PolyChloroBiphenyls

Management of a legacy pollutant
in the built environment

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1. Introduction
2. Sources and matrices
3. Regulations and management
4. Inspection and diagnostics
5. Sampling and Analyses
6. Remediations in the built environment

Geneva State - SABRA - Toxicology

Controlling health and environmental risks from toxic substances in the built environment

Mission

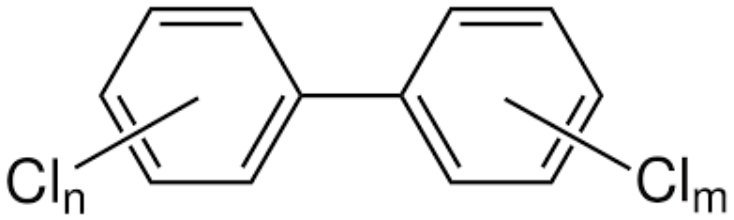
Danger and risk assesment

Information

Authority

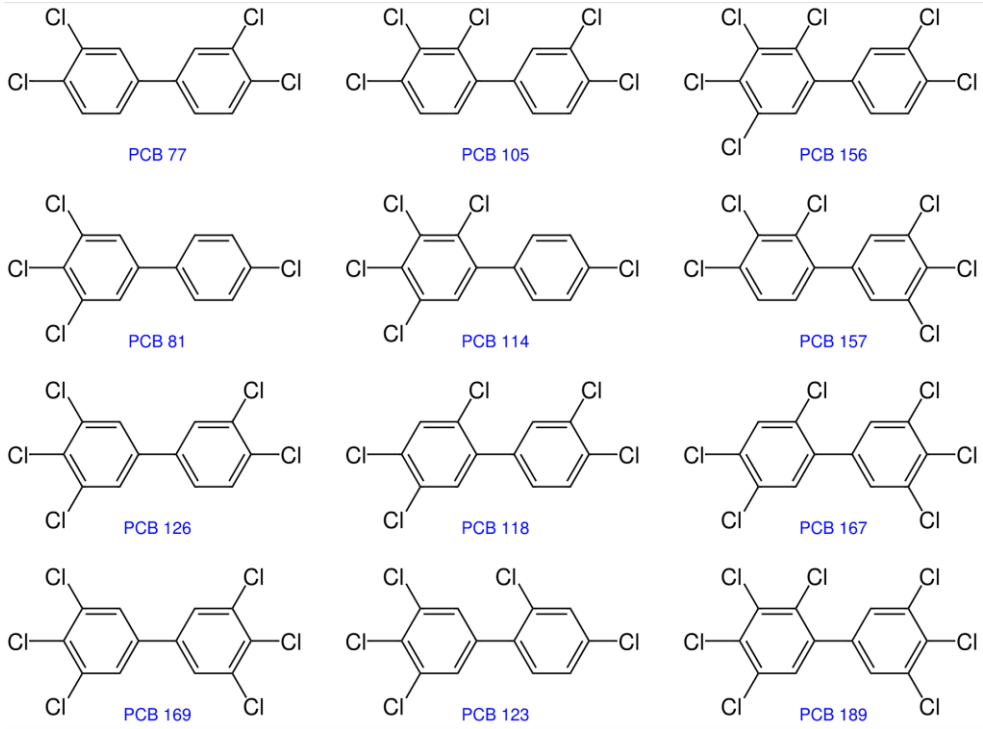
PCB physical characteristics

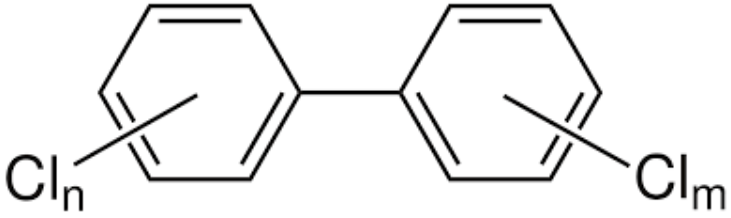
- Viscous liquids (oils) with high thermal stability (degradation from 300-400° C)
- Formation of PCDD (dioxins) and PCDF (furans) upon heating!
- High chemical stability (acids and alkalis)
- Very low volatility (volatility decreasing with higher chlorine content)
- Good heat conduction
- Excellent breakdown voltage (> 35 kV/mm)
- Highly lipophilic



PCB structures

Not a compound but a mixture

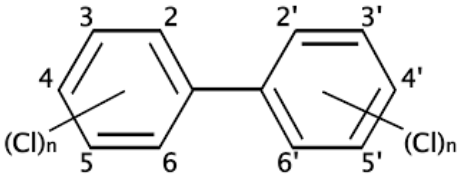




Chlorine from 1 to 10

209 possible configurations (or congeners)

PCB nomenclature

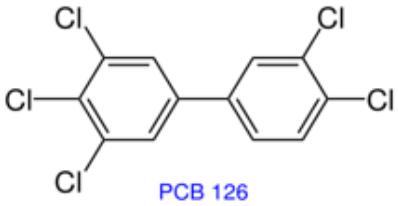


Chlorine position on each ring	None	2	3	4	2,3	2,4	2,5	2,6	3,4	3,5	2,3,4	2,3,5	2,3,6	2,4,5	2,4,6	3,4,5	2,3,4,5	2,3,4,6	2,3,5,6	2,3,4,5,6
None	0	1	2	3	5	7	9	10	12	14	21	23	24	29	30	38	61	62	65	116
2′		4	6	8	16	17	18	19	33	34	41	43	45	48	50	76	86	88	93	142
3′			11	13	20	25	26	27	35	36	55	57	59	67	69	78	106	108	112	160
4′				15	22	28	31	32	37	39	60	63	64	74	75	81	114	115	117	166
2′,3′					40	42	44	46	56	58	82	83	84	97	98	122	129	131	134	173
2′,4′						47	49	51	66	68	85	90	91	99	100[c]	123	137	139	147	181
2′,5′							52	53	70	72	87	92	95	101	103	124	141	144	151	185
2′,6′								54	71	73	89	94	96	102	104	125	143	145	152	186
3′,4′									77	79	105	109	110	118	119	126	156	158	163	190
3′,5′										80	107	111	113	120	121	127	159	161	165	192
2′,3′,4′											128	130	132	138	140	157	170	171	177	195
2′,3′,5′												133	135	146	148	162	172	175	178	198
2′,3′,6′													136	149	150	164	174	176	179	200
2′,4′,5′														153	154	167	180	183	187	203
2′,4′,6′															155	168	182	184	188	204
3′,4′,5′																169	189	191	193	205
2′,3′,4′,5′																	194	196	199	206
2′,3′,4′,6′																		197	201	207
2′,3′,5′,6′																			202	208
2′,3′,4′,5′,6′																				209

