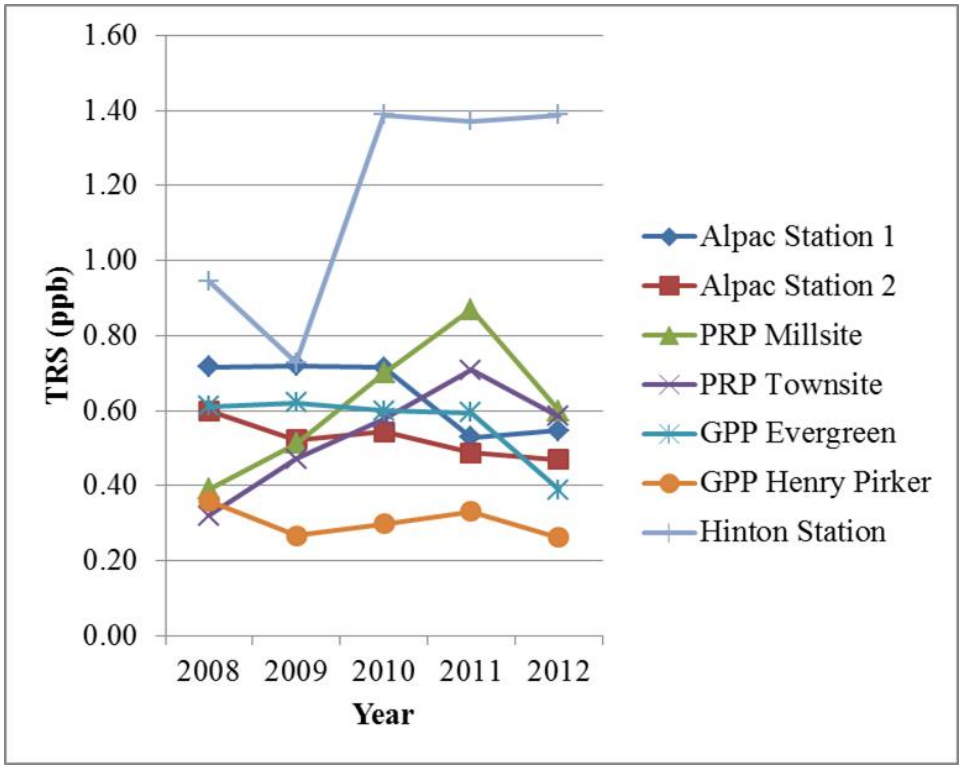
National Pollutant Release Inventory, tonnes of TRS

- ESRD only regulates individual point sources, not total emissions
- HP emitted more TRS than all other mills combined.

Results: Regulatory Framework Dispersion Modelling

- Projects ambient ground level concentrations that will result from point source emissions and results are compared to AAQO's
- Variations between the mills with respect to:
  - Dispersion models used
  - Source information input into model
  - Pollutant parameters (H_2S vs. TRS)
- All mill models projected maximum hourly and daily ground level concentrations would exceed AAQO's, except at Alpac
  - No additional modelling or evaluations were required

Results: Regulatory Framework Ambient data



Mean Annual Ambient TRS in ppb from 2008 to 2012

- Two stations at each mill, except only one in Hinton
- Hinton: sig. higher mean TRS concentration
- Hinton: greatest number of daily and hourly H_2S AAQO exceedances

Results: Corporate EM

- Environmental Policies
  - Adherence to ISO 14001 standard but variation in detail between the mills
  - GPP policy endorsed by top level management
  - Alpac and PRP: no commitment to regular reporting on goals and progress
- Environmental Management Systems (EMS)
  - All mills have EMS systems that meet ISO standard
    - GPP EMS not ISO certified but has lowest TRS emissions for several point sources and the best environmental performance

