



***Poduzimanje mjera za zdravlje
radnika – dim i prašina
Taking measures for the Worker's
Health – Fumes and Dusts***

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International seminar ASPHALT PAVEMENTS 2018**

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REPORT OF EAPA HSE COMMITTEE WORK

- **2 main topics**

to improve preventive measures for workers' health :

1.Bitumen fumes

2.Respirable silica dust

1 – Bitumen fumes

1- BITUMEN FUMES

- **4 main parts:**

1. After the IARC monography : differentiation between air-rectified and oxidized bitumen
2. Vigilance on several recent studies done on the health of workers in relationship with bitumen fumes
3. A plan for the harmonization and upgrading of equipment (pavers) has been devised;
4. Improvement and standardization of the methods of measures of the exposure on construction site;

1- BITUMEN FUMES

1. After the IARC monography :

Eurobitume and EAPA are still working on the differentiation between air-rectified and oxidized bitumen.

2. Vigilance on several recent studies:

EAPA carefully follows the ongoing reports and releases on the topic e.g. the Norwegian studies (chronic obstruction pulmonary disorder)

1- BITUMEN FUMES

3. About the equipment : the pavers:



- an new annex D to the standard "ISO 20500 -5 **Mobile road construction machinery — Safety — Part 5: Specific requirements for paver-finishers** " about emission reducing device in progress



1- BITUMEN FUMES

4. Improvement and standardization of the methodology of assessment of the exposure of employees on construction site;
- In France, implementation of a “Metropol 123” protocol, which allows the determination of semi-volatile organic compounds, particularly those present in bitumen.



Photos Eurovia

Over 75 roadworks (motorways, car parks, or under tunnels) and more than 250 individual measurements at different work stations (paver and roller drivers, screed men, rakers, etc.).

Conclusions: - efficiency of warm mix asphalt
- efficiency of exhaust system devices on pavers
- no effect of RAP.

1- BITUMEN FUMES

4. Improvement and standardization of the methodology of assessment of the exposure of employees on construction site;

- In Germany, the method used by IFA for years is IFA n°6305 “*Bitumen (Dämpfe und Aerosole, Mineralölstandard)*”. This method is based on infrared absorption of the C-H aliphatic wavelength (from 2800 cm⁻¹ to 3000 cm⁻¹). Germany has the largest database of exposure on bitumen fumes; a European method will not be possible without the introduction of comparative tests which will, logically, determine a conversion factor.

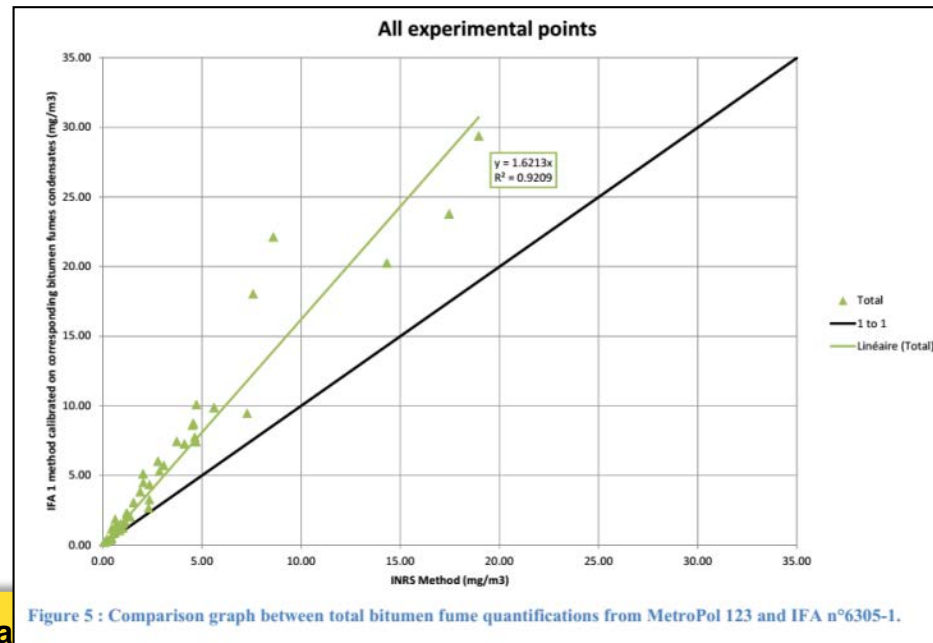


Figure 5 : Comparison graph between total bitumen fume quantifications from MetroPol 123 and IFA n°6305-1.

1- Bitumen fumes

5. USIRF-Routes de France has implemented a database “CIMAROUT” with :

- Over 75 roadworks (motorways, car parks, or under tunnels) and more than 250 individual measurements at different work stations (paver and roller drivers, screed men, rakers, etc.).