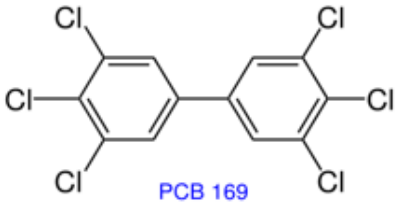
From B. Lindell, Polychlorinated biphenyls, 2004

In grey: 12 dioxin-like congeners (ability to adopt a planar configuration)

PCB dioxin-like congeners



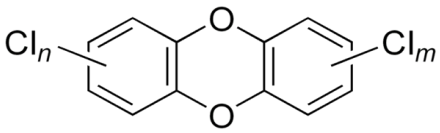
PCB 126



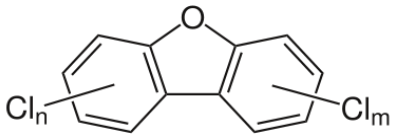
PCB 169

PCBs	TEF	TEQ	PCBs	TEF	TEQ
PCB-77	0.0001	0.0072	PCB-118	0.00003	0.0016
PCB-81	0.0003	0.0184	PCB-123	0.00003	0.0033
PCB-126	0.1	9.6630	PCB-156	0.00003	0.0020
PCB-169	0.03	1.4784	PCB-157	0.00003	0.0014
PCB-105	0.00003	0.0017	PCB-167	0.00003	0.0008
PCB-114	0.00003	0.0019	PCB-189	0.00003	0.0017

The most toxic congeners in comparison to dioxin



Polychlorodibenzodioxines
(PCDD)
75 congénères



Polychlorodibenzofuranes
(PCDF)
135 congénères

PCB biological effects

- **Cancer effects**: PCBs are probable human carcinogens (IARC, EPA)

Non-cancer effects:

- **Immune effects**: Decreased resistance to viruses and other infections (evidence in animals and humans)
- **Reproductive effects**: Reproductive effects may be important in humans following exposures to PCBs (evidence in humans)
- **Neurological effects**: Significant deficits in neurological development (evidence in animals)
- **Endocrine disrupting effects**: PCB exposures have been associated with changes in thyroid hormone levels in infants in studies

PCB

Parts of the dirty dozen (the 12 initial POPs)

- **Persistence**: dependant from the degree of chlorination, half-lives can vary from 10 days to one-and-a-half years
- **Bioaccumulative**: especially the highly chlorinated congeners, tend to accumulate in lipid-rich tissues due to their lipophilic nature
- **Toxic**: Cancer and non cancer effects

Names of commercial mixtures

Arochlors 1242, 1248, 1254, 1260

12 C

48% of Cl in weight

Pays	Nom commercial	Fabricant
USA	Asbetol	American Corporation
	Chlorextol	Allis Chlamers
	Diaclor	Sangamo Electric
	Dykanol	Cornell Dubilier
	Elemex	Mac Graw Edison
	Hyvol	Aerovox
	Inerteen	Westinghouse Electric
	No-Flamol	Wagner Electric
	Pyranol	General Electric
	Saf-T-Kuhl	Kuhlman Electric
	Therminol	Monsanto
	Aroclor	Monsanto
Royaume-Uni	Aroclor	Monsanto
République Fédérale d'Allemagne	Clophen	Farbenfabriken Bayer
France	Phenoclor	Rhone-Poulenc
	Pyralène	Prodelec
	Electrophenyle	Ugine-Kuhlman
Ex-Union Soviétique	Soval	Sovol
Tchécoslovaquie	Delor	Chemko
Japon	Santotherm	Mitsubishi-Monsanto
	Kanechlor	Kanegafuchi Chem. Co
Italie	Fenclor	Caffaro
	D.K.	

PCB sources

PCBs were used in hundreds of industrial and commercial applications including:

- ✓ Electrical, heat transfer and hydraulic equipment
- ✓ Plasticizers in paints, plastics and rubber products
- ✓ Pigments, dyes and carbonless copy paper

PCB applications

PCB Use	Pounds (millions)	Percentage of Total
Capacitors	630	50.3%
Transformers	335	26.7%
Plasticizer uses	115	9.2%
Hydraulics and lubricants	80	6.4%
Carbonless copy paper	45	3.6%
Heat transfer fluids	20	1.6%
Petroleum additives	1	0.1%
Miscellaneous industrial uses	27	2.2%
TOTALS	1,253	100.0%

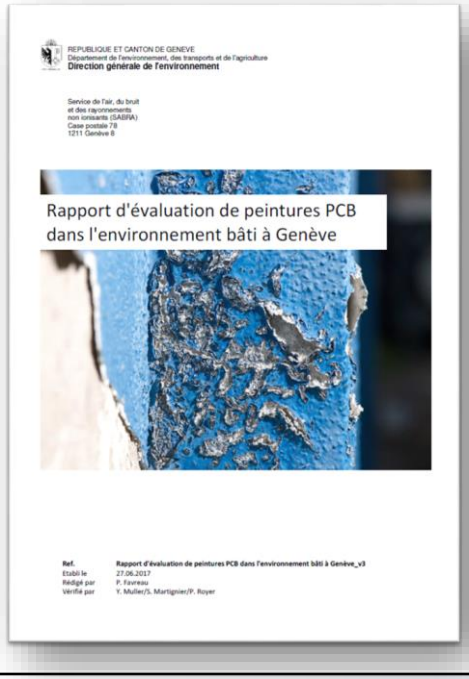
EPA, 1/30/97

caulks

paints

Local situation as an example:

- 70% of precast concrete buildings in Geneva contain PCB joints (1955 to 1975)
- 20% of technical paint in buildings contain PCB (>100 ppm)
- 20% of paint bridges contain PCB (>100 ppm)



PCB regulation

1996: EU- Directive on the disposal of PCBs/PCTs enters into force

2001: Stockholm convention signed 2001, into force in 2004 for the 12 initial POPs (including PCBs)

2025: PCBs within di-electric equipment in concentrations above 0.005% (50 ppm) and in volumes greater than 50 ml to be identified and removed from use.

