



Occupational Hygiene
Industrial Toxicology

9th BioDetectors conference 2016

**Lausanne, Switzerland
14, 15 april 2016**

*Occupational Health & Consumer
Products CALUX applications*

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TOXpro SA
Certified Occupational Hygienist
Toxicologist

What is occupational hygiene ?

the discipline of anticipating, recognizing, evaluating and controlling health hazards in the working environment with the objective of protecting worker health and well-being and safeguarding the community at large.

International occupational hygiene association (IOHA)

Well, to resume :

1. Occupational Hygiene is a silly name
2. This seems to deal with dust, solvent noise and other dirty things we tend to avoid by having a long years of education.

Who cares ?

... not so many, in fact

... very few interest from academy, research field, lack of visibility and finance

We have to interest ourself of developpement in other fields .. to borrow their super tools



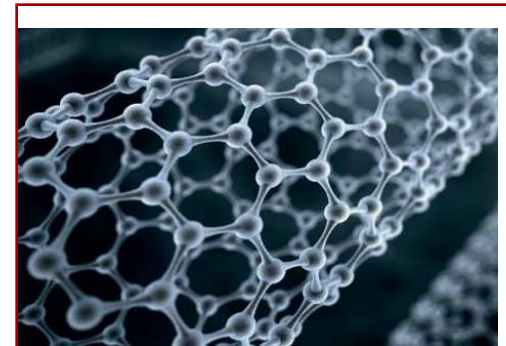
And CALUX is one of those toys

Current paradigm and limitation

Testing exposure compliance substances by substances (OEL).

But on workplaces (and real life)

- Multiple complex cocktail exposure
- Exposure to unregulated substances



Valeurs limites
d'exposition aux postes
de travail 2016

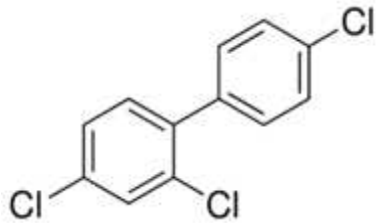
suvapro
Le travail en sécurité

PCB indicators

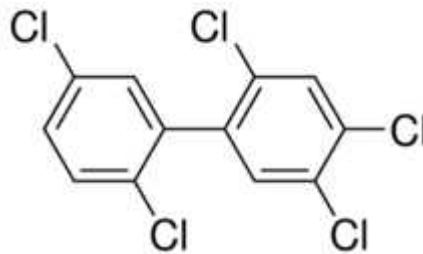
The 6 big electors (from 209)

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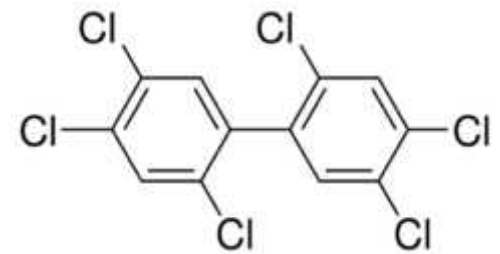
PCB 28



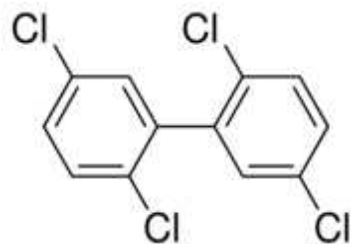
PCB 101



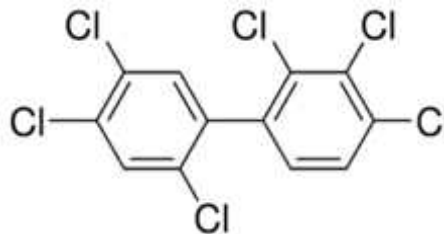
PCB 153



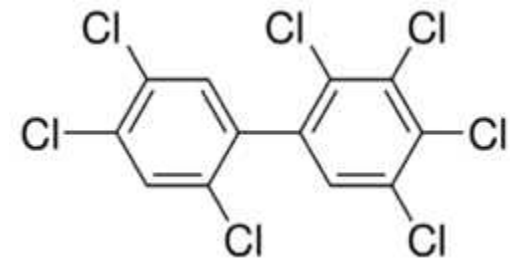
PCB 52



PCB 138



PCB 180



Official PCBs concentration analysis

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La teneur totale en PCB se calcule en multipliant la somme des 6 congénères indicateurs déterminés quantitativement par un facteur de conversion à déterminer expérimentalement pour chaque mélange technique de PCB

$$(\sum_{(PCB)} = f \times \sum (PCB \text{ n}^\circ 28 + 52 + 101 + 138 + 153 + 180).$$

Pour autant que le mélange de PCB rencontré dans un échantillon de mesure puisse être attribué à un mélange technique connu de PCB, il faut utiliser le facteur de conversion spécifique pour le calcul de la teneur totale en PCB de l'échantillon (cf. encadré).

