FLEMISH INDOOR AIR DECREE

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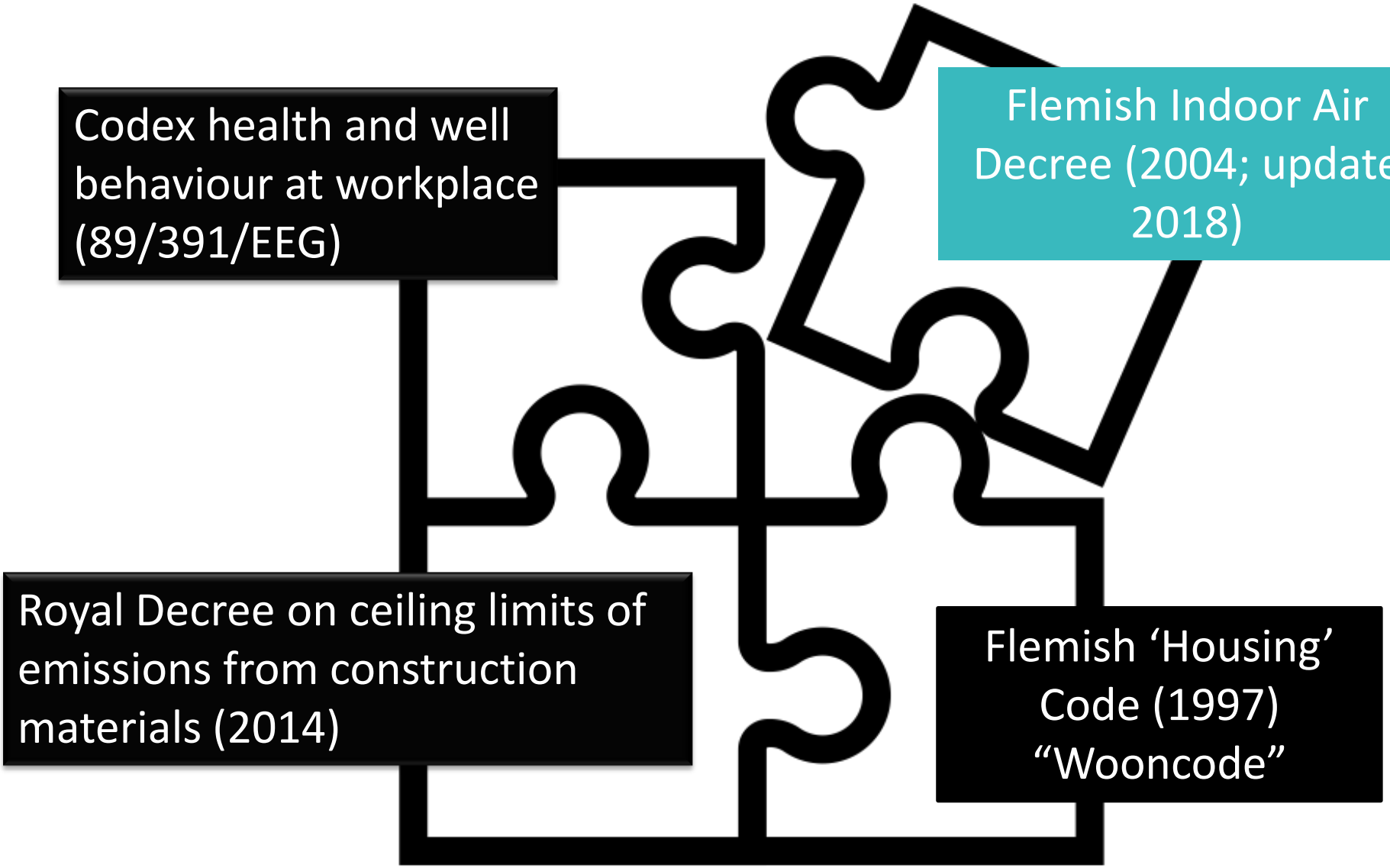