European Commission

EU countries much ensure that they

- make inventories of big equipment containing PCBs or PCTs
- adopt plans for the disposal of this equipment, and safely dispose of it (deadline for disposal was the end of 2010)
- prepare outlines for collecting and disposing of non-inventoried equipment containing PCBs and PCTs (such as most household appliances manufactured prior to the ban on these chemicals)

PCB regulation

European requirements have been incorporated into Swiss law by the Ordinance on Chemical Products (Annex 1.1 and 2.14)

814.81

| Développer tout | Vue par article | Fermer tout |

English is not an official language of the Swiss Confederation. This translation is provided for information purposes only and has no legal force.

Ordinance on the Reduction of Risks relating to the Use of Certain Particularly Dangerous Substances, Preparations and Articles

(Chemical Risk Reduction Ordinance, ORRChem)

of 18 May 2005 (Status as of 1 June 2023)

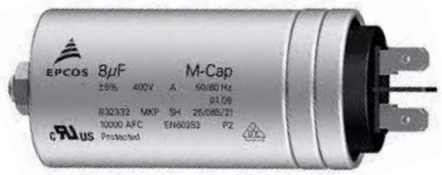
PCB regulation - Switzerland

Open systems
(elastic sealants, anti-corrosion coatings, paints and varnishes

PCB ban in **1972**

Closed systems
(transformers and capacitors)

PCB ban in **1986**



A transitional period until 1998 has been granted for the decommissioning and disposal of large capacitors (total weight > 1 kg) and transformers

A limit of 50 ppm is applied for transformers, capacitors and caulks and 100 ppm for paints

PCB management

- Efforts must be focused on sources BEFORE any environmental release
- Efforts to locate, detect and manage properly transformers, capacitors, caulks, paints, etc.

Environnemental contamination

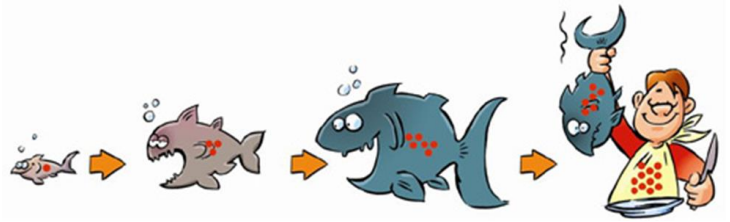
A contaminated fish = 40 µg of **PCB**

1 meter of caulk with PCB = 1 g of **PCB**

Stock in caulks in Switzerland = 100 tons of **PCB**

Leading to PCB exposition

- Indirect exposition through food
- Direct exposition in the built environment



80 % of our time in the built environment

INHALATION	***CUTANEOUS***		***ABSORPTION***
AIR, DUST	***AIR***	***MATERIALS***	***DUST***

PCB value guidelines (swiss)

Dust For total PCB: 10 µg/100cm^2 (US EPA)

Air (aerosol and gaz phase)

Durée de séjour moyenne dans le bâtiment concerné	Exemples	Valeur indicative pour les PCB (concentration maximale tolérable dans l'air des locaux, en tant que PCB totaux, moyenne annuelle)
24 heures par jour	appartement, hôpital, home, etc.	2 µg/m^3
8 heures par jour	Ecole, jardin d'enfant, bureau, etc.	6 µg/m^3

After remediation: release measurement tPCB < 600 ng/m3

Average exposure limit (8h) for workers : 500 µg/m3

PCB

Transformers

- A major PCB fraction
- Inventory facilitated by relatively easy identification of owners (electrical suppliers, industry)

In Switzerland, transformers and capacitors containing more than 1 kg of PCBs had to be taken out of service and disposed of by summer 1998.

But for other applications ???

PCB

Small capacitors, caulks, paints

- Many diffuse applications, difficult to locate and manage
- Major risk is dissemination and exposition due to handling and management without knowledge

Renovation and **Demolition** work in building identified as a key point

PCB regulation

- Local regulations for hazardous substances in the **built environment** (including PCBs)

Règlement sur les substances dangereuses dans l'environnement bâti (RSDEB) K 1 70.14

Tableau historique

du 10 septembre 2008

(Entrée en vigueur : 18 septembre 200

LaLPE

Art. 15B[(13)] **Substances dangereuses dans l'environnement bâti**

[1] Le Conseil d'Etat définit les prestations cantonales en matière de substances dangereuses dans l'environnement bâti, dont l'adoption d'un plan de mesures et l'organisation de campagnes d'information et de sensibilisation des corps de métier concernés et de la population.

[2] Il veille à la prise des mesures nécessaires à l'assainissement des bâtiments contenant de l'amiante et d'autres substances dangereuses.

[3] En cas de travaux soumis à autorisation de construire au sens de la loi sur les constructions et les installations diverses, du 14 avril 1988, ou de la loi sur les démolitions, transformations et rénovations de maisons d'habitation (mesures de soutien en faveur des locataires et de l'emploi), du 25 janvier 1996, le requérant doit joindre à la demande d'autorisation, pour les parties du bâtiment concernées par les travaux, une attestation de présence ou d'absence de substances dangereuses. Les substances concernées sont :

a) l'amiante, pour les demandes portant sur des bâtiments construits avant 1991;
b) les biphényles polychlorés (PCB), pour les demandes portant sur des bâtiments construits entre 1955 et 1975.

[4] Des contrôles ponctuels sont effectués par le département.

PCB regulation

BEFORE any renovation work or demolition

- Obligation to conduct a PCB assessment for the owners
- Allow authorities to conduct controls in construction and renovation work

If PCBs are present:

- Remediation must be performed (removal of materials containg PCBs)
- After remediation, release measures have to be done to ensure no contamination

Guidelines and Recommandations

pollu doc

Les Polluants du bâti

https://polludoc.ch/fr

REPUBLIQUE ET CANTON DE GENEVE
Département du territoire
Service de l'air, du bruit et des rayonnements non ionisants

version 2
août 2018

DIRECTIVE – DIAGNOSTIC PCB

I. INTRODUCTION

Les polychlorobiphényles (PCB) constituent une famille de composés chlorés de synthèse reconnus comme polluants majeurs à l'échelle internationale. Ils ont été totalement interdits en Suisse depuis 1986. De nomb
présents dans les constructions
et déposés avec les précautio
personnes et une contamination

C'est pourquoi, un diagnostic
constructions qui ont été réalisé
des PCB peuvent être retirés sa
et des analyses supplémentaire
afin de déterminer les filières d
conformément à l'ordonnance s
de ces investigations incomber
être réalisées par un diagnostiq

Le SABRA publie sur internet l
diagnostic PCB et qui se sont f
est disponible sur : www.ge.ch/t

II. BUT DE LA DIRECTIVE

La présente directive est des
notamment les propriétaires, les

Elle définit les exigences minim
que les principes d'un diagnostic

Seul le diagnostic avant travau
d'une construction concernées p

Si les parties concernées par le
pouvoir l'attester. Dans le cas c

REPUBLIQUE ET CANTON DE GENEVE
Département du territoire
Office cantonal de l'environnement

Version 2
Janvier 2021

DIRECTIVE SABRA

ASSAINISSEMENT DES MATÉRIAUX CONTENANT DES PCB

I. INTRODUCTION

A Genève, le service de l'air, du bruit et des rayonnements non ionisants (ci-après SABRA) est l'autorité compétente en ce qui concerne la protection de la population et l'environnement vis-à-vis des substances dangereuses. Dans ce cadre, le service réalise des contrôles par pointage.

