Control of Hexavalent Chromium Emissions at Sonaca (Wallonia, Belgium)

AIR - CLRTAP

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agence wallonne de l'air & du climat

23rd EGTEI,
Brussels, 10/10/14

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Control of Hexavalent Chromium Emissions at Sonaca (Wallonia, Belgium)

- Part I: Issue
  - Matter of concern
  - Problem
- Part II: Problem solving (know-how & technology)
- Part III: Results

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Part I: Issue

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Hexavalent chromium (Cr VI)

Highly carcinogenic compound

- Group I International Agency for the Research on Cancer: carcinogenic to humans
- Concentration in ambient air corresponding to an excess cancer risk of 1 in a million:

  0.025 ng/m^3 (WHO Air Quality Guidelines, 2000)

EXTREMELY LOW !

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- Dispersion modelling based on measured releases from sources carried out by Mons Polytech (UMons-FPMs) on behalf of AwAC (the Walloon Agency for Air and Climate).
- Data relating to stacks (height, internal diameter, flow rate, concentration, temperature...)

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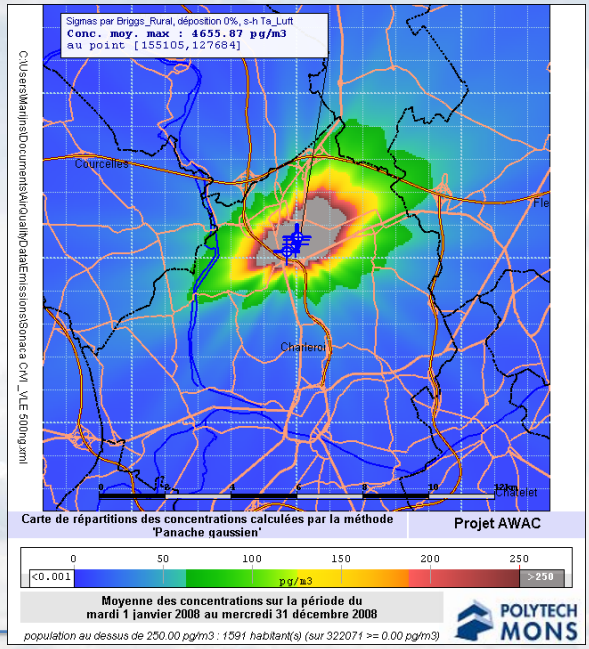
Initial situation (2008) with exceedance: maximum average concentration of about 5 000 pg/m³



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- Result: substantial risk for the population living in the surroundings.

=> STRINGENT ABATEMENT COMPULSORY !

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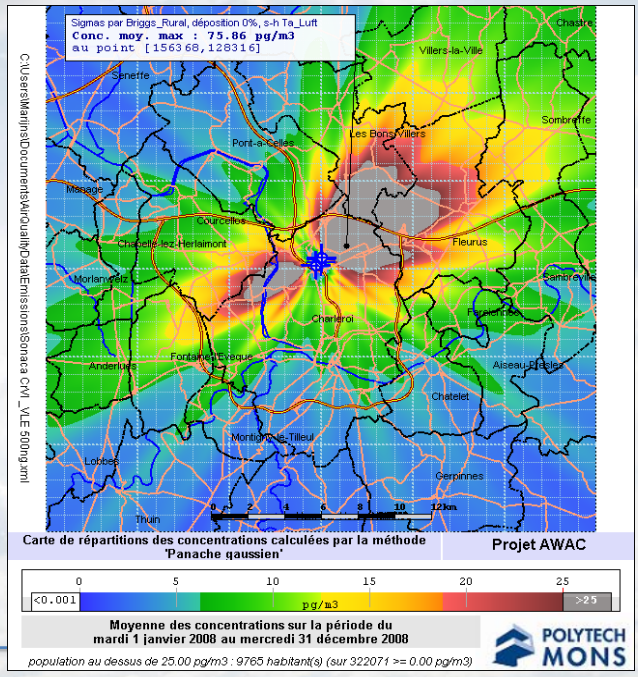
Acceptable risk:
- after abatement measures proposals to put in place on the basis of modelling results;
- maximum average concentration of about 75 pg/m³.



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Setting of an emission limit value:

- Leading to an acceptable risk at ground level, checked by dispersion modelling
- Achievable with the most efficient control devices technically available
- Analytically measurable (not in Belgium at that time !)