Codex health and well behaviour at workplace (89/391/EEG)
Flemish Indoor Air Decree (2004; update 2018)
Royal Decree on ceiling limits of emissions from construction materials (2014)
Flemish 'Housing' Code (1997) "Wooncode"

Flemish Indoor Air Decree : some history

Decree Preventive Healthcare (21 NOV 2003)

Published in Belgian Statute Book 7 SEPT 2018;
Enters into force 17 SEPTEMBER 2018

11 JUNE 2004: Decision of the Flemish Government: measures to lower health risks from indoor air pollution

13 JULY 2018 : Decision of the Flemish Government for modifications of various aspects of the measures to lower health risks from indoor air pollution

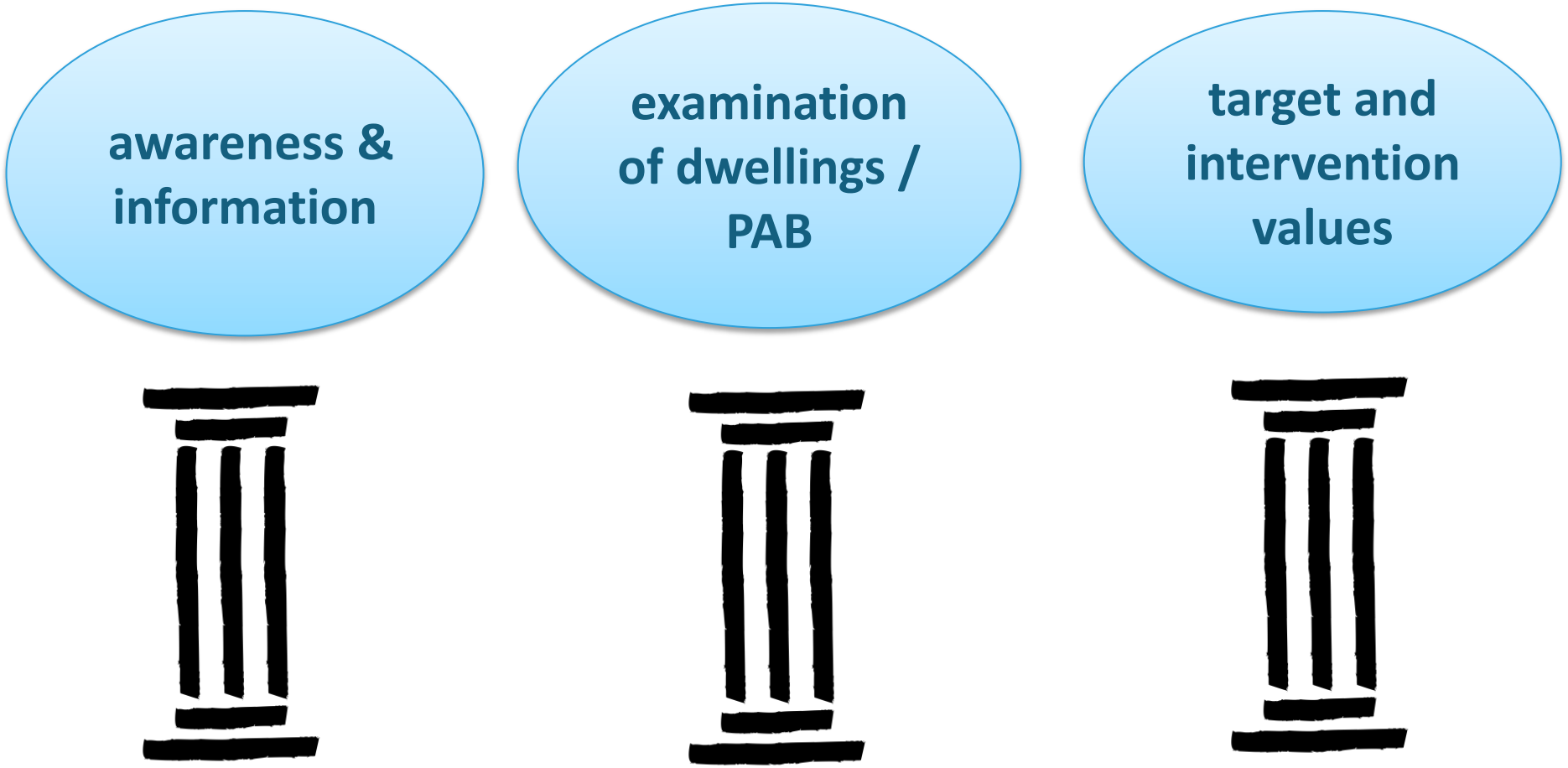
Modification ?