Il publie sur Internet des fiches techniques de référence pour les principales méthodologies de retrait des matériaux contenant avec des PCB : www.ge.ch/lc/liste-pcb .

Les entreprises peuvent mettre en œuvre d'autres méthodologies à condition qu'elles soient transmises au SABRA 10 jours avant le commencement des travaux.

Un élément contenant plus de 50 mg/kg PCB doit être considéré comme contaminé et toutes interventions nécessitent des précautions particulières afin d'éviter :

- une exposition des personnes (ouvriers et voisinage) ;
- une dissémination de PCB dans l'environnement ;
- la transformation de PCB en dioxines.

L'élimination des déchets contenant des PCB est régit par l'ordonnance sur la limitation et l'élimination des déchets (OLED). Dans ce cadre, des analyses complémentaires peuvent être nécessaires pour déterminer la teneur en PCB dans les bétons qui ont été contaminés par contact et définir ainsi leur filière d'élimination.

Les déchets contenant des PCB doivent être conditionnés conformément aux règles de OMoD et l'ADR. Ils seront acheminés dans la filière d'élimination pour déchets spéciaux conforme à l'OLED. Pour plus information, le GESDEC publie un guide sur les déchets de chantiers : www.ge.ch/document/dechets-guide-dechets-chantier.

A key part is the **IDENTIFICATION OF RISK ELEMENTS** in the building by specialized inspectors:

The inspector determines the presence or absence of PCBs for each of the following elements:

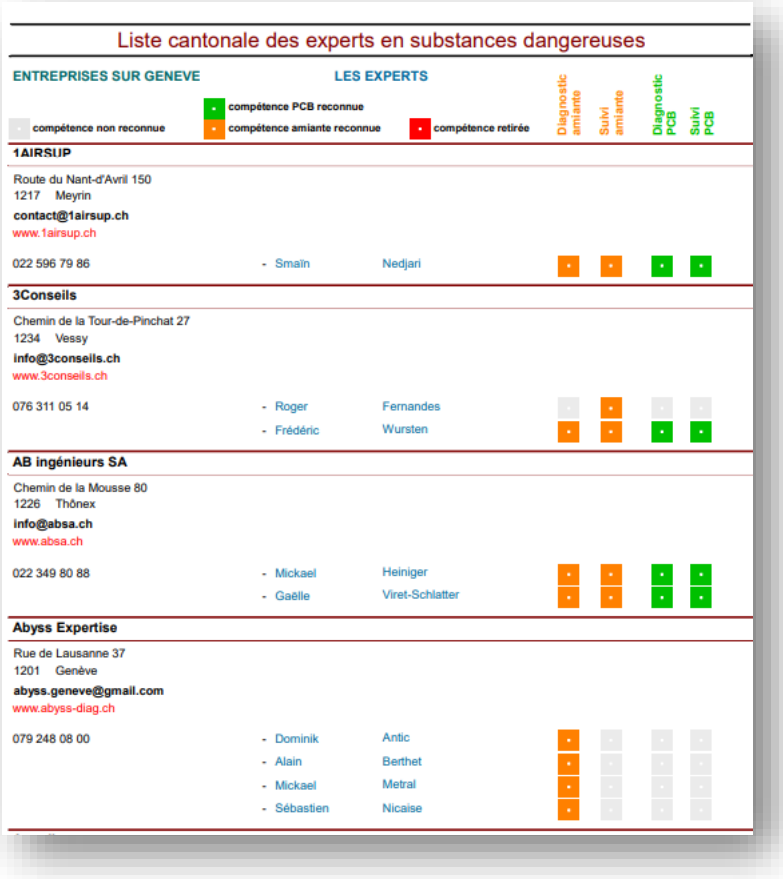
1. Electrical transformers and capacitors manufactured up to the end of 1986;

2. Caulks on buildings constructed before 1975;

3. Hazardous paints dating before 1975 with a technical function, i.e. anti-corrosion paints, paints on floors and walls subject to heavy stress and waterproofing paints.

PCB diagnostic

- Inspection is performed by specialized companies (PCBs, Asbestos, PAH, Lead)
- Inspectors must be trained to conduct diagnostics and samplings
- A national exam is available
- A list of trained and competent inspectors is provided by the authority (Geneva canton)

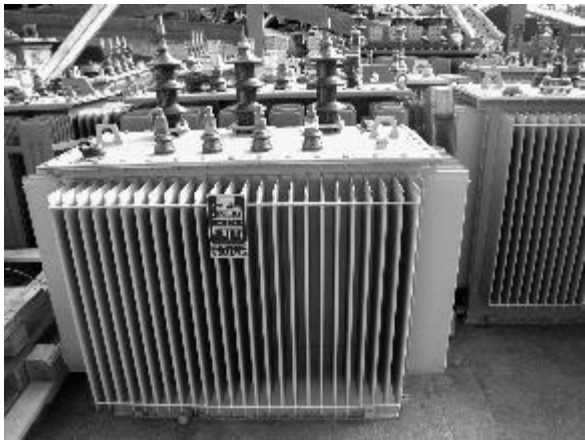


Liste cantonale des experts en substances dangereuses

ENTREPRISES SUR GENEVE		LES EXPERTS		Diagnostic amiante	Suivi amiante	Diagnostic PCB	Suivi PCB
compétence non reconnue; compétence PCB reconnue; compétence amiante reconnue; compétence retirée							
1AIRSUP							
Route du Nant-d'Avril 150 1217 Meyrin **contact@1airsup.ch** www.1airsup.ch							
022 596 79 86	-	Smaïn	Nedjari	■	■	■	■
3Conseils							
Chemin de la Tour-de-Pinchat 27 1234 Vessy **info@3conseils.ch** www.3conseils.ch							
076 311 05 14	-	Roger	Fernandes		■		
	-	Frédéric	Wursten	■	■	■	■
AB ingénieurs SA							
Chemin de la Mousse 80 1226 Thônex **info@absa.ch** www.absa.ch							
022 349 80 88	-	Mickael	Heiniger	■	■	■	■
	-	Gaëlle	Viret-Schlatter	■	■	■	■
Abyss Expertise							
Rue de Lausanne 37 1201 Genève **abyss.geneve@gmail.com** www.abyss-diag.ch							
079 248 08 00	-	Dominik	Antic	■			
	-	Alain	Berthet	■			
	-	Mickael	Metral	■			
	-	Sébastien	Nicaise	■			