0.5 µg/Nm³

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Part II: Problem solving

- Look for chromium-free alternatives
- Where chromium emission will persist, install appropriate filters

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Look for chromium-free alternatives

In Aerospace, in order to prevent corrosion on aluminium, hexavalent chromium is still used in the following processes :

- surface treatments (chromic acid anodising, sealing of the anodic layer, chemical conversion (Alodine 1200), hard chromium plating…)

- painting / bonding primers : all paint or bonding primers applied on aluminium surfaces still contain high levels of strontium chromate.

Few alternatives exist but are not qualified yet by all customers .

→ Major aerospace industries are part of the CTAC and CCST consortia requesting ECHA authorization for further use of chromium trioxide and compounds beyond their sunset date (respectively Sept 2017 and Jan 2019).

→ Chromium emissions will continue for years and need to be managed and reduced.

SONACA

Emissions observed from 2010 to early 2013

	2010	2012	early 2013
Paint/bonding primers	428 µg/Nm³ (Cr_{TOT})	19 µg/Nm³ (Cr_{TOT})	0,13 µg/Nm³ (Cr6+)
	Maintenance actions Ok		No further investment required
Chromic acid bath	443 µg/Nm³ (Cr_{TOT})	248 µg/Nm³ (Cr_{TOT})	29 µg/Nm³ (Cr6+)
	Maintenance actions : not sufficient		Invest still required

Chromium Mist Eliminator

- *How to get the highest performance on Chromium aerosols ?*
- *Request < 0,5 µg Cr^{6+} / Nm^3*

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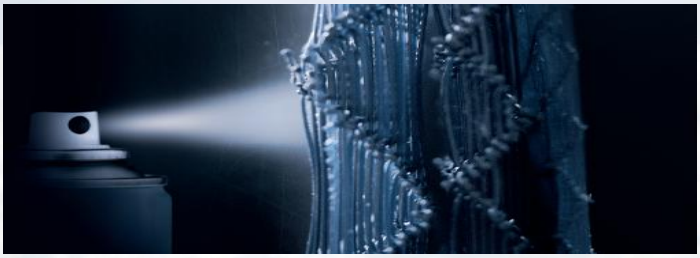
How does a Mist Eliminator work ?



- *To capture droplets*
- *To coalesce aerosols*

BluEFil technology

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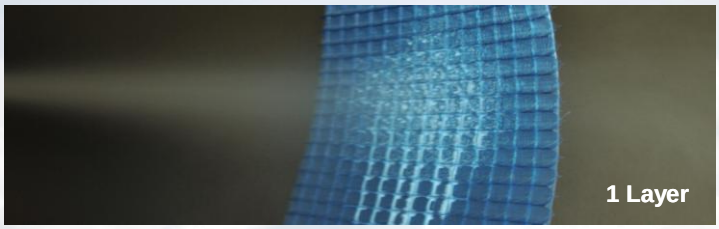
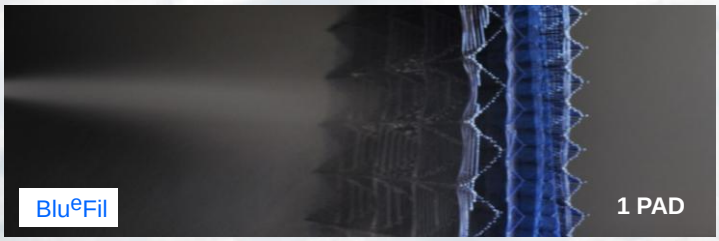
How does a Mist Eliminator work ?





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Chromium Mist Eliminator

Solution 5 stages cross-flow

Protection	Protection	Coalescing	Coalescing	Entrainem. Separation
Stage 1 + water	**Stage 2** + water	**Stage 3** + water	**Stage 4** + water	**Stage 5**
99% > 10 µ	99% > 5 µ	99% > 2 µ	99% > 1 µ	99% Drops
+ Solid Particles			**Finest droplets**	

Inlet → Stage 1 ; Stage 5 → Outlet

Pumps 5,5 kW + Vent 22 kW

Deionized water 3,6 m³/day

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Chromium Mist Eliminator

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99% > 10 µ	99% > 5 µ	99% > 2 µ	99% > 1 µ	99% Drops
+ Solid Particles			**Finest droplets**	

Inlet → Stage 1 ; Stage 5 → Outlet

1 / 125

Effluent Mass ?