- **list of chemical compounds**
- **values of target values (TV) and intervention values (IV)**
- **implications of exceedances IV**
- **Source control**

Vlaanderen is zorg AGENTSCHAP ZORG & GEZONDHEID

FLEMISH INDOOR AIR DECREE

SCOPE: DWELLINGS AND PUBLICLY ACCESSIBLE BUILDINGS (PAB)



Awareness and information

General public:

campaigns in media, social media, websites

Woon Gezond
Samen naar een rookvrij huis!
GEZOND BINNEN

Local actors

environmental services of municipalities, (para) medici, social housing companies, etc.

trigger: health complaints

Dwellings: Citizens

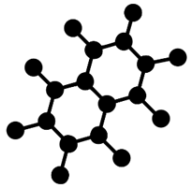
Doctors, home nursing, social housing agencies, local environmental services

examination of dwelling / PAB

Local medical environmental team:

1) visual examination of dwelling/ PAB
2) [Measurements IAQ]

~ advice → remediation



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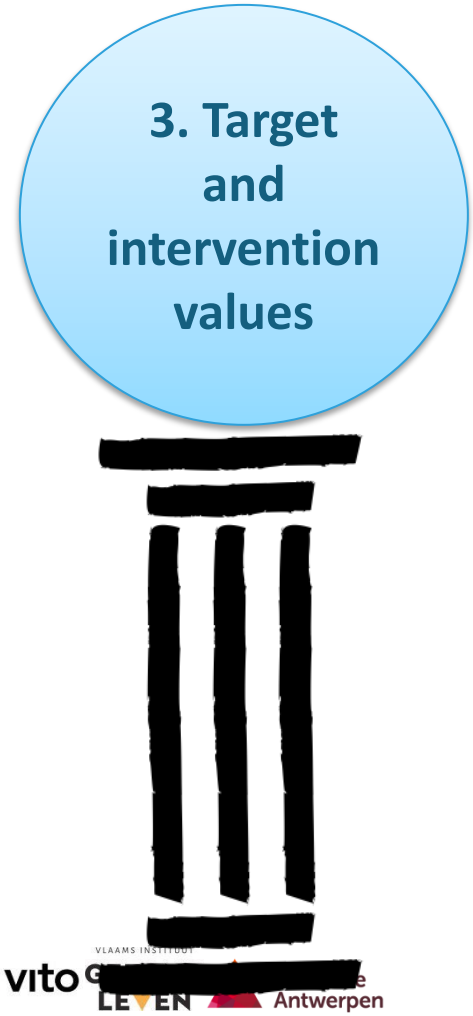
TARGET AND INTERVENTION VALUES

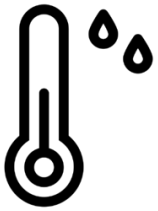


- **Target value (TV) :** measurable concentration of a chemical, fysical or biotic factor in the indoor environment corresponding to a quality level which **should be achieved as much as possible.** For chemical factors, this level corresponds to a concentration where we do not expect negative impact on **health** of the occupants the indoor environment

- **Intervention value (IV)**: measurable concentration of a chemical, fysical or biotic factor in the indoor environment requiring a **remediation action** because the concentrations might provoke a **health** risk for the occupants of the indoor environment

TARGET AND INTERVENTION VALUES

Biotic factors: moulds and vermin



Physical factors: low frequent electromagnetic radiation, temperature, draft, moisture content