Currently more than 30 companies active in the field (diagnostic and/or remediation)

Guidelines in Switzerland



Transformers / Capacitors

A PCB analysis must be carried out before work begins:

- ✓ Installations built before 1987
- ✓ Capacitors can be identified with the "Chemsuisse capacitor directory" if they contain PCB
- ✓ No capacitor analyses, as they do not contain any easy access to the fluid

In case of doubt or lack of information, it is preferable to consider condensers as containing PCBs by default (PCB content > 50 mg/kg).

Guidelines in Switzerland

Paint on mineral substrates

A PCB analysis of paints and coatings must be carried out before work begins on:

- ✓ For buildings built before 1976
- ✓ For more than 20 m^2 of paint/coatings
- ✓ For paints having a technical function (e.g. waterproofing paint on floors under tank sumps, gymnasiums, hydraulic structures, cellars, laundry rooms, corridors, balconies, etc.)

In-depth analyses of the underlying masonry / concrete (secondary contamination) must also be carried out for paints / coatings with a PCB content > 1'000 mg/kg, as these mineral materials may contain PCBs through the migration (diffusion) effect of PCBs

Guidelines in Switzerland

Paint on metals

A PCB analysis of paints and coatings must be carried out before work begins on:

- ✓ Load-bearing structures in steel frameworks for industrial and commercial buildings and infrastructures
- ✓ Tanks with a capacity of over 200,000 l
- ✓ Gasometers and natural gas tanks
- ✓ Bridges
- ✓ Hydraulic installations and structures, such as power plants and sewage treatment plants
- ✓ High-voltage pylons.

In any case, if work on paints/coatings is likely to produce dust (e.g. sanding) PCB sampling and analysis is mandatory.

Guidelines in Switzerland

Paint on wood

A PCB analysis of paints and coatings must be carried out before work begins on:

- ✓ wood from attics and building exteriors, if disposal is performed in an installation not adapted to treat PCBs (low incineration temperature and/or no fume treatments)

Guidelines in Switzerland

Caulks

A PCB analysis of paints and coatings must be carried out before work begins on:

- ✓ For building dated before 1976
- ✓ Expansion joints such as connection joints, structural element joints, building separation joints and shrinkage joints
- ✓ For a minimum quantity of 10 linear meters per construction project

In-depth analyses of the underlying masonry / concrete (secondary contamination) must also be carried out for paints / coatings with a PCB content > 1'000 mg/kg, as these mineral materials may contain PCBs through the migration (diffusion) effect of PCBs

Reports

- ✓ Identification of pollutants (asbestos, PCB, lead, PAH, HBCD)

If pollutants are present, the owner is responsible for ordering remediation work

BÂTIDIAG
diagnostic immobilier

APA/323838/1 | Lot en date du 07.12.2022

BATI-DIAG SA
Avenue Cardinal-Mermillod 36
1227 Carouge
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F +4122 301 67 75
info@batidiag.ch

DIAGNOSTIC AMIANTE - PCB - HAP - Plomb - HBCD
« AVANT TRAVAUX - Complet »

Aménagement de locaux
en hébergement pour migrants

CONCLUSIONS SELON LIMITES DU DIAGNOSTIC (page 4)	
a Présence d'Amiante	PCB Présence de PCB
Pb Présence de Plomb	HAP Absence de HAP
HBCD Présence de HBCD	

Reports

- A location map indicate all polluted element

Reports

- List of all elements that were sampled with indication of the pollutant

Pièces	Polluant concerné (TYPE POLLUANT)	N° Echantillon/Sondage	Localisation	Description matériau	Quantité matériau	Présence polluant Oui/Non/Retiré	Sur la base de LAB/EXP/DIR/XRF	Remarques
Bât. 24 - Rez supérieur - Salles de douche	Am	ECH-007	Sols	Linoleum tacheté + colle		N	LAB	-
Bât. 24 - Rez supérieur - Salles de douche	Am	ECH-008	Murs	Colle de faïence		N	LAB	-
Bât. 24 - Rez supérieur - Salles de douche	Am	ECH-009	Faux-plafond	Dalles 60x60	15 m2	O	LAB	-
Bât. 24 - Rez supérieur - Salles de douche	PCB	SON-001	Plafond	Condensateur de néons	4 pièce(s)	O	LAB	-
Bât. 24 - Rez supérieur - Salles de douche	PB	012	Portes (A)	Bois-Peinture-Blanche	-	N	XRF	-
Bât. 24 - Rez supérieur - Salles de douche	PB	013	Mur (B)	Plâtre-Peinture-Blanche		O	XRF	-
Bât. 24 - Rez supérieur - WC douche	Am	ECH-010	Sols	Linoleum bleu + colle		N	LAB	-
Bât. 24 - Rez supérieur - WC douche	Am	ECH-011	Sols	Dalles vinyle + colle sous lino		N	LAB	-
Bât. 24 - Rez supérieur - WC				Colle de carrelage sous dalles				

Reports

- Pictures to identify elements

Sampling

Scratch sampling
Syringe aspiration

Active sampling on PUF cartridge

Surface wipe

Sampling transformers

- Oil extracted through an opening (usually two possible openings: at the top and bottom of the transformer).
- Collection in a glass container (at least 2 ml), as PCB oils accumulate towards the bottom due to their high density.
- Precautions to prevent leakage during and after sampling
- The presence of a specialized electrical contractor is mandatory.

Sampling paints / caulks

- Use of PPE (disposable protective gloves)
- The sampling tool must be changed or cleaned to avoid contamination
- Sample wrapped in a glass container or aluminum foil, then in a plastic bag. In all cases, it is essential that the packaging is airtight.