1 / 1000

> 0,5 µ (50%)

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Chromium Mist Eliminator

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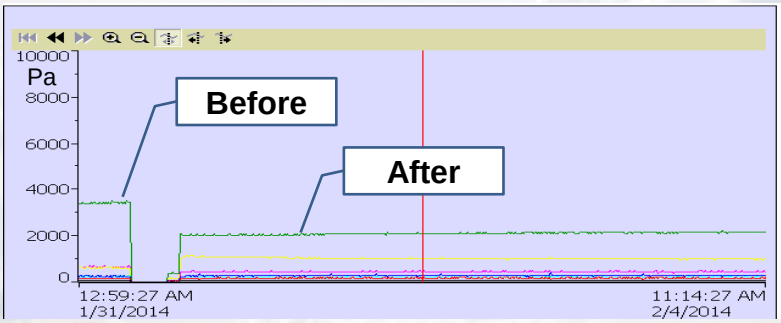
Chromium Mist Eliminator

Maintenance **Following the pressure drops**



Each 3-4 month ***Swap in < 4 hr production stop***

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Part III: Results

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désignation	Chromium 6+ (µg/Nm³) March 2013 24 hour average	Chromium 6+ (µg/Nm³) June 2013 24 hour average	Chromium 6+ (µg/Nm³) Sept. 2013 24 hour average	Chromium 6+ (µg/Nm³) Dec. 2013 24 hour average	Chromium 6+ (µg/Nm³) March 2014 24 hour average	Chromium 6+ (µg/Nm³) June 2014 24 hour average
cabine peinture PPE cheminée 1	0,60	0,03	0,57	0,69	0,10	0,006
cabine peinture PPE cheminée 2	0,19	0,22	0,57	0,01	0,28	0,006
cabine thermoréacteur Sunkiss PPE	< 0,033	0,05	0,02	0,10	0,13	0,010
sas de désolvatation Sunkiss PPE	0,08	0,02	< 0,024	0,02	0,01	0,005
cabine peinture ASSY gaine 1	0,06	0,04	0,08	0,23	0,03	0,03
cabine peinture ASSY gaine 2	0,01	0,10	0,23	0,34	0,04	0,18
désolvavtion ASSY	-	-	-	-	0,05	0,02
application BR 127 - GPE collage	< 0,032	**1,26**	**1,16**	0,77	0,35	0,06
cabine thermoréacteur Sunkiss GPE	0,23	**2,33**	**2,77**	0,23	< 0,01	**3,78**
sas désolvatation Sunkiss GPE	< 0,019	< 0,023	0,18	0,03	0,06	0,02
cabine peinture Composite (labo préparation)	-	0,02	< 0,025	0,01	0,01	0,007
cabine peinture Composite	-	0,02	< 0,027	0,01	< 0,01	0,006
CA Anodisation bath	**29,00**	**< 0,022**	**0,10**	**0,01**	**< 0,011**	**0,011**

May 2013 action on CAA Introduction of Chrome filters

OK	= conform (less than 0,5 µg/Nm³)
Action	= between 0,5 and 1 µg/Nm³
Investigation	= more than 1,0 µg/Nm³

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Chromium Mist Eliminator

Result $< 0{,}1\ \mu g\ Cr^{6+} / Nm^3$

$< 3\ g\ Cr^{6+} / yr$

Now we can speak in nanograms !

The outlet quantity is divided by 1.000 !

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Conclusion

désignation	Chromium 6+ (µg/Nm³) March 2013 24 hour average	Chromium 6+ (µg/Nm³) June 2013 24 hour average	Chromium 6+ (µg/Nm³) Sept. 2013 24 ho	Chromium 6+ (µg/Nm³)	Chromium 6+ (µg/Nm³) March 2014	Chromium 6+ (µg/Nm³) June 2014 24 hour average
cabine peinture PPE cheminée 1	0,60	0,03				0,006
cabine peinture PPE cheminée 2	0,19	0,				06
cabine thermoréacteur Sunkiss PPE	< 0,033	0				0
sas de désolvatation Sunkiss PPE	0,08					5
cabine peinture ASSY gaine 1	0,06	0,				3
cabine peinture ASSY gaine 2	0,01	0,10				0,18
désolvavtion ASSY	-	-				0,02
application BR 127 - GPE collage	< 0,032	1,26				0,06
cabine thermoréacteur Sunkiss GPE	0,23	2,33	2,77		< 0,01	3,78
sas désolvatation Sunkiss GPE	< 0,019	< 0,023	0,18	0,03	0,06	0,02
cabine peinture Composite (labo préparation)	-	0,02	< 0,025	0,01	0,01	0,007
cabine peinture Composite	-	0,02	< 0,027	0,01	< 0,01	0,006
CAA bath	29,00	< 0,022				11

Maintenance Actions

Investment Actions

May 2013 : action on CA
Introduction of Chrome filters

µg/Nm³

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Thank you for your attention !

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For additional information on Cr VI regulation, please contact :

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