22 chemical (groups) and PM

TARGET AND INTERVENTION VALUES : CHEMICALS

Formaldehyde
Acetaldehyde
C_4-C_{11} aldehydes
Benzene
Styrene
Toluene
C_9-C_{14} alkanes
2-ethylhexanol
Naftaleen
Benzo(a)pyreen
Tertrachloorethyleen
Trichloorethyleen
Total VOC

Asbestos (mixtures)
Asbestos chrysotile
Asbestos amphibole
Metallic Hg
PM2,5
NO_2
Ozon
Nicotine
Carbon monoxide

New in 2018 Flemish Indoor Air Decree

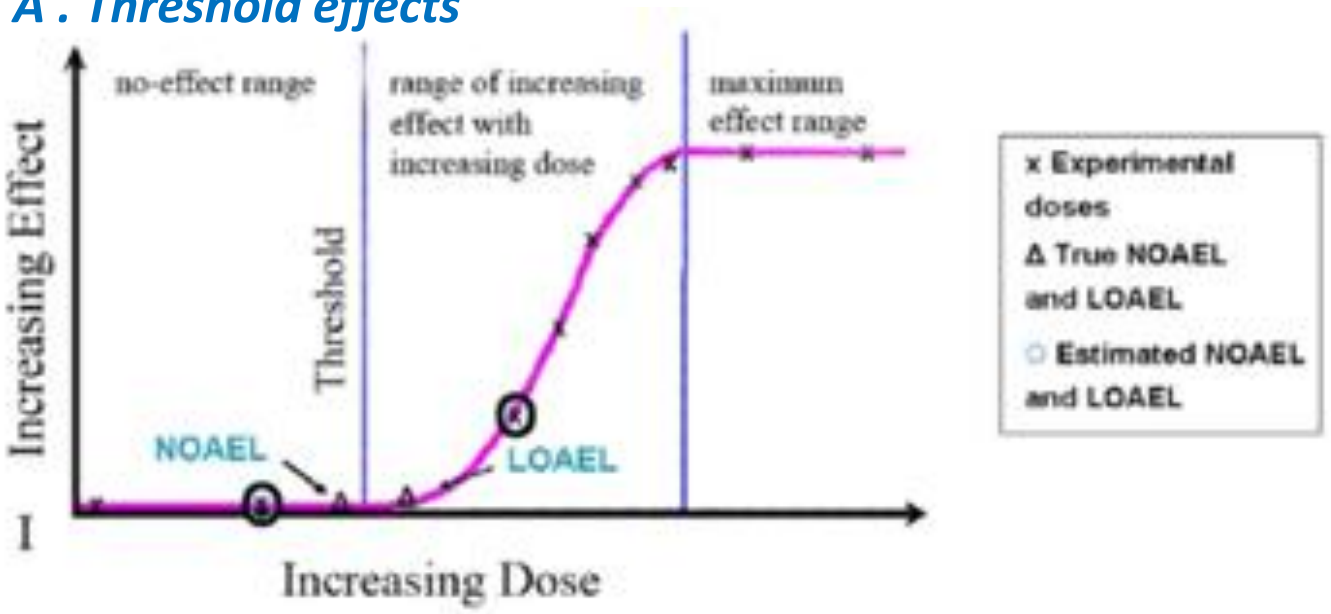
SETTING TARGET AND INTERVENTION VALUES FOR CHEMICALS: APPROACH

- Chronic exposure
- Based on existing health based guidelines and reference values for inhalation exposure (WHO, US EPA, ATSDR, Health Canada, ANSES, German IAQ RW, etc)
- Selection: based on a critical review of existing health based refererence values (choice of pivotal study, assessment factors, applicable for indoor, etc)
- Threshold effects and carcinogenicity (for non-threshold carcinogenic substances: unit risk approach)
- Starting point : target value (NOAEL) → intervention value

  (preference for key studies with NOAEL)
- Target and intervention value: based on same key study

SETTING TARGET AND INTERVENTION VALUES FOR CHEMICALS: APPROACH

A . Threshold effects



Target Value =
NOAEL × $AF_1 \times AF_2 \times \ldots\ AF_N$

Intervention value =
LOAEL × $AF_1 \times AF_2 \times \ldots\ AF_N$

AF: Assessment Factor 1→ n:
Exposure duration, study length, intraspecies, interspecies, quality of data,….

TARGET AND INTERVENTION VALUES FOR CHEMICALS: APPROACH

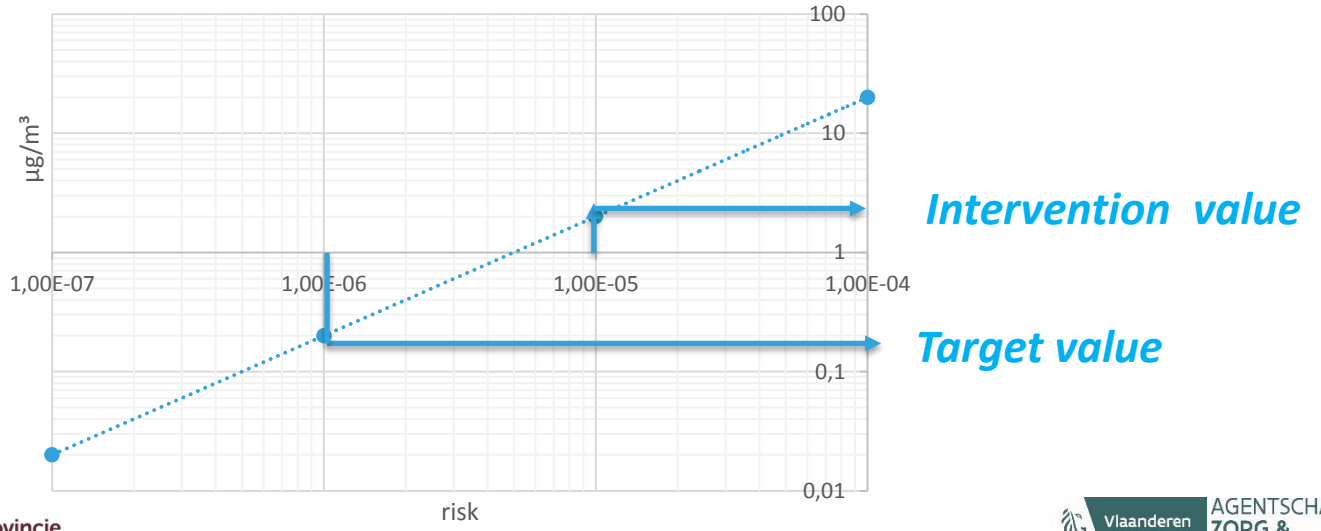
B. non-threshold effect (carcinogenic substances : inhalation unit risk approach)

Target Value =

IA concentration corresponding to a risk of <u>1 per 10^{-6}</u> (lifelong exposure)

Intervention Value =

IA concentration corresponding to a risk of <u>1 per 10^{-5}</u> (lifelong exposure)



TARGET AND INTERVENTION VALUES FOR CHEMICALS: APPROACH

A. Threshold effects	[B. Carcinogenic non-threshold IUR approach]
Target value (~ NOAEL)	Target value (1.10^{-6})
Intervention value (~ LOAEL)	Intervention value (1.10^{-5})

A < B → target/intervention value A selected

B < A → target/intervention value B selected

TARGET AND INTERVENTION VALUES: EXAMPLES

trichloroethylene

A . Threshold effects

Agency	Name	Value
EU risk assessment (ECB, 2004)	NOAEL	100 ppm
ATSDR (1997)	MRL, intermediate	0,1 ppm (537 µg/m³)
ATSDR (2014) draft	MRL, chronic	0, 0004 ppm (2 µg/m³)
US EPA (2011)	RfC, chronic	2,3 µg/m³
Cal EPA (OEHHA, 2008)	REL, chronic	600 µg/m³
ANSES (2009)	Intermediate VGAI (14 days – 1 year)	800 µg/m³

Critical endpoints: effects kidney, liver, neurological and immunological effects

Pivotal study: Keil et al., 2009 (thyroid weight); oral study – rats

TARGET AND INTERVENTION VALUES: EXAMPLES

trichloroethylene

B . Non-threshold effects

IARC Group 1 Carcinogenic to humans

Agency	Name	Value
WHO (2010)	Unit risk	4 ,3 x 10^{-7} per µg/m^3
US EPA (2011)	Unit risk	4 x 10^{-6} per µg/m^3
ANSES (2009)	Unit risk	4 ,3 x 10^{-7} per µg/m^3
CAL EPA (OEHHA, 2011)	Unit risk	2,0 x 10^{-6} per µg/m^3

Kidney cancer; US EPA (2011) based on workers study of Charbotel et al. (2006)

TARGET AND INTERVENTION VALUES: EXAMPLES

trichloroethylene

A. Threshold effects	B. Carcinogenic non-threshold IUR approach
target value (~ NOAEL) : 2,3 µg/m³	Target value (~ 1.10^{-6}) : **0,2 µg/m³**
Intervention value (~ LOAEL): 2,3 µg/m³ * LOAEL/NOAEL	Intervention value (~ 1.10^{-5}): **2,5 µg/m³**

Flemish IAQ Decree (2004):
Target value trichloroethylene: 200 µg/m³

TARGET AND INTERVENTION VALUES: EXAMPLES

Metallic Mercury (Hg^0) vapours

A. threshold effects

Agency	Name	value
WHO (2000)	Air Quality Guideline (AQG)	1 µg/m³
EPA IRIS (1995)	Reference Concentration (RfC)	0,3 µg/m³
ATSDR (1999)	Minimal Risk Level (MRL)	0,2 µg/m³ (chronisch)
OEHHA (2008)	Reference Exposure Level (REL)	0,03 µg/m³ (chronisch)
RIVM (2015)	Maximaal Toelaatbaar Risiconiveau lucht (MTR_{lucht})	0,05 µg/m³
UBA (1999)	Richtwerte (RW) I en II	RW I = 0,035 µg/m³ RW II = 0,35 µg/m³

TARGET AND INTERVENTION VALUES: EXAMPLES

Metallic Mercury (Hg^0) vapours

A. threshold effects

Agency	LOAEL ($LOAEL_{adj}$) ($\mu g/m^3$)	Assessment factors
EPA IRIS (1995)	25 (9)	use of LOAEL instead of NOAEL : 10 Intraspecies/sensitive groups: √10 lack of data: 3 Total: 30
ATSDR (1999)	26 (6,2)	Use of LOAEL instead of NOAEL: 3 Intraspecies/sensitive groups: 10 Total: 30
Umweltbundesamt (1999)	35 (7)	RW II→ RW I: 10 Intraspecies/sensitive groups: 10 and 2 Total: 200
WHO (2000)	(15-30)	Use of LOAEL instead of NOAEL: 2 Intraspecies/sensitive groups: 10 Totaal: 20
OEHHA (2008)	25 (9)	use of LOAEL instead of NOAEL : 10 Intraspecies/sensitive groups: √10 en 10 Total: 300
RIVM (2015)	25 (6,0)	use of LOAEL instead of NOAEL : 10 Intraspecies/sensitive groups: 10 Total: 100

TARGET AND INTERVENTION VALUES: EXAMPLES

Metallic Mercury (Hg^0) vapours

- Target value = **0,05 µg/m³**
- Intervention value = LOAEL x TAF
- Factor 10 used as AF 'use of LOAEL instead of NOAEL' by lack of NOAEL in critical study

→Intervention value = LOAEL/NOAEL x target value

→ **Intervention value** = 10 x 0,0595 µg/m³

→ (not rounded target value)

= **0,6 µg/m³**

B. non- threshold effects: not relevant

TARGET AND INTERVENTION VALUES: EXAMPLES

Acetaldehyde

A . Threshold effects

Agency	Name	Value
EPA IRIS (1991)	Reference Concentration (RfC)	9 µg/m^3
OEHHA (2008)	Reference Exposure Level (REL)	Chronisch: 140 µg/m^3 8-uur: 300 µg/m^3 Acuut: 470 µg/m^3
Health Canada (2004)	Tolerable Concentration (TC) inhalation	390 µg/m^3
Umweltbundesamt (2013)	Richtwerte (RW)	RW II= 1000 µg/m^3 RW I = 100 µg/m^3
Anses (2014)	Valeurs Guides de qualité d'air intérieur (VGAI)	Long term: 160 µg/m^3 (year) Short term : 3000 µg/m^3 (1 hour)

Pivotal study (Dorman et al., 2008) – subchronic inhalation exposure rats; irritation

TARGET AND INTERVENTION VALUES: EXAMPLES

Acetaldehyde

B . Non threshold effects

- IARC group 2B (possibly carcinogenic to humans)
- IUR EPA (1991); OEHHA (1993) and Health Canada (2004): unit risk based on nasal tumors in rats
- ANSES (2014), UBA (2013), INDEX project (JRC, 2005) consider tumor formation triggered by long lasting irration of nasal epithelium

  → prevention of damage to nasal epithelium: protective for tumor formation

  → target value based on threshold effects → also protective for tumor ~ acetaldehyde exposuse

Conclusion

- **Target value = 160 µg/m³** (based on ANSES, 2014)

⟺

Flemish IAQ Decree (2004): Target value acetaldehyde: 4600 µg/m³

- NOAEL = 90 mg/m³; LOAEL = 280 mg/m³ (Dorman et al, 2008)
- **Intervention value** $= \text{target value} \times \frac{LOAEL}{NOAEL}$ **= 480 µg/m³**

TARGET AND INTERVENTION VALUES FOR CHEMICALS: SOME DEVIATIONS FROM APPROACH

- **TVOC:**
  - complex and diverse mixture
  - lack of a toxicological or epidemiological based guidance value for TVOC as a group
  - TVOC measurements as screening (no quantification of compound) → important
  - Flemish target and intevention values based on TVOC classes (UBA, 2007)
- **Nicotine:**
  - passive smoking
  - no safe levels;
  - target value based on pragmatic approach: < 0,1 µg/m³ (rooms without ETS)

SUMMARY: TARGET AND INTERVENTION VALUES

	Target value	Intervention value
Formaldehyde		100 µg/m³
Acetaldehyde	160 µg/m³	480 µg/m³
C_4-C_{11} aldehydes	650 µg/m³	1600 µg/m³
Benzene		0,4 µg/m³*
Styrene	260 µg/m³	2500 µg/m³
Toluene	5000 µg/m³	14 000 µg/m³
C_9-C_{14} alkanes	250 µg/m³	490 µg/m³
2-ethylhexanol	100 µg/m³	810 µg/m³
Naftaleen	3 µg/m³	31 µg/m³
Benzo(a)pyreen (indicator for PAHs)	0,012 ng/m³	0,1 ng/m³
Tertrachloorethyleen	4 µg/m³	38 µg/m³
Trichloorethyleen	0,2 µg/m³	2,5 µg/m³
Total VOC	300 µg/m³	1000 µg/m³

SUMMARY: TARGET AND INTERVENTION VALUES

	Target value	Intervention value
Asbestos chrysotile	28 fibres/m³	280 fibres/m³
Asbestos amphibole	3 fibres/m³	30 fibres/m³
Metallic Hg (vapour)	0,05 µg/m³	0,6 µg/m³
PM2,5	10 µg/m³	
NO_2	20 µg/m³	40 µg/m³
Ozon	40 µg/m³	78 µg/m³
Nicotine	0,1 µg/m³	
Carbon monoxide		8 mg/m³

OUTLOOK

- Enforcement (17th September 2018)
- future: consider additional substances, update values

MORE INFORMATION:

https://codex.vlaanderen.be/Portals/Codex/documenten/1013487.html

https://www.zorg-en-gezondheid.be/passief-roken-erkend-als-gezondheidsrisico-in-huis

https://esites.vito.be/sites/IndoorAirQuality/NL/home/Pages/home.aspx