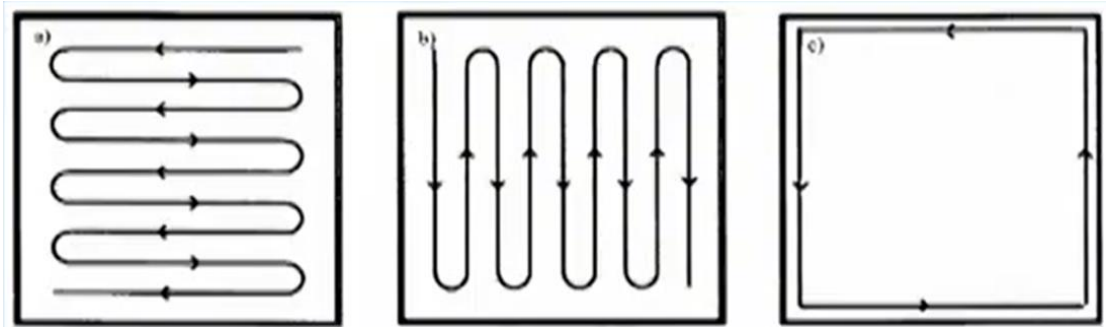
Sampling air

- Active sampling with pump on a support

Method	Aérosol	Vapor	Sampling	Analysis
VDI 4300 / EPA TO10a - mod	PUF (alvéoles ouvertes, 22 mg/cm^3)		5h @ 5 l/min	GC / MS
ISO 16000-13	Filtre 37 mm, quartz ou fibre de verre	PUF (alvéoles ouvertes, 22 mg/cm^3)	8h @ 2 l/min	GC-FID / GC-MS
NIOSH 5503	Filtre 13 mm, fibre de verre	Florisil 100mg/50mg	4h @ 0.2 l/min	GC-ECD
ISO 12884	Filtre 50 mm, fibre de verre	2x PUF	2h @ 46 l/min	GC-MS

Sampling dust

- Wipe samples on a standardized surface (generally 10x10 cm = 100 cm2).
- The risk of cross-contamination is high, so gloves must be changed for each sample
- Field blanks must be performed



Rapid field tests

- ✓ Fast screening method to test electrical insulating fluids only
- ✓ test in less than 5 minutes
- ✓ Quantification based on Aroclor 1242 (conservative quantification)

→ Allow PCB detection and concentration range identification

→ Can be used before costly and time consuming lab analysis

Sample preparation

- Documentation (unique sample ID, description, etc.)

Caulks:

- A sub-sample is taken from the inner part of the caulk (avoid contamination issues)
- The sample is cut into small parts (few mm)

Paints:

- The sample is reduced to powder (homogeneity)

Extraction

P, T, organic solvents

Clean-up

Crude extract

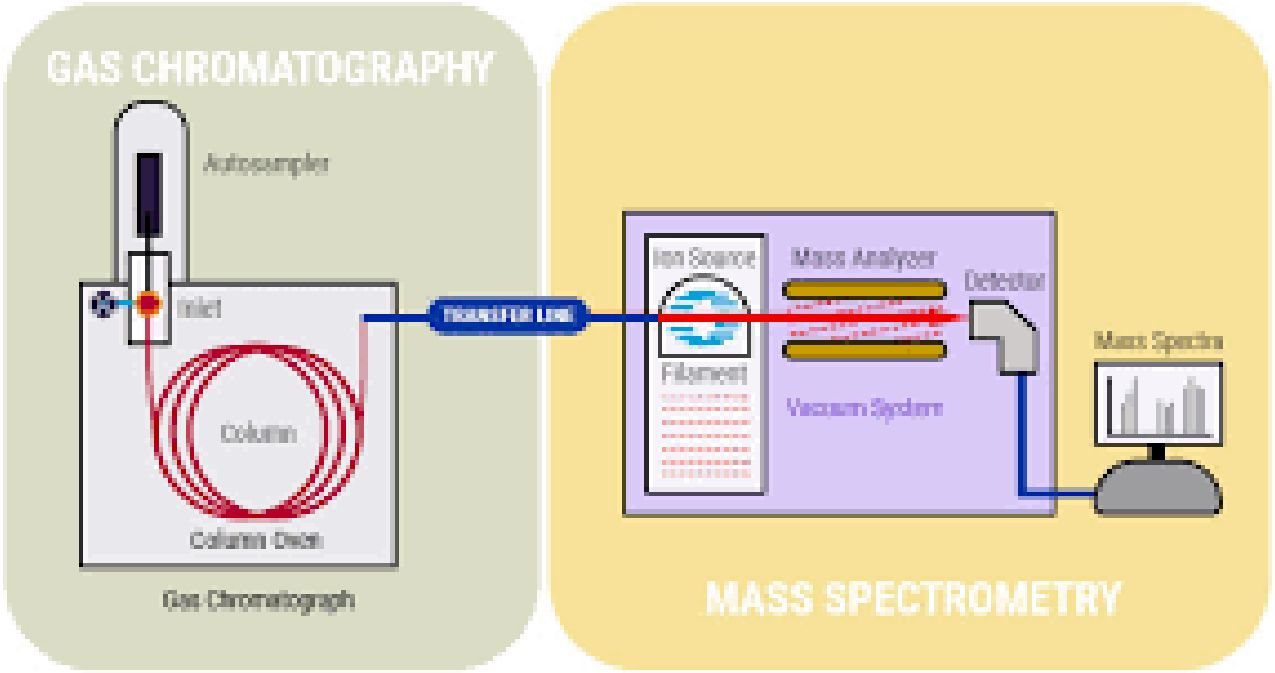
$AgNO_3/SiO_2$
(removal of S compounds)

H_2SO_4/SiO_2
(removal of basic compounds)
(hydrolysis of fats)

"Clean" extract

GC-MS Analysis

- Separation of congeners
- Identification and quantification of congeners

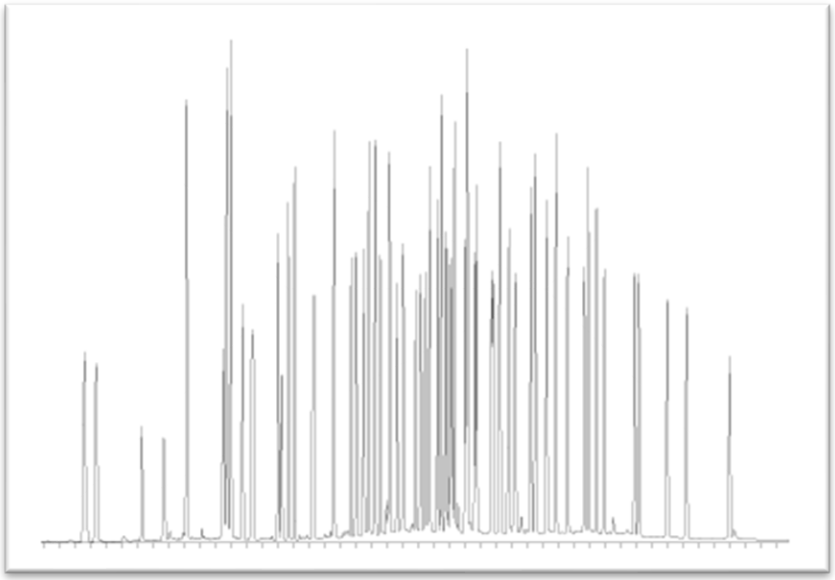


https://www.youtube.com/watch?v=ipfC_GB28Nc&feature=youtu.be

Analytical step

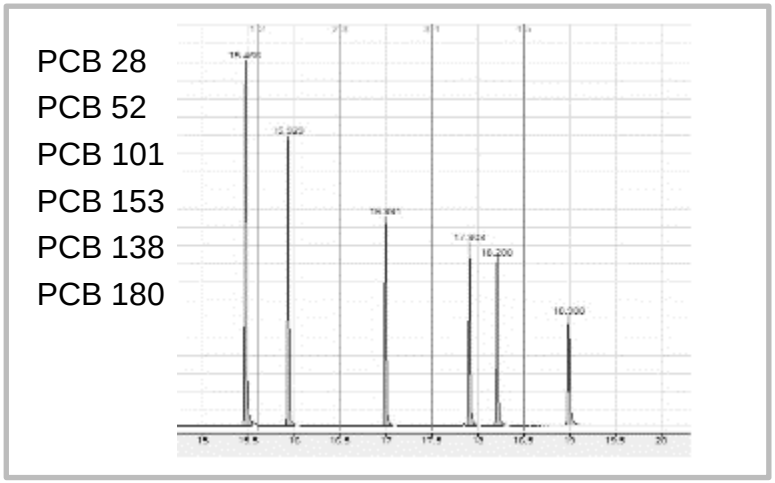
PCB quantification is simplified by the use of only few congeners from the mix

A technical mixture



6 indicator PCBs

PCB 28
PCB 52
PCB 101
PCB 153
PCB 138
PCB 180

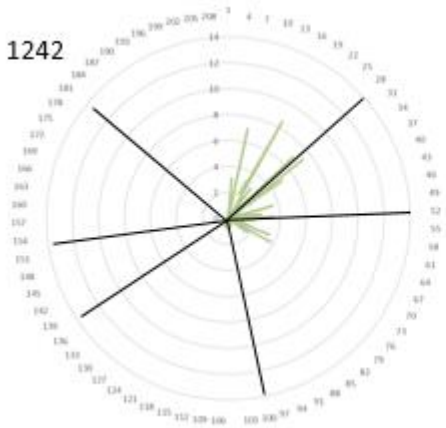


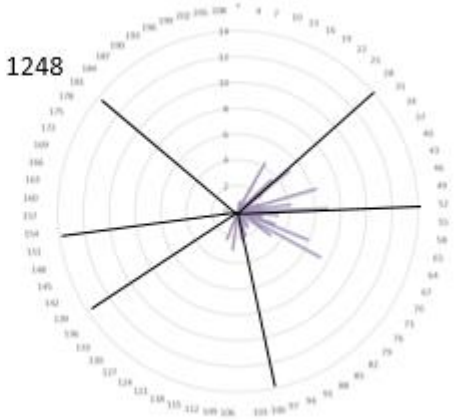
Data treatment

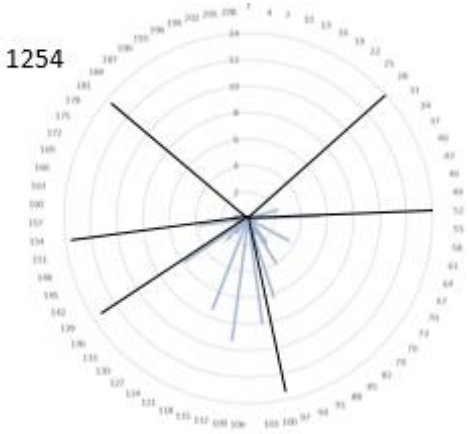
- Each technical mixture has characteristic quantities of the 6 indicative PCB

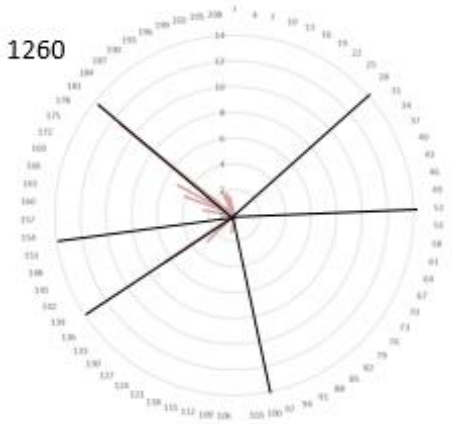
- The ratio of the 6 i PCB identifies the technical mixture

A conversion factor gives total PCB









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 »)**

Reference (orange) vs Sample (blue)

Best correlation

PCB quantification

Total PCB = [iPCB] x conversion factor (between 3.1 and 8.5)