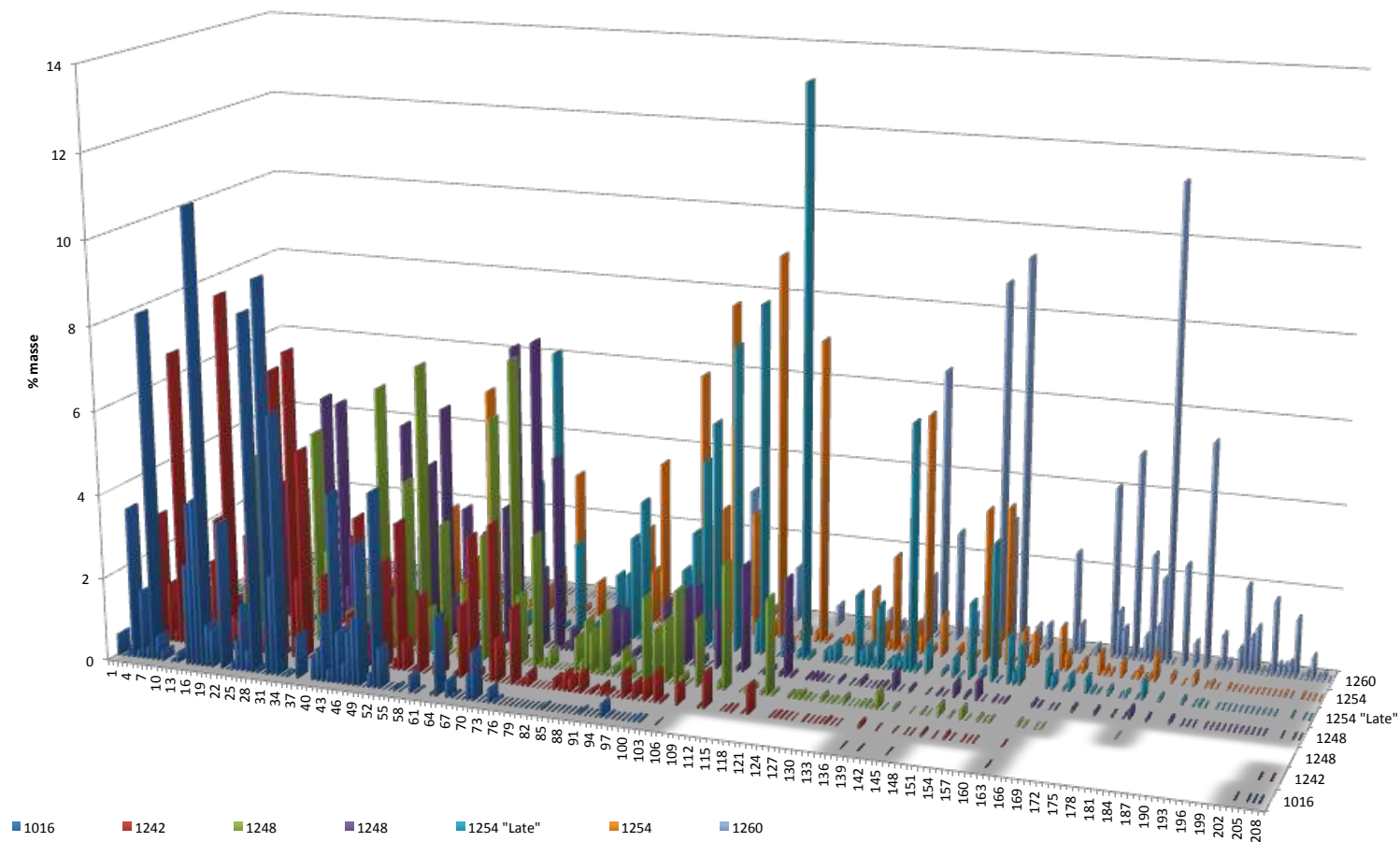
Mélange de PCB	Facteur de conversion f
Aroclor 1242 ou Clophen A 30	8,5
Aroclor 1248 ou Clophen A 40	7,0
Aroclor 1254 ou Clophen A 50	4,7
Aroclor 1260 ou Clophen A 60	3,1
Mélange Clophen A 50 / A 60, rapport des masses 1:1	4,4
Mélange Clophen A 30 / A 40 / A 50 / A 60, rapport des masses 1:1:1:1	5,0 (« valeur conventionnelle »)

Dans la recherche de la teneur totale en PCB des mélanges de PCB des masses d'étanchéité de composition inconnue, le facteur de conversion 5,0 est en général appliqué par convention.

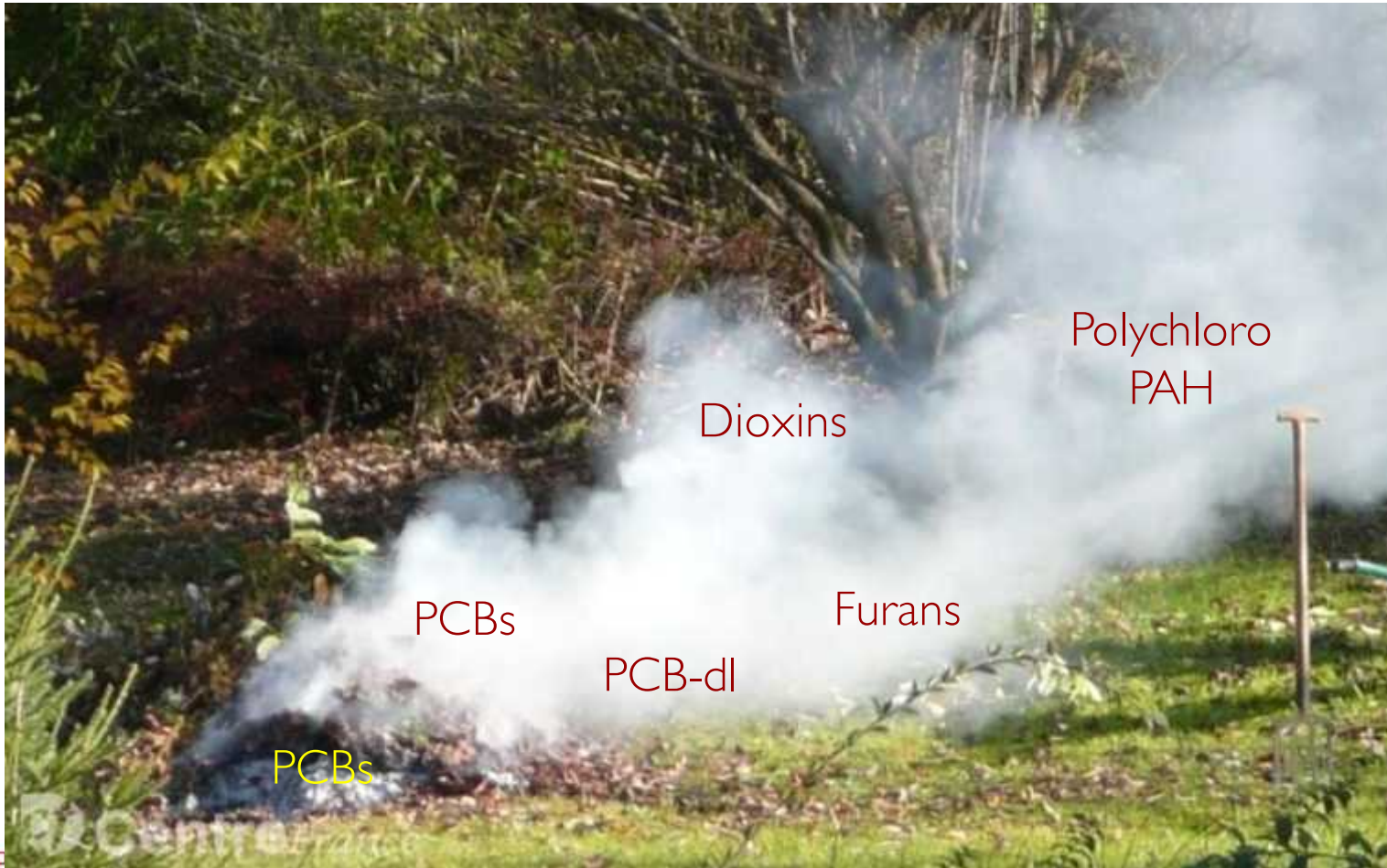


PCBs oil composition (aroclor)

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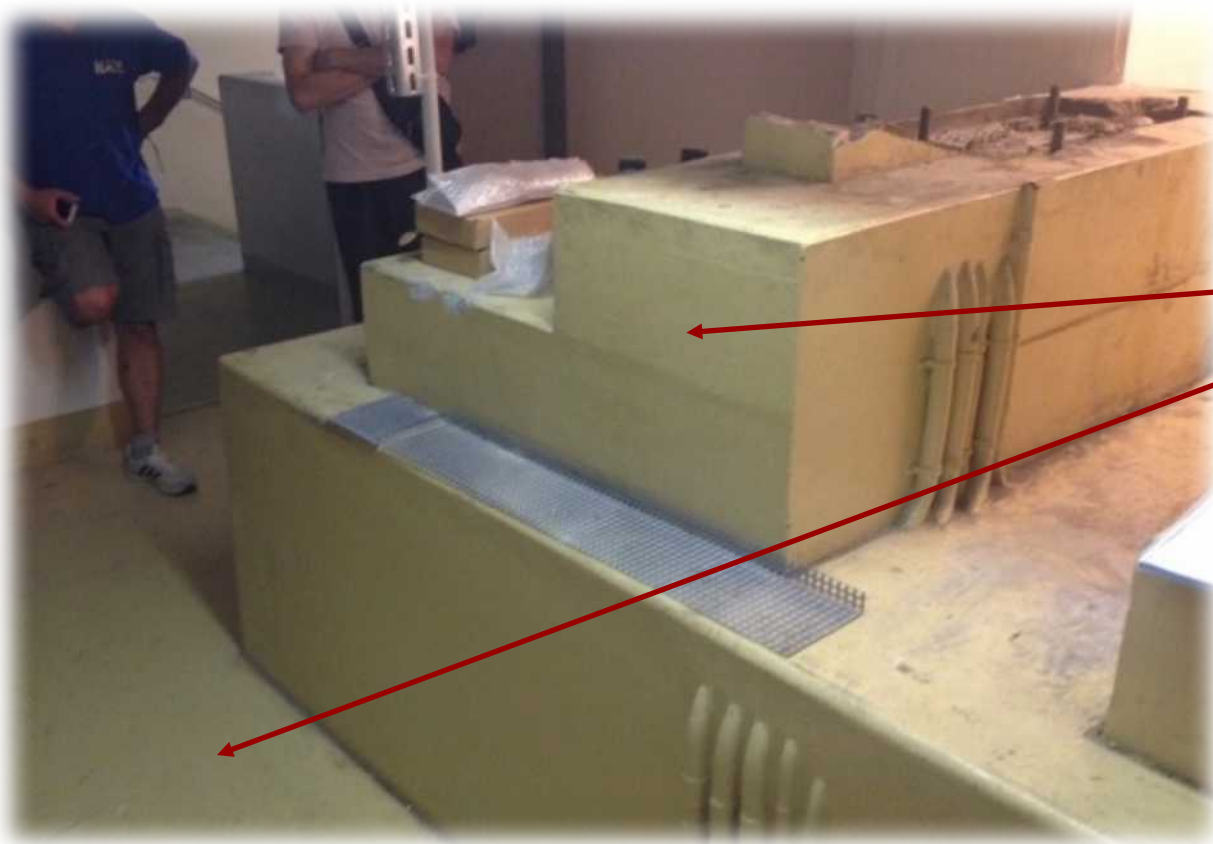


... GASP !



PCBs in painting

Elevator machine room



PCB : 4500 ppm
(mg/kg)

DR-CALUX

PCB-dl : 560'000 ng/kg TEQ

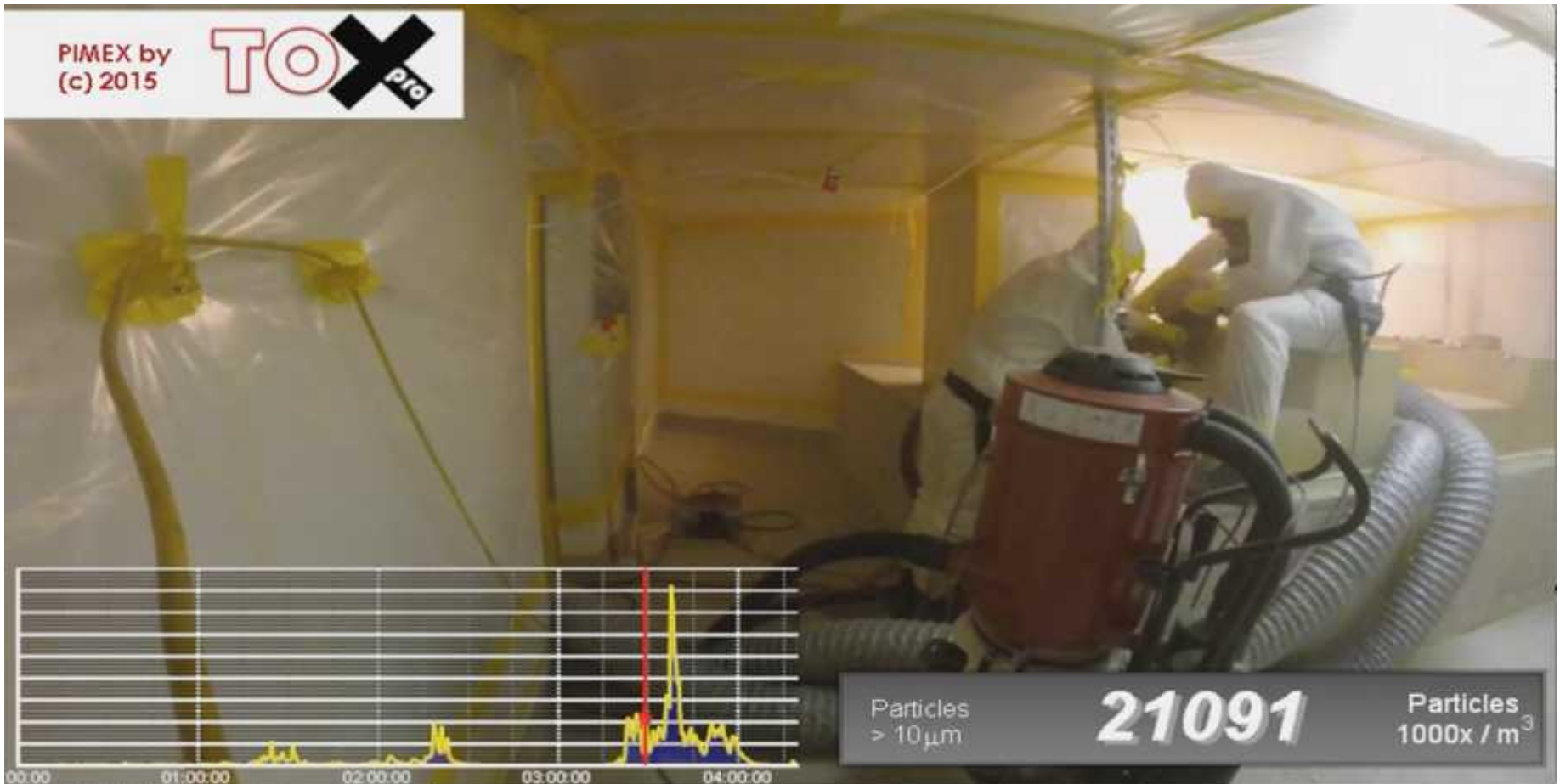
PCDD/PCDF : 36'000 ng/kg TEQ

Occupational exposure during paint remediation

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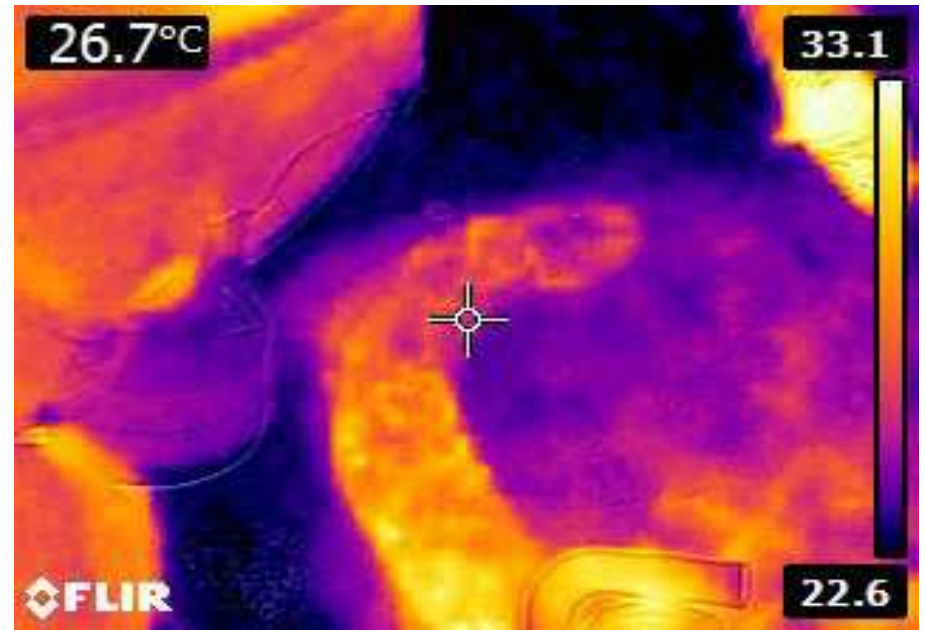
PIMEX by
(c) 2015

TOX
pro



TOX
pro

Overheating issue of PCBs ?



Occupational exposure measurement

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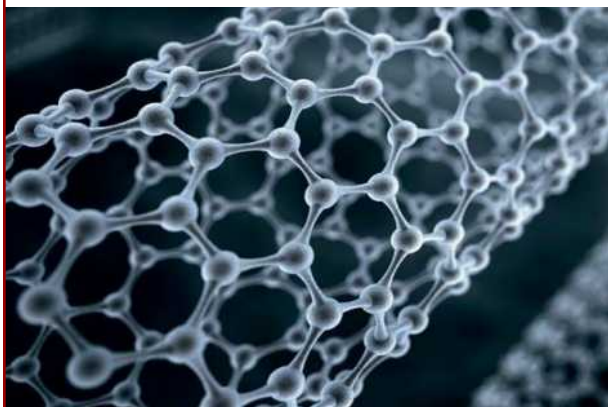
Aerosol / Vapor -
PCB (NIOSH
5503)

PUF –VDI 4300 (PCB)



PCB – Occupational Exposure Limits (OELs)

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Valeurs limites
 d'exposition aux postes
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Substance [no CAS]	VME		VLE		Notations R S O ^B B P C M R _D R _F SS	Toxicité critique
	ml/m ³ (ppm)	mg/m ³	ml/m ³ (ppm)	mg/m ³		
Diphényles chlorés [53469-21-9]; [11097-69-1]	0,05	0,5	0,4	4	R C2 R1 _{BF} R1 _{BD} SS _B	Yeux & VRS, Foie, Chloracné

VME(OEL) PCBs : 500 µg/m³

Results



Congénères	Localisation	PUF Opérateur Teneur PUF µg	%
PCB28		0	0%
PCB52		0.11	17%
PCB101		0.23	35%
PCB138		0.18	28%
PCB153		0.13	20%
PCB180		0	0%
Total congénères (µg)		0.65	100%
Facteur de pondération		4.7	
Volume d'air prélevé (m ³)		0.714	
Teneur PCB corrigée		4.28 µg/m ³	

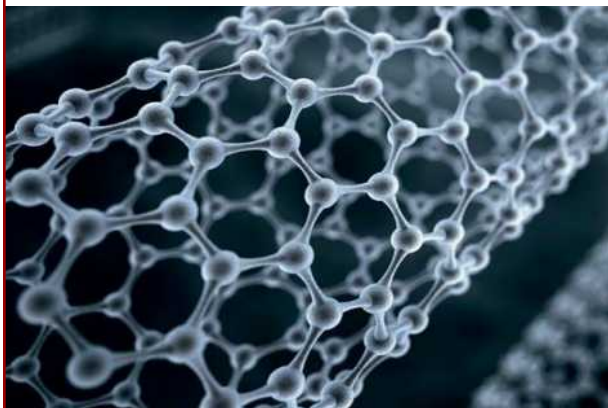
$$C_{\text{moy}} \text{ PCB } 4.3 \text{ µg/m}^3$$

$$\text{OEL : } 500 \text{ µg/m}^3$$

NO RESPIRATORY PROTECTION REQUIRED !?!?!?!?!?!?!?

TCDD – Occupational Exposure Limits (OELs)

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Valeurs limites
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Substance [no CAS]	VME		VLE		Notations R S O ^B B P C M R _D R _F SS	Toxicité critique
	ml/m ³ (ppm)	mg/m ³	ml/m ³ (ppm)	mg/m ³		
Diphényles chlorés [53469-21-9]; [11097-69-1]	0,05	0,5	0,4	4	R C2 R1 _{BF} R1 _{BD} SS _B	Yeux & VRS, Foie, Chloracné
2,3,7,8-Tétrachloro-p-dibenzodioxine (TCDD) [1746-01-6]		1 x 10 ⁻⁶ mg/m ³ i 10 pg/m ³ i			R SS _C	Formel ^{TC}

OEL : 10 pg/m³ eq TCDD



DR-CALUX of the PUF extract

51 pg/m³ eq TCDD

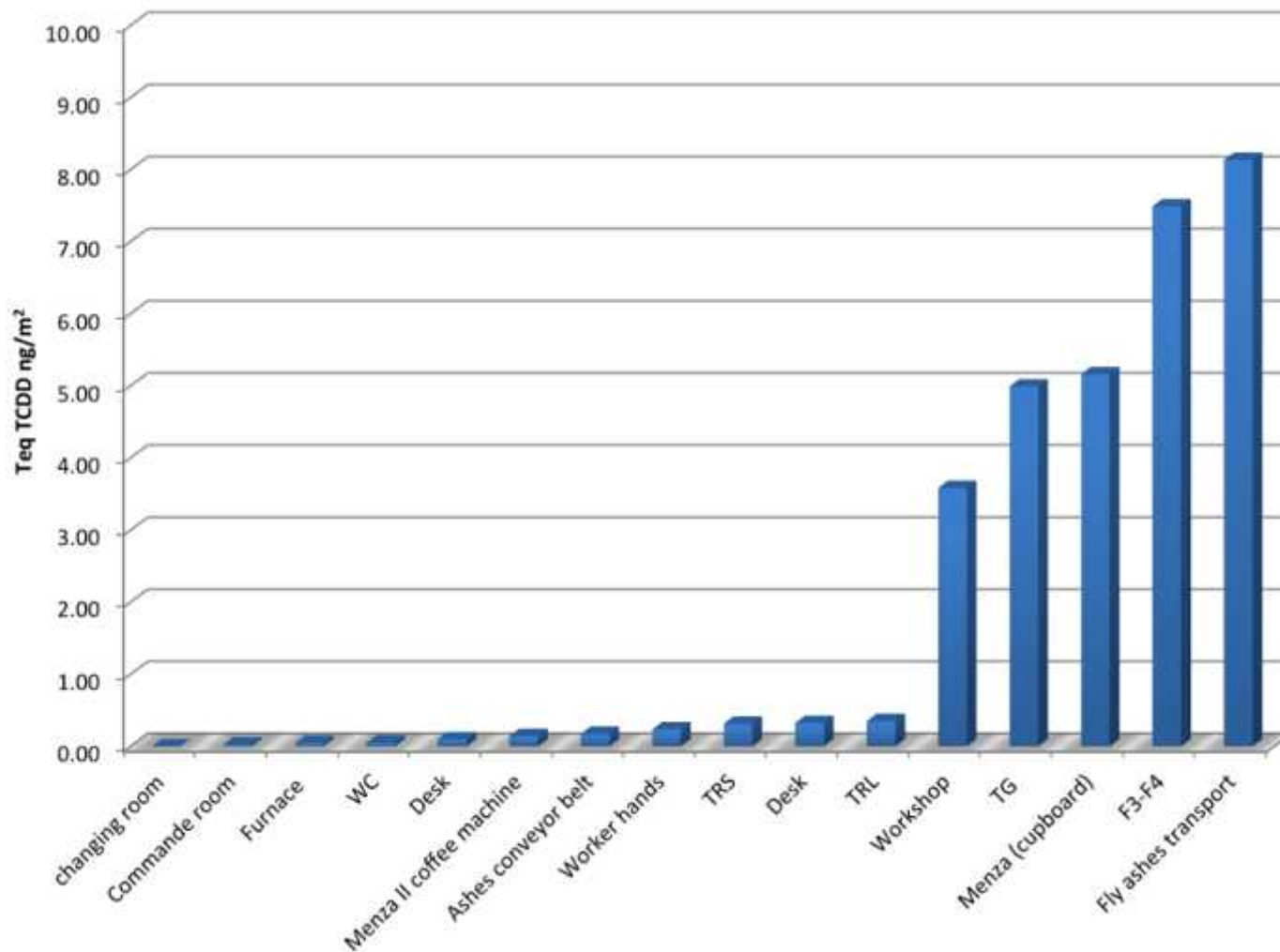
Municipal incinerator case

Calux application exemple from the field



Surface contamination wipe test results

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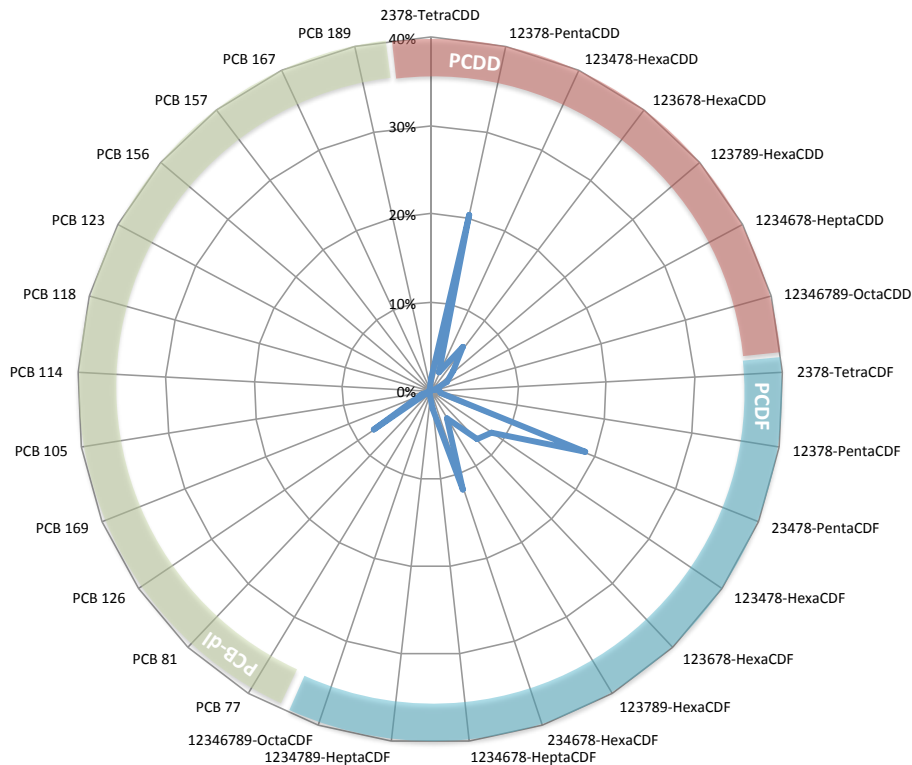
Proposed
limit value
(Germany)

10 ng/m²

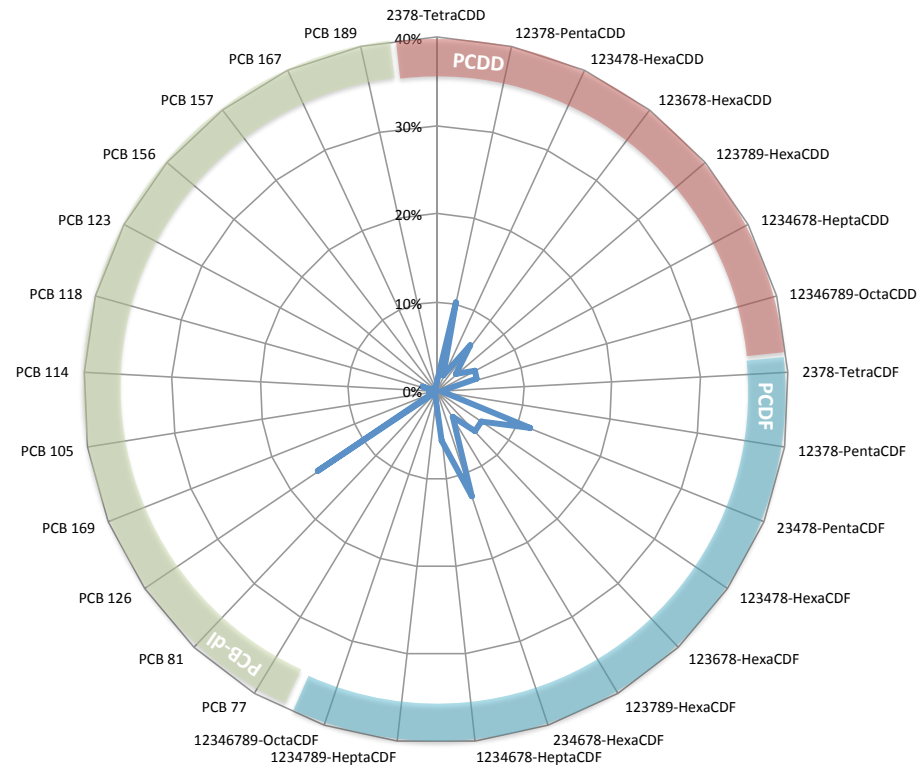
Source of contamination GC-HRMS analysis of dust

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Fly-ashes



Dust in the Menza



PCBs in asbestos cement roofs

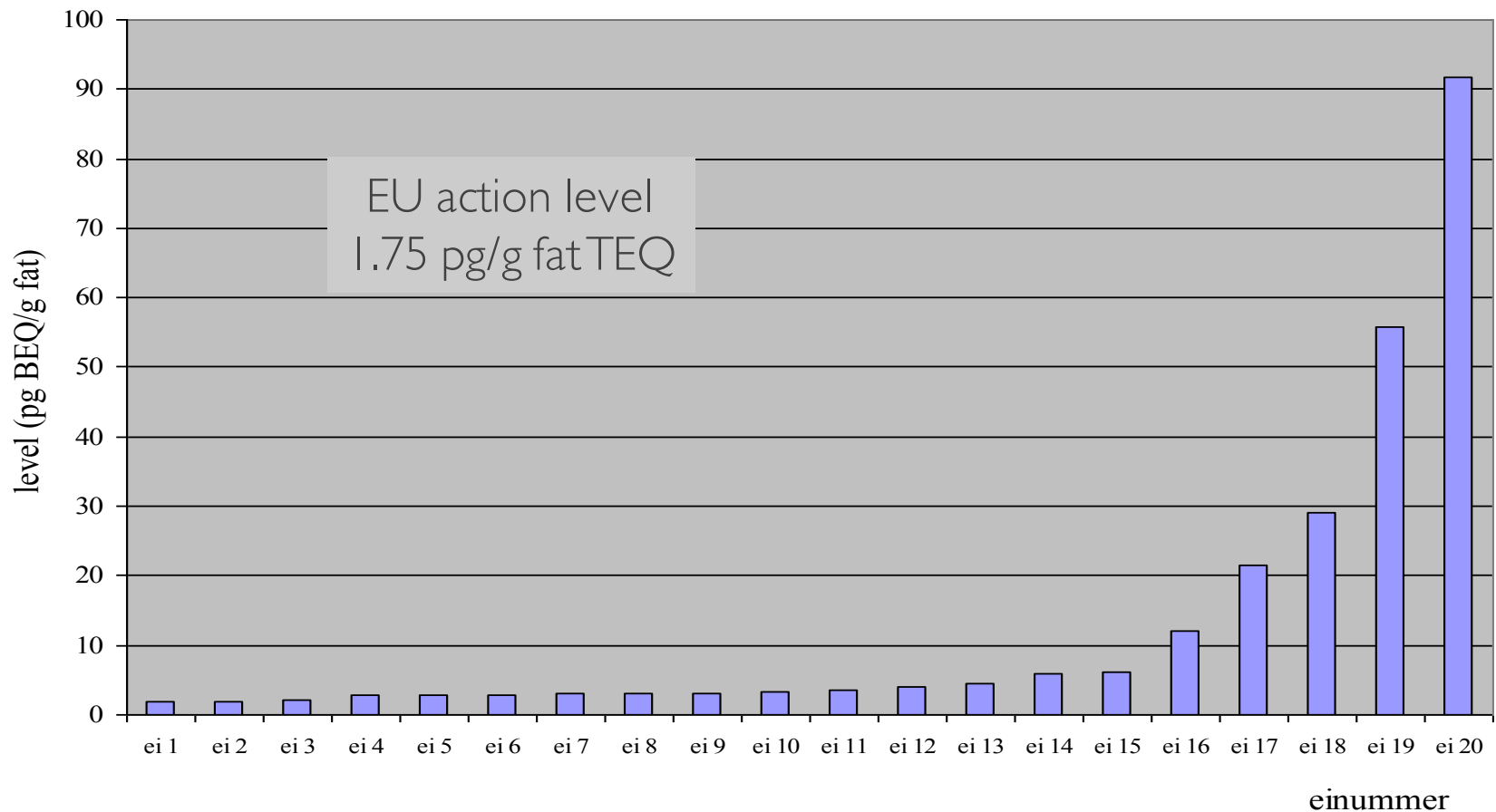
Calux application exemple from the field

A PECULIAR CASE OF PCB CONTAMINATION IN YOUNG ORGANIC HENS

Wim Traag, Ron Hoogenboom, Guillaume van Dam, Jaap Immerzeel, Gerlof Oegema, Cornelis van der Kraats,



Eggs contamination in 2 stables (BDS data)





Soil
139 pg/g PCD-dl (Teq TCDD)

A PECULIAR CASE OF PCB CONTAMINATION IN YOUNG ORGANIC HENS

Wim Traag, Rob Hoogenboom, Guillaume van Dam, Jaap Immerzeel, Gerlof Oegema, Cornells van der Kraats,

Wageningen University & Research



Surface scrapping :
345'141 pg/g PCB-dl (Teq TCDD)

Roof :
13 pg/g PCB-dl (Teq TCDD)

A PECULIAR CASE OF PCB CONTAMINATION IN
YOUNG ORGANIC HENS

Wim Traag, Rob Hoogenboom, Guillaume van Dam, Jaap
Immerzeel, Gerlof Oegema, Cornelis van der Kraats,

Wageningen Environmental Research



8 samples from cement asbestos roof
 (Western Switzerland) – DR CALUX (BDS)

Etat	Concentration TCDD-TEQ	
	pg/g TEQ	pg/cm ² TEQ
Site A - gris clair	< 0.067	< 0.12
Site A - gris foncé après incendie	1.900	0.50
Site B - peinture de surface rouge	0.940	2.70
Site C - gris clair	0.400	0.34
Site D - gris foncé	0.066	0.07
Site E - gris foncé	0.037	0.05
Site F - gris clair	0.029	0.03
Site G - gris clair	0.061	0.05

PCB indicateurs	Ech. 2	Ech. 3
	pg/g	pg/g
PCB 28	<5.8	<0.24
PCB 52	<5.8	14
PCB 101	28	58
PCB 138	103	57
PCB 153	71	46
PCB 180	141	13

1.72 ppm < 50 ppm

Waterproofing agents in spray

Calux application exemple from the field



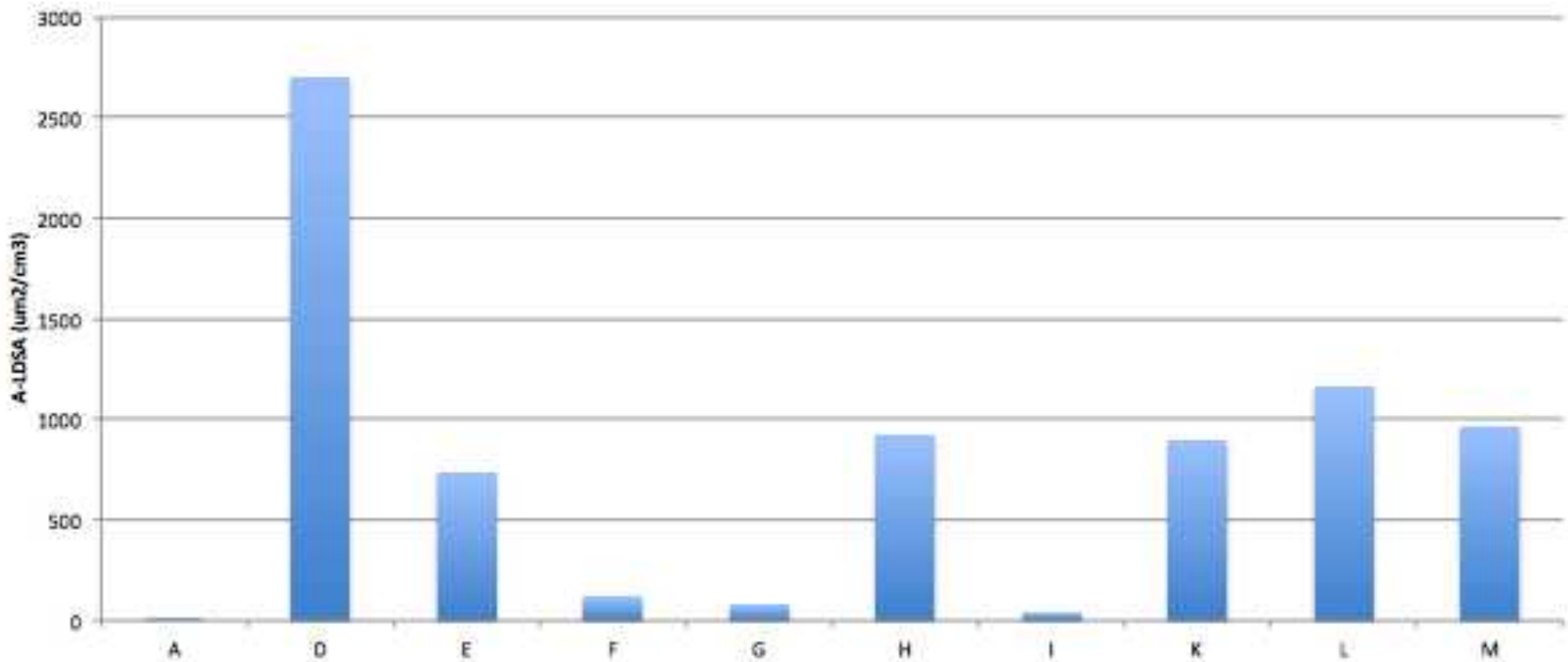
Market product test for TV consumer show

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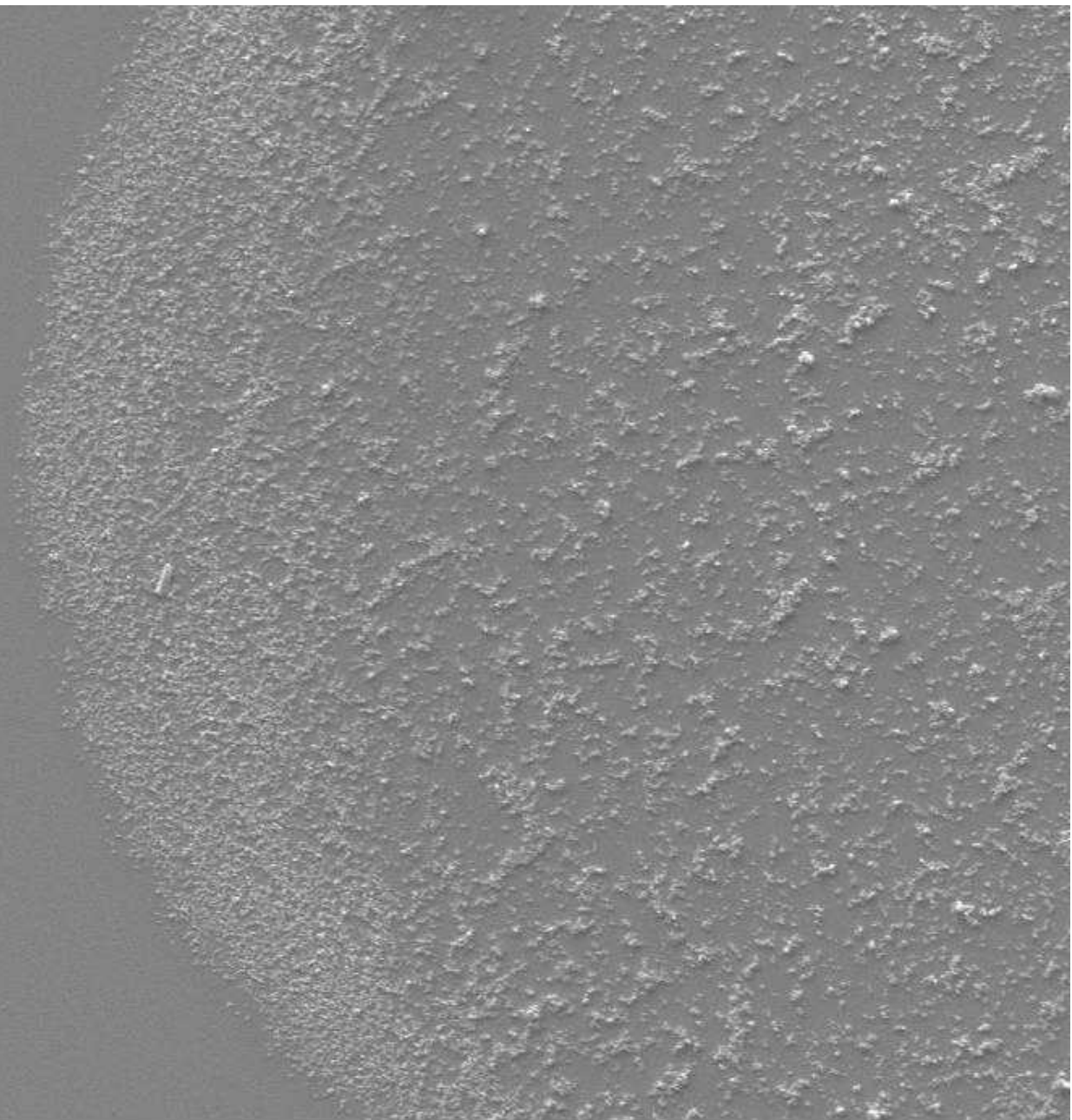


Aerosols inhalation exposure

Aerosol alveolar lung deposited surface area (A-LDSA)
 $\mu\text{m}^2/\text{cm}^3$, after 1 sec spray in test chamber



Silicone nanoparticles
deposited from a droplet



10 μm



EHT = 20.00 kV Signal A = SE1
WD = 6.0 mm Photo N° = 629

Date :17 Nov 2014
Grand. = 1.50 K X

SURCOTEC 
SURFACE COATING TECHNOLOGY

Hormonal activity screening test

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Phtalate
Bisphenol

Phtalate, Bisphenol

Silicon containing bis-
phenol derivatives

Per/poly fluorinated
compounds

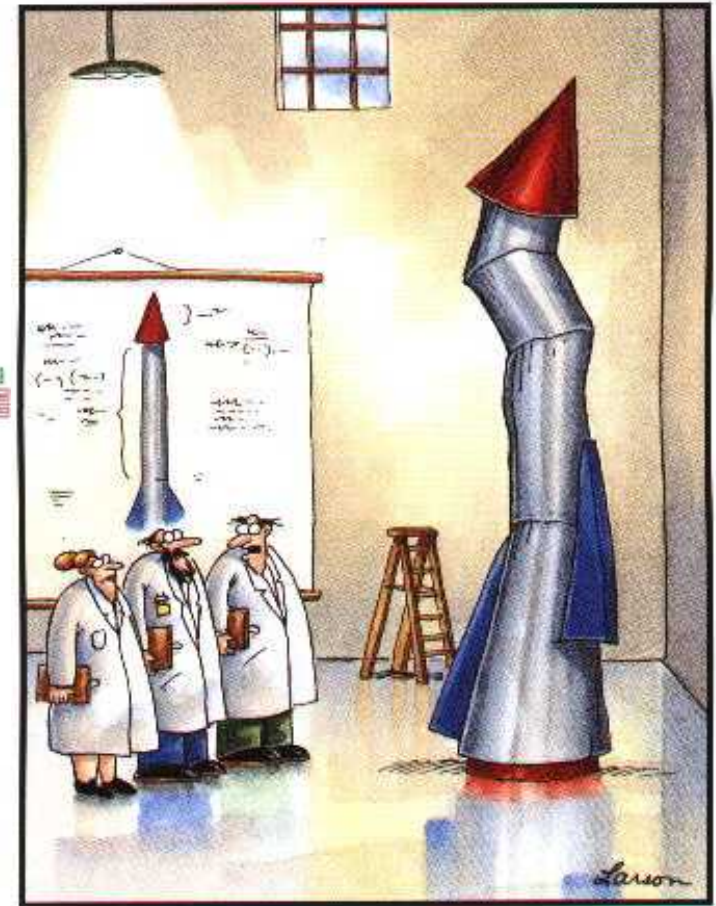
	ER	Anti-AR	PPARγ
Echantillon	ng eq.17 β -estradiol/ml	μ g eq.Flutamide / ml	ng eq Rosiglitazone/ml
A	n.s	4000	n.s
D	n.s	30	n.s
E	n.s	133	n.s
F	n.s	1000	n.s
G	n.s	10	n.s
H	n.s	2333	n.s
I	n.s	3333	n.s
K	n.s	3	n.s
L	n.s	5000	n.s
M	0.25	12000	n.s

1 ml : 12 mg Flutamide

Cancer prostate ? ... so spray your shoes !



That's all folks ...



"It's time we face reality, my friends. ...
We're not exactly rocket scientists."