Results: Corporate EM

- Best Practices measured by monitoring practices, communications, and adoption of EU's Best Available Techniques for Odour Control
  - Similar approaches between mills wrt reviewing data
  - Different approaches to monitoring venting episodes and scrubber downtime, and controlling fugitive emissions
  - Similar BAT's adopted between the mills except:
    - HP has no storage capacity for discharge steams, i.e. spill pond
    - Condensates are treated in the condensate stripper to varying degrees
    - HP incinerates HVLCs in Power Boiler as opposed to RB
- Corporate Sustainability Report (CSR)
  - GPP's CSR is the only report published to the Global Reporting Initiative

Results: Social License

Hourly exceedances of Alberta's Ambient Air Objective for H_2S

	Alpac #111		Peace River Pulp #115		Grande Prairie Pulp #113		Hinton Pulp #99
	Station 1	Station 2	Millsite	Townsite	Evergreen	Henry Pirker	Hinton
2008	0	0	1	0	0	0	4
2009	0	0	10	0	0	0	59
2010	3	6	4	0	0	0	86
2011	0	6	14	0	0	0	143
2012	3	1	3	0	0	0	182
Total	6	13	32	0	0	0	474

*Note: Values in the dataset that were 10.0 ppb and higher were considered exceedances of the AAQO.

Daily exceedances of Alberta's Ambient Air Quality Objective for H_2S

	Alpac #111		Peace River Pulp #115		Grande Prairie Pulp #113		Hinton Pulp #99
	Station 1	Station 2	Millsite	Townsite	Evergreen	Henry Pirker	Hinton
2008	0	0	0	0	0	0	4
2009	0	0	2	0	0	0	9
2010	0	2	0	0	0	0	36
2011	0	1	6	0	0	0	30
2012	0	0	1	0	0	0	39
Total	0	3	9	0	0	0	118

*Note: Values in the dataset that were 3.0 ppb and higher were considered exceedances of the AAQO.

Results: Social License

Public complaints of odour to the mills and ESRD from 2008 to 2012

		Alpac #111	Peace River Pulp #115	Grande Prairie Pulp #113	Hinton Pulp #99
2008	To Mill	0	8	0	0
	To ESRD	0	1	1	2
2009	To Mill	0	4	0	0
	To ESRD	0	3	0	2
2010	To Mill	0	6	0	0
	To ESRD	0	3	0	6
2011	To Mill	0	5	1	0
	To ESRD	0	1	0	13
2012	To Mill	0	7	0	0
	To ESRD	0	1	0	25
Total	To Mill	0	30	1	0
	To ESRD	0	9	1	48
	Total	0	39	2	48

Hinton Pulp is the only mill situated directly within a municipality

Relevance to Literature Review

- Health effects of chronic low level exposure to TRS may be underestimated
  - Residents exposed to 1.4-2.1 ppb TRS reported more respiratory problems and headaches than reference community (Partti-Pellinen et al., 1996)
  - Similar to concentrations in Hinton
- Most large improvements in performance linked to tightening of regulatory requirements
  - Corporate EM is what separates leaders from laggards
  - Large variances in environmental performance still exist (Thornton, Kagan & Gunningham, 2003).
- Social pressure can be more demanding than legal requirements in some cases (Thornton et al., 2003)
  - Such is the case with odours in Hinton

Conclusions

- Each factor contributed slightly differently to environmental performance at each mill
  - Factors working together well in most cases to achieve acceptable environmental performance re: air quality, except in Hinton
- Some irregularities between mills, unclear expectations and vagueness in regulatory requirements
- Mean TRS emissions are significantly lower than regulatory limits
  - Incentive for continuous improvement?
- Results may reflect the effectiveness of the current environmental management approach taken by the regulator and regulated stakeholders

Recommendations

1. Dispersion modelling should be scrutinized to ensure inputs yield the most accurate results
2. Regulators should ensure similar approval limits, monitoring conditions, reporting requirements and clear expectations for similar facilities
3. Approvals should place emphasis on meeting outcomes, like ambient air quality objectives
4. Regulator should facilitate open, collaborative discussions with industry stakeholders
5. Regulators should encourage adoption of corporate EM practices
6. Regulators should develop clear methodology for acting on environmental impacts and conditions under which enforcement action should be taken

Refining the roles and responsibilities of all parties is critical to managing cumulative effects and meeting sustainability goals.

Questions?

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