- 2 methods :

- Global Index (“Metropol 123” protocol) , which allows the determination of semi-volatile organic compounds, particularly those present in bitumen.
- Measurements of several classic PAH

1- Bitumen fumes

- **All the activities concerned by bitumen fumes were assessed:**
 - Mechanical laying
 - ✓ 52 jobsites,
 - Manual laying
 - ✓ 27 jobsites,

- **With asphalt mixes at different temperatures**
 - Hot mix asphalt (140 to 170 ° C)
 - ✓ 40 jobsites,
 - Warm mix asphalt (103 to 135 ° C)
 - ✓ 6 jobsites,

- **In different configurations**
 - 33 outdoors,
 - 7 in semi-closed space.

1- Bitumen fumes

EXAMPLE OF PYRENE

- There is no limit value for pyrene,
- When laying asphalt, pyrene is one of the majority of PAHs. It is often taken as an indicator of the presence of PAHs.
- Of the 115 values, 52% are below the limit of detection,
- The median concentration is 4.00 ng / m³,
- The 90 percentile is at 109 ng / m³:
 - the 20 values above the 90th percentile relate to a confined site (semi-enclosed configuration) and a 2001 site with a highly fluxed emulsion based on coal oils.

1- Bitumen fumes

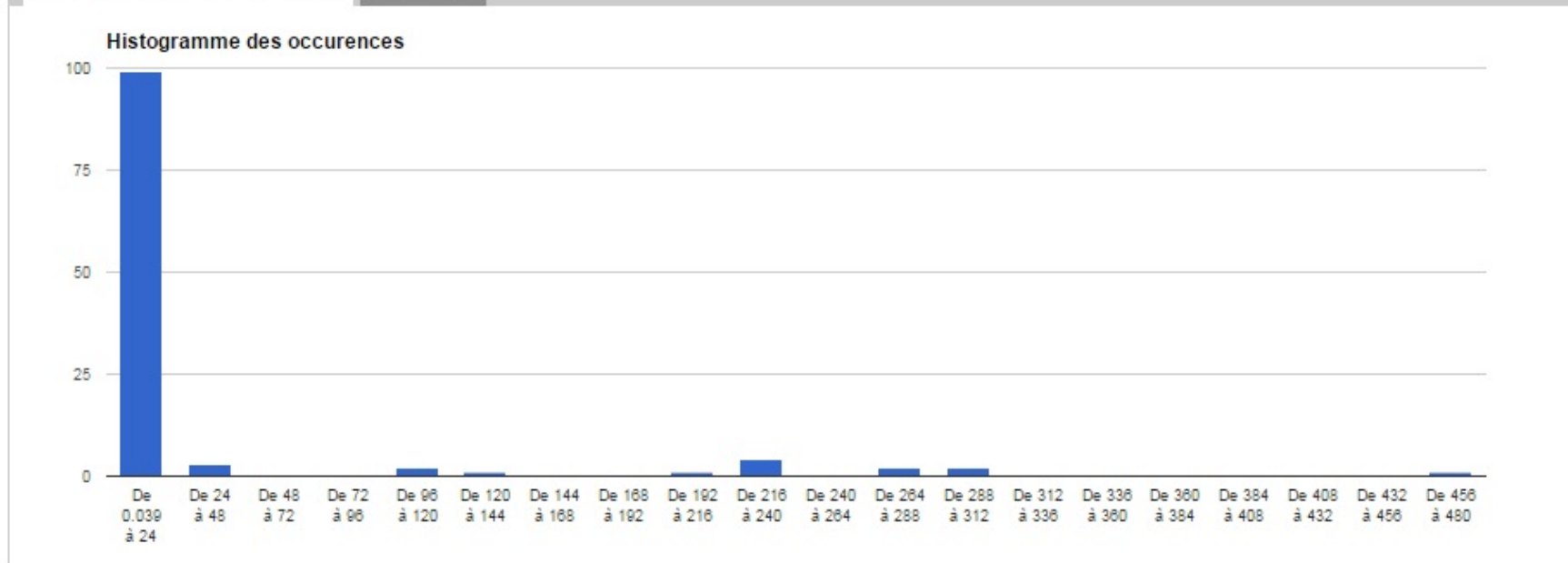
Extracting of database of CIMAROUT

PYRENE

<p>Agent chimique : Pyène</p> <p>Unité : ng/m3</p> <p>Valeur objectif : -</p> <p>Nb de valeurs : 115</p>	<p>Valeur minimale : 0.04</p> <p>Valeur maximale : 474</p> <p>Etendue : 474</p> <p>Moyenne arithmétique : 30.9</p> <p>% valeurs < limite détection: 52% (60/115)</p>	<p>Percentile 5 : 0.0613</p> <p>Percentile 50 : 4</p> <p>Percentile 75 : 6.63</p> <p>Percentile 90 : 109</p> <p>Percentile 95 : 229</p>	<p>Filtre en cours :</p> <ul style="list-style-type: none"> - Type d'activité : 'Application mécanique d'enrobés', 'Application manuelle d'enrobés', 'Fabrication d'enrobés' - Produits : 'Enrobés à chaud', 'Enrobés tièdes' - Configuration = 'En plein air', 'Souterrain', 'Usine fabric', 'Non connu' <p>Méthode de calcul : Méthode 2</p>
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Histogramme des occurrences

Percentiles



1- Bitumen fumes

BENZO(A)PYRENE

- **Reference value: 150 ng / m³, value recommended by the French Health of Workers Organism for the evaluation of carcinogenic risk due to PAHs,**
- **Of the 195 measurements, 76% are below the detection limit and 100% below the reference value.**
- **For example, on low-temperature melt asphalt applications, benzo (a) pyrene could not be detected.**
- **The median concentration of BaP is 2.5 ng / m³.**

1- BITUMEN FUMES

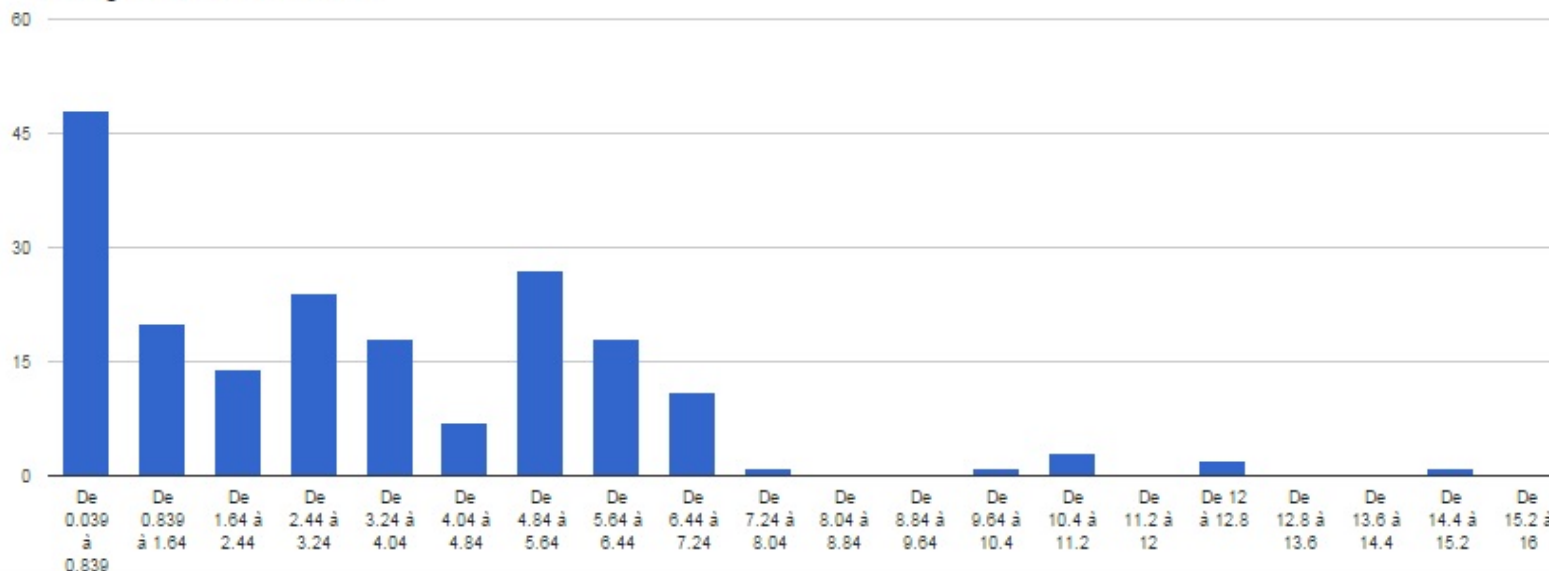
BENZO(A)PYRENE

<p>Agent chimique : Benzo(a)pyrène</p> <p>Unité : ng/m3</p> <p>Valeur objectif : 150</p> <p>Nb de valeurs : 195</p>	<p>Valeur minimale : 0.04</p> <p>Valeur maximale : 15</p> <p>Etendue : 15</p> <p>Moyenne arithmétique: 3.27</p> <p>% valeurs < limite détection: 76% (148/195)</p> <p>% valeurs < valeur objectif: 100% (195/195)</p>	<p>Percentile 5 : 0.075</p> <p>Percentile 50 : 2.5</p> <p>Percentile 75 : 5</p> <p>Percentile 90 : 6.38</p> <p>Percentile 95 : 7</p>	<p>Filter en cours :</p> <ul style="list-style-type: none"> - Type d'activité : 'Application mécanique d'enrobés', 'Application manuelle d'enrobés', 'Fabrication d'enrobés' - Produits : 'Enrobés à chaud', 'Enrobés tièdes' - Configuration = 'En plein air', 'Souterrain', 'Usine fabric', 'Non connu' <p>Méthode de calcul : Méthode 2</p>
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Histogramme des occurrences

Percentiles

Histogