Going to talk about air standards in Canada as well as the production of copper throughout the same time period

Question of the Day ?

- Is Canadian policy towards air emissions over the last 10 years or so really benefitting the environment?

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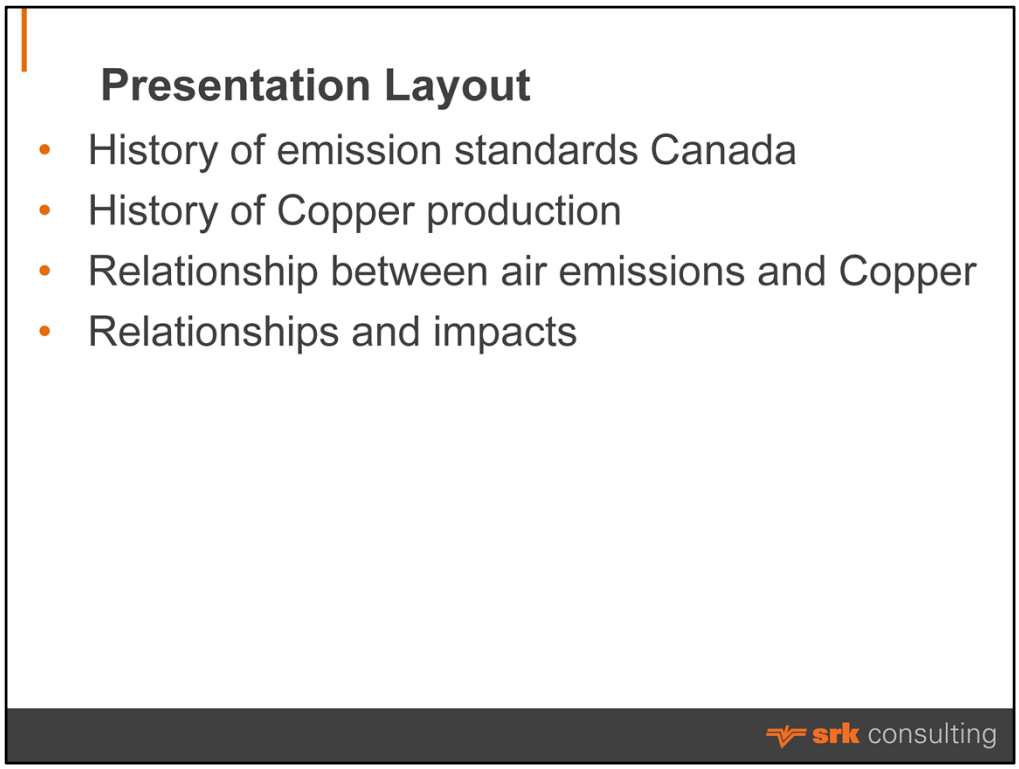
The purpose of the talk is to generate some thinking. If I can make you say HUM at the end of this then I have accomplished what I came to do!

I will ask you to keep the following question in mind throughout the remainder of this talk.



Look at the history of air standards in Canada over the last 40 odd years, look at the production of copper during the same time period, the relationships between the these two and how each have impacted one another during that time.

Canadian Emission Standards

- Essentially nothing prior to 1970
- I960 – 1970s SO_2 was focused on, Acid rain.
- Late 80s particulate matter - initially PM_{10}
- Late 90s – 2000s $PM_{2.5}$ was starting to garner attention
- Around early 2000s Ozone + PM gained attention
  - European union took a leading role - 2002
- Green House Gases – 90s and onward
  - Copenhagen Accord in December 2009

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Attack this on a decade by decade approach. Starting with 1960s to 1970s and move through to 2010 or present

Canadian Emission Standards

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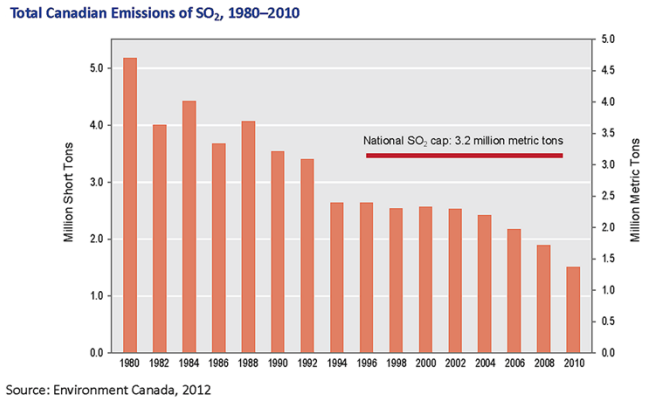

Source: Environment Canada, 2012

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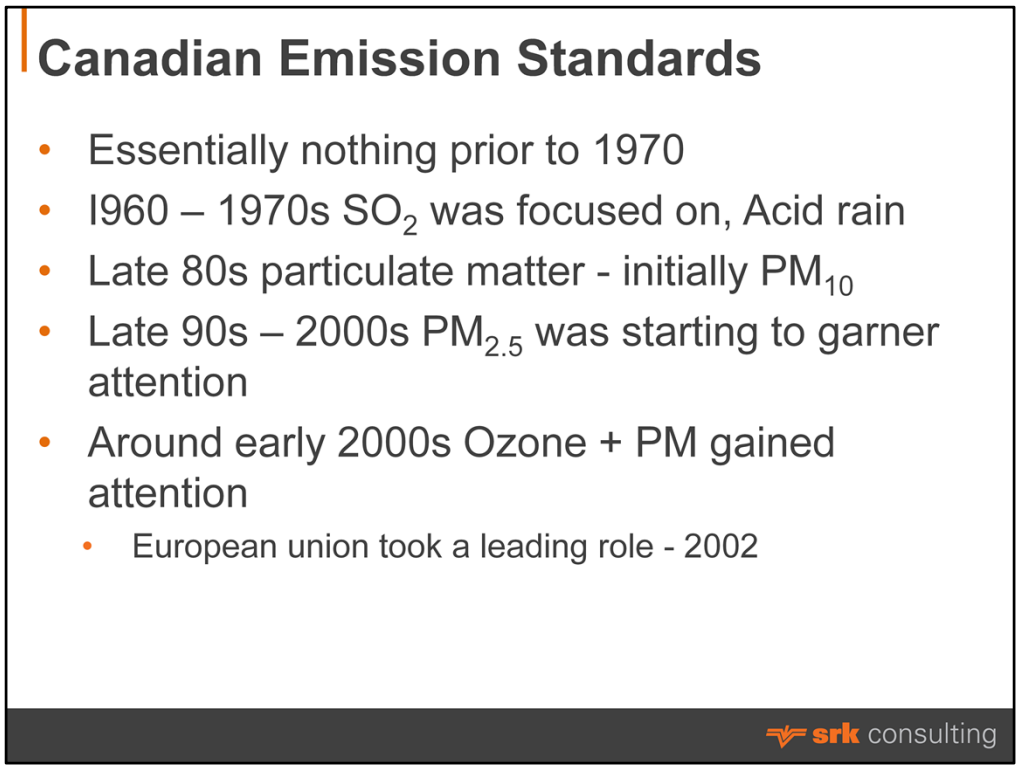
So looking at air emissions prior to 1970 it is not any different than any other environmental regulation in the world. There was none!
Then in the 1960s and 70s scientists started to realize there was a problem with SO2. Acid rain was starting to kill many of the natural lakes in the areas around industry with high SO2 emissions.
So legislation was drafted and regulations were created to reduce our SO2 emissions – this was a good thing and something that needed to happen. Simply plot that shows a steady decrease from 1980 to 2010

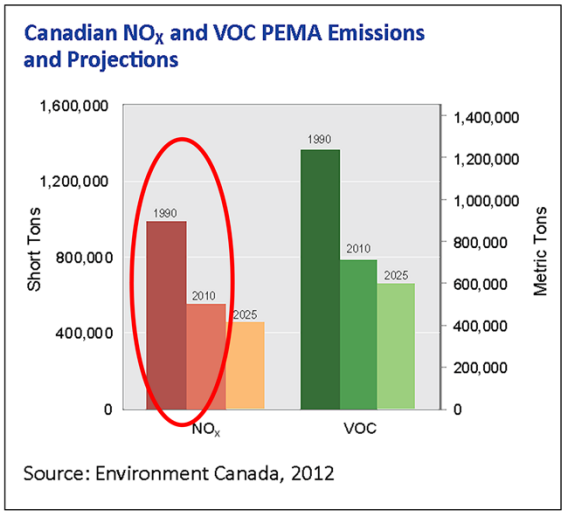


In the 1980s Total Particulate matter became the flavour of the day, which quickly shifted to PM 10 or particulate matter with a size fraction less than 10 microns.

Later in the 90s – 2000s PM 2.5 became the focus and again changes were made to regulations to tighten up our emissions

Around the early 2000s Ozone combined with PM became the focus. European union led the ozone charge in around 2002.

Canadian Emission Standards



Caption/Description

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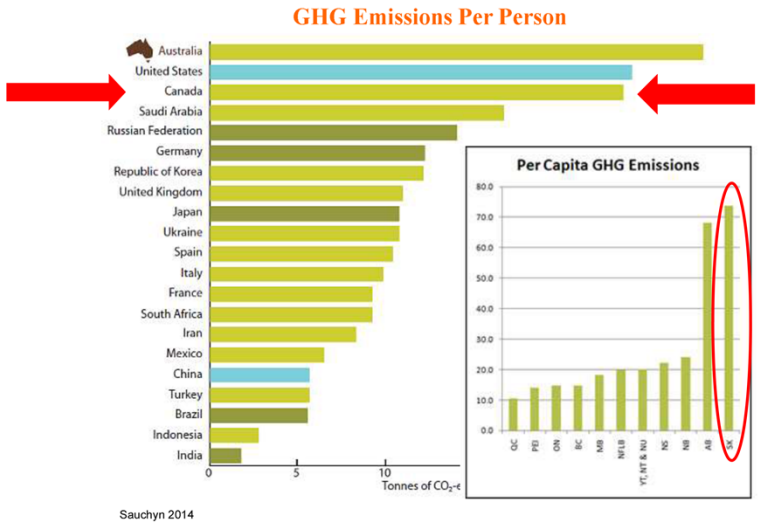
Again I don't think anyone was disputing that some changes were necessary. This plot simply shows the reduction of Nox which includes ozone and Particulate matter by about 50% from 1990 to 2010.

Also in the 90s and 2000s onward, GHG stole centre stage. Canada recognized the issue and signed on to the Copenhagen Accord in Dec 2009. Since then the federal and provincial governments have been working with industry to reduce GHG.
But we have a long way to go. We are certainly not global leaders in the area.

Canadian Emissions Standards



Caption/Description

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Here is a simple plot showing GHG emissions on a global scale per person/ per country. So on a per capita basis. If you look at this plot Canada ranks 3rd in the world.
A little closer to home Saskatchewan the province I am from is the highest per capita in the country. Per capita – only 1M people in Saskatchewan

Canadian Emissions Standards

"*The state of air quality in Canada has improved significantly since the 1970s, in most regions, with respect to all major pollutant types*,"

Joel Wood, author of Canadian Environmental Indicators - Air Quality, Frazer Institute, 2012

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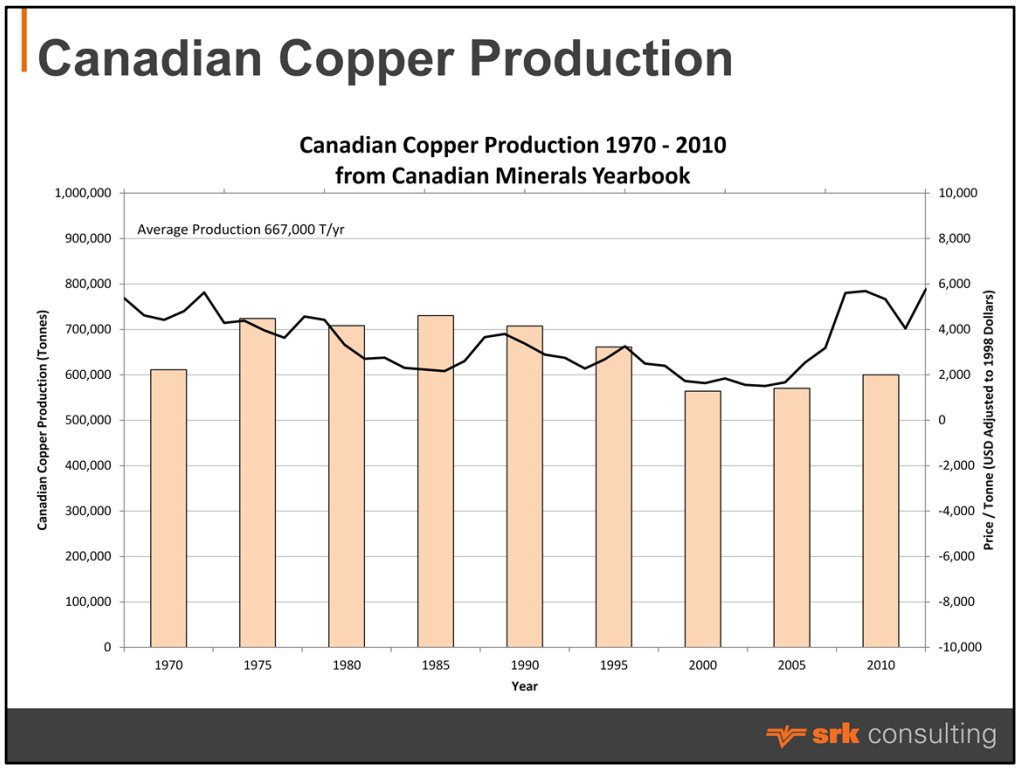
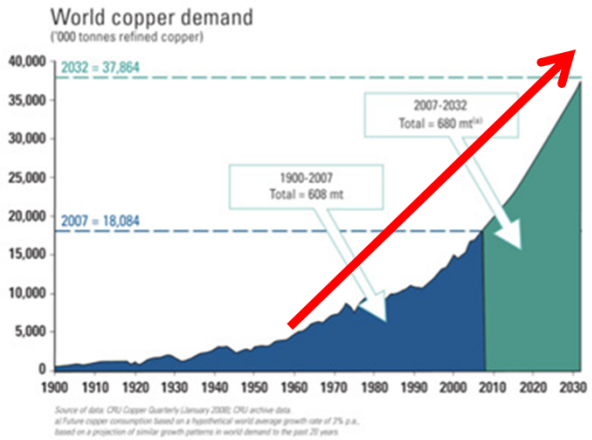
That being said, we have made significant progress in improving our air emissions since 1970. And I think it is safe to say that most canadians feel pretty good about their air quality.



So lets look at Copper. Here is a simple plot showing the production of copper over the last 40 od years in Canada. Shown in 5 year increments. The black line on top represents the global price of copper adjusted for inflation. As you can see, Canada produced roughly 500K to 700K tonnes of copper throughout this period and for the most part the production numbers had a pretty close relation to the fluxuations in the global price.

Canadian Copper Production

- Global demand is continuing to increase
- 40 year average suggests Canada will contribute to that production
- Exploration activities in Country support this statement



From: AQM Copper INC. website, 2015

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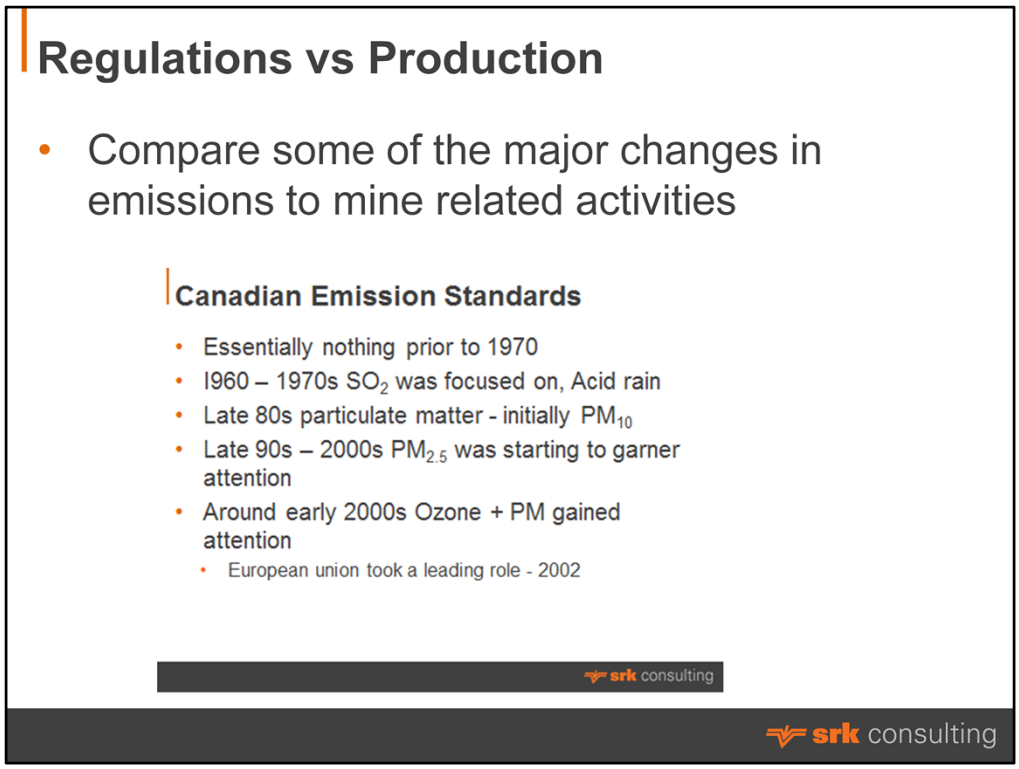
This is a simple plot showing the copper demand across the globe. From 1990 to 2010 these are real numbers with 2010 to 2030 representing an estimate.

The take home story here is that the demand for copper on a global basis is not going down.

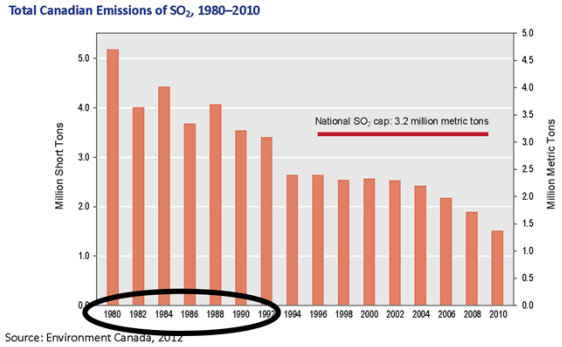
Canada's 40 year history suggests that we will continue to play a part in this production. And the exploration activities in the country don't suggest anything other than the same.



So lets look at the interaction between air emission improvements and the production of copper. We will take the same approach and focus on decades.

Regulations vs Production

- 60s to 70s a reduction of SO2 emissions was necessary
- It took about 10 years to meet the targets



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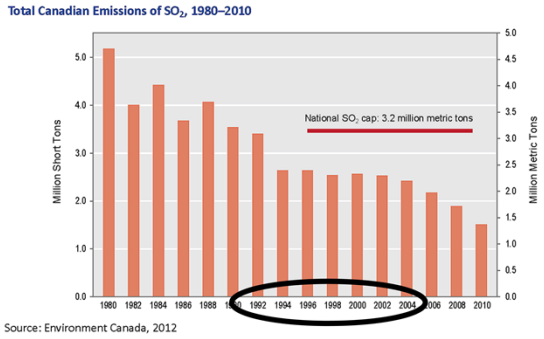
So as I mentioned, in the 60s and 70s SO2 was the focus of attention – rightfully so. However to meet the changes created within guidelines and regulations it took industry about 10 years to get there. As shown on this SO2 plot

Regulations vs Production

- 80s and 90s focused on a reduction of Particulate Matter
- It took roughly another 10 years to meet the new PM targets (1990s – 2000)



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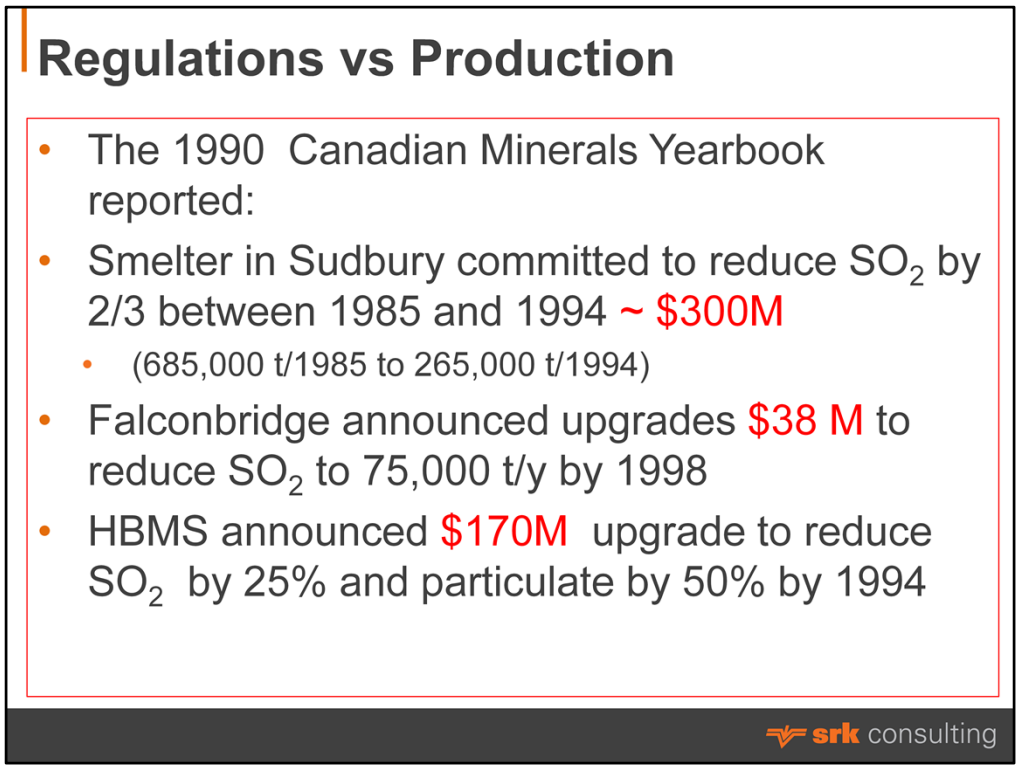
During the 80s and 90s the focus was on particulate matter. Again to catch up with the changes in regulations it took industry about 10 years to catch up.
I am using the same plot SO2 emissions from 1980 t0 2010, it is not a truly linear relationship, but it is close enough for what I am demonstrating here today.

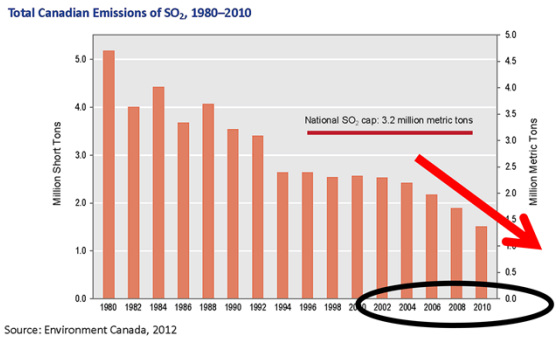
Now it is important to note that meeting these changes didn't come without a cost.



The 1990 Canadian Minerals Yearbook reported: A smelter in Sudbury had committed to reducing it's SO2 emissions by 2/3 between 1985 and 1994. Not a small reduction, and not a small cost.
Falconbridge another smelter in the area announced a $38M upgrade to their facility in order to reduce their SO2 emissions to 75,000 t/y by the year 1998
Another smelting company HBMS announced a $170 M upgrade to reduce their SO2 by 25% and PM by 50% by 1994

Regulations vs Production

- 2000 and onward Ozone and PM was the focus
- Changes started to be realized within about 5 years



Source: Environment Canada, 2012

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Later in the early 2000s when ozone became the center of attention a similar pattern can be tracked, these changes were realized a little faster, likely as a result of some of the upgrades in the past couple decades, but it took about 5 years to realize these changes. And the trend continues to go down.

Again these changes did not come for free.

Regulations vs Production

- 2009 Canadian Minerals Yearbook
- The permanent closure of two Canadian copper smelters and one Canadian copper refinery was announced
- If your not in the copper business…..

- We didn't stop mining copper we simply shut down a few smelters…
- So what did we do with the copper?

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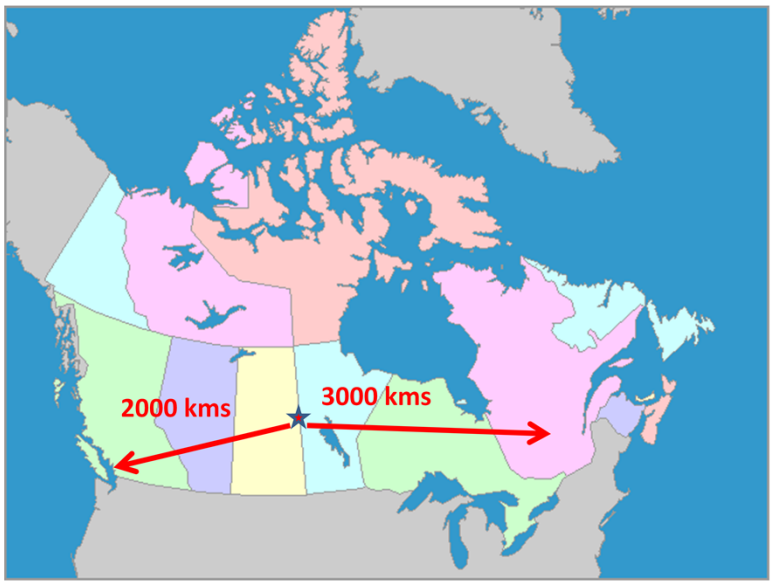
The 2009 Canadian minerals Yearbook reported to permanent closure of 2 Canadian smelters an 1 refinery

Now if you are not in the copper business and overly concerned with air emissions in Canada you might think this is a pretty good thing, maybe even something you would applaud!!!

However, it is important to note that we didn't stop mining copper – we simply shut down a couple of smelters

So what did we do with the copper?

Regulations vs Production



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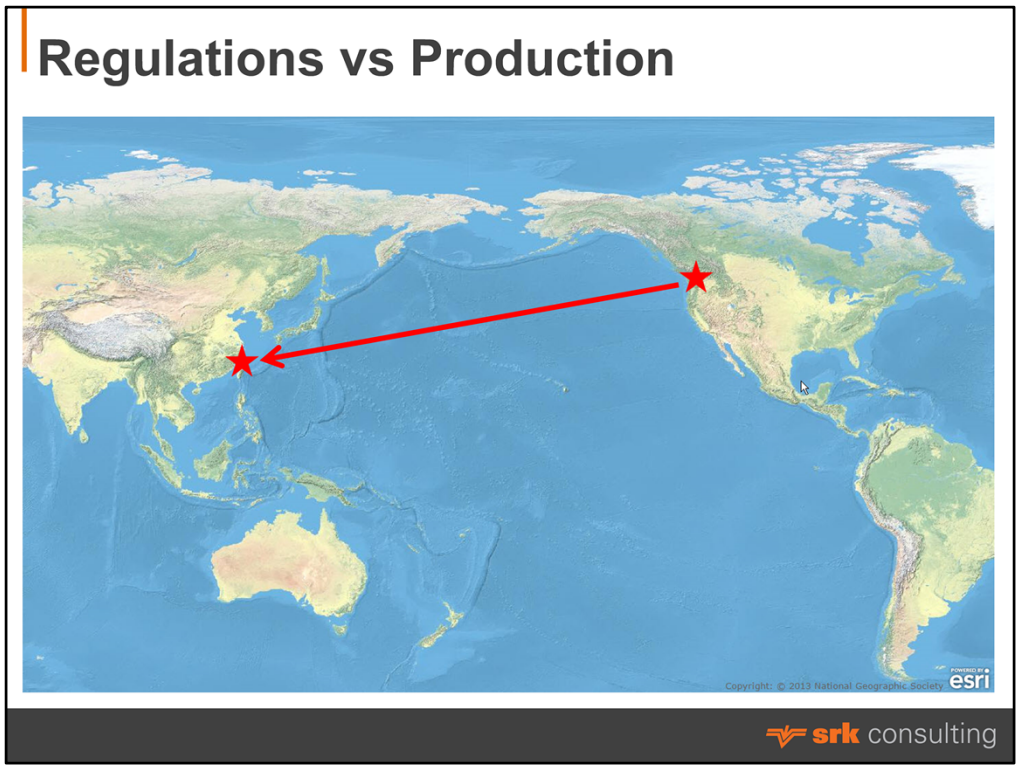
Well lets look at one of the smelters that shut down in 2010 located here in central Canada. They continued to produce copper concentrat. A portion of this concentrate was loaded on to rail cars and shipped to Quebec where it was smelted under contracts into copper metal and then sold to clients.
Another portion of the copper concentrate was shipped on a train to the port of Vancouver. Some 2000 kms away.



So what happened to the concentrate that landed in Vancouver. Well it is loaded on to ships and transported to a custom smelter in China where the concentrate is smelted in contract smelters operating within the legislation and regulations of china. So what does this mean – if you don't see where I am going yet!

Conclusions

Emission Standards Comparison					
		Canada 2015	China 2016	EU	
Pollutant	**Avr. Timing**	**limit**	**limit**		**unit**
$PM_{2.5}$	Annual	10	35	-	ug/m3
$PM_{2.5}$	24 hour	28	75	25	ug/m3
Ozone	8 hour	63	160	120	ppb

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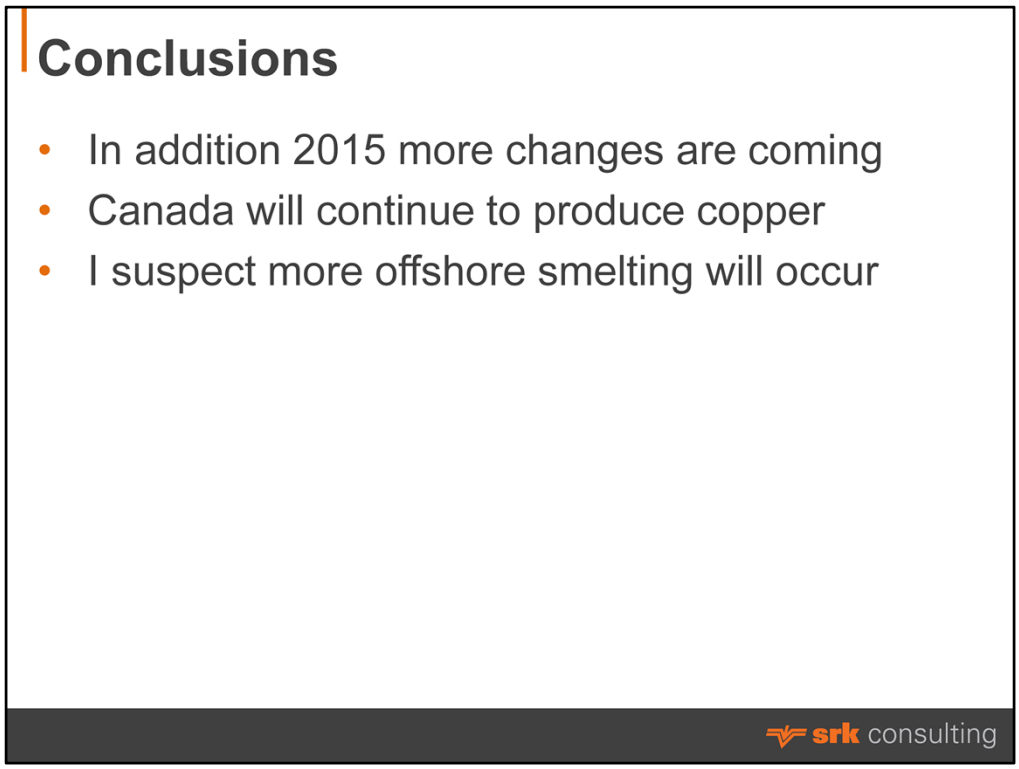
Well if we look at Canadian limits for PM and Ozone in 2015 versus what China's will be adjusted down to by 2016 you can see that China allows about 3 times the emissions that Canada currently does. If your curious the European union is in blue for both these parameters.



In addition we are expecting additional changes in Canada this summer. Tightening the limits again.
Canada will continue to produce copper.
It is important to state that I focused on copper in this presentation the same came be said for every base metal mined in Canada, zinc, nickel, lead. So I suspect that each operation will look at the upcoming changes and evaluate the economics of upgrading there stacks to meet the new regulations and determine on a case by case basis whether or not they continue to operate their smelters or rely on offshore smelters.

As well the story I have told today is exactly the same for the US.

Conclusions

- In a Global Sense is the tightening of Canada's emission standards really the right thing to do?
- Or should our NGOs and Policy makers lobby elsewhere and Not In My Back Yard?

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So this brings me back to the initial question – is Canada's approach to reducing air emissions to as low as achievable the right environmental choice on a global scale?

Or maybe our NGOs and Policy makes should be focusing their lobbying efforts NIMBY!

Thanks for listening.