Value found from analysis

Value from the technical mixture identifed

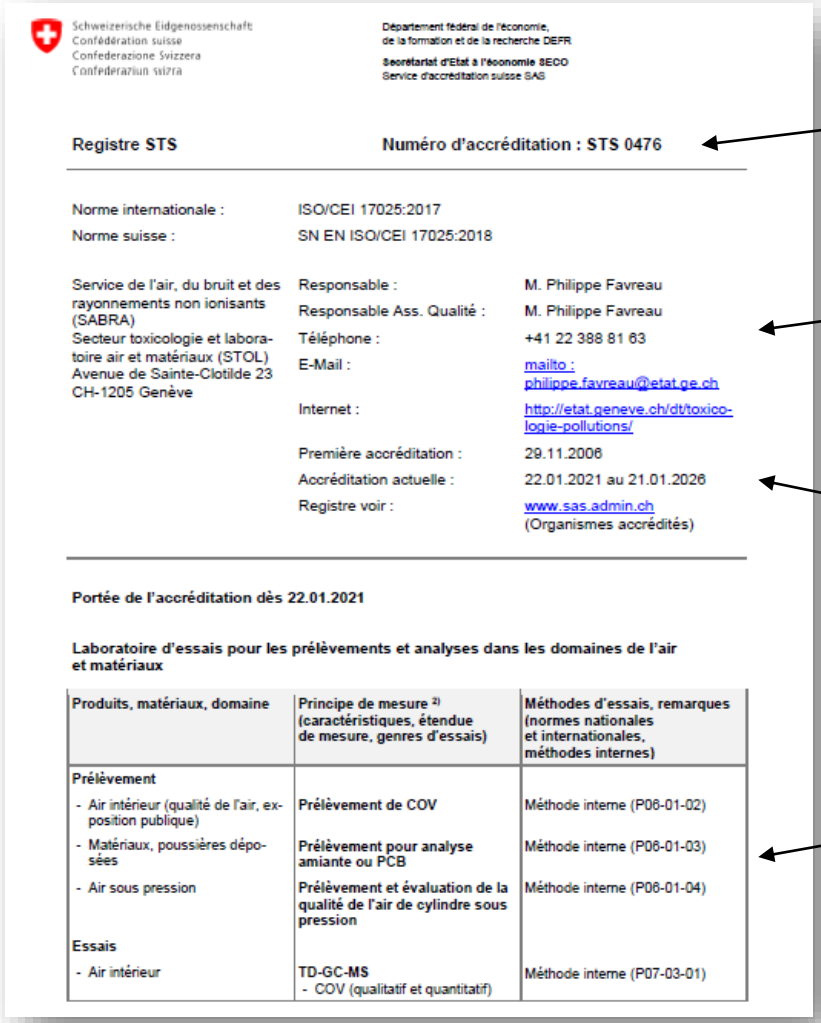
Equal to 5 if no identification

Laboratory quality

- Assesment and delivered by a national authority

ISO 17025 ACCREDITED

The signature of the ilac convention beetween countries allow for mutual recognition of the international standard



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Département fédéral de l'économie, de la formation et de la recherche DEFR
Secrétariat d'Etat à l'économie SECO
Service d'accréditation suisse SAS

Registre STS **Numéro d'accréditation : STS 0476**

Norme internationale : ISO/CEI 17025:2017
Norme suisse : SN EN ISO/CEI 17025:2018

Service de l'air, du bruit et des rayonnements non ionisants (SABRA)
Secteur toxicologie et laboratoire air et matériaux (STOL)
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Téléphone : +41 22 388 81 63
E-Mail : mailto : philippe.favreau@etat.ge.ch
Internet : http://etat.geneve.ch/dt/toxicologie-pollutions/
Première accréditation : 29.11.2006
Accréditation actuelle : 22.01.2021 au 21.01.2026
Registre voir : www.sas.admin.ch (Organismes accrédités)

Portée de l'accréditation dès 22.01.2021

Laboratoire d'essais pour les prélèvements et analyses dans les domaines de l'air et matériaux

Produits, matériaux, domaine	Principe de mesure [2] (caractéristiques, étendue de mesure, genres d'essais)	Méthodes d'essais, remarques (normes nationales et internationales, méthodes internes)
Prélèvement		
- Air intérieur (qualité de l'air, exposition publique)	**Prélèvement de COV**	Méthode interne (P06-01-02)
- Matériaux, poussières déposées	**Prélèvement pour analyse amiante ou PCB**	Méthode interne (P06-01-03)
- Air sous pression	**Prélèvement et évaluation de la qualité de l'air de cylindre sous pression**	Méthode interne (P06-01-04)
Essais		
- Air intérieur	**TD-GC-MS** - COV (qualitatif et quantitatif)	Méthode interne (P07-03-01)

Accreditation number

Laboratory idententification

Validity for a given period

Identification of the accredited methods

Remediation of caulks/paints with PCB

1. Removal with cutter
2. Joint removal with concrete sawing

"Standard" companies

3. Joint removal with concrete scratching
4. Paint removal (containment)

Trained companies

5. Release measures

Specialized companies

Remediation of caulks with PCB

Personal protective equipment (mask, gloves, protective suit)

Remediation of caulks with PCB

Example

No dust !!!

Remediation of caulks with PCB

Banned practices

Removal of caulks with concrete scratching

Technique in containment

Step 1 : caulks removed with vacuum cleaning at the source

Step 2 : careful removal of joint residue with vacuuming at source

Step 3 : scraping of concrete over 3 mm (diamond oscillating blade) with vacuuming at the source

grinding forbidden !

Removal of caulks with concrete sanding

Initial situation:
127’647 mg/kg PCB

After remediation
< 5 mg/kg PCB

Remediation of paints with PCB

Principles

a) Companies with PCB training

b) Trained person present on site

c) PRC sent to SABRA 10 days before work

d) Mandatory "Status Quo" air analysis

e) Release measures (visual control + wipes + air analysis)

The "PRC" = Withdrawal and containment plan

- The address of the site;
- Location of elements contaminated with PCBs;
- The surface area of paintings to be cleaned up in square metres;
- The duration of the intervention;
- The protective measures implemented;
- The type and model of tools used;
- The air balance of the zones;
- The analyses that will be carried out before, during and after the work to determine possible exposure of people or contamination of the environment.

Remediation of paints with PCB

Techniques : anything that does not produce dust and/or gases

Otherwise: stripping with aspiration at source

The release measures

After remediation : Zone cleaned, protection inside the containment removed

Step 1 : visual control + Wipes

- No residues or dust
- PCB conc. < 10 µg/100 cm^2

Step 2 : After 2 days minimum, PCB analysis in air

- PCB < 600 ng/m^3

If no precautions…

Sanding metallic structures with PCB paint in cabin ~20'000 mg/kg de PCB (2%)

Contaminated dust in the whole company

- cabin (~500 µg/100cm^2)
- All site (40-180 µg/100cm^2)

Decision criteria : 10 µg/100cm^2 (US)

- Worker protected during operation
- Workers and public exposed AFTER the work on the company site

After remediation (air analyses):

3-4 µg / m^3 (cabine)
0.2 µg / m^3 (atelier)

Maximal conc., 8h/day occupation: **6 µg / m^3** (OFEV - population)
Maximal conc., 8h/day occupation: **500 µg / m^3** (MAK – worker)

If not using the right techniques…

Grinding

Avant l'assainissement: < 100 ng/m³ PCB

Source ETI Umwelttechnik AG

Source ETI Umwelttechnik AG

After remediation : > 4'000 ng/m3 PCB

Source ETI Umwelttechnik AG

Thank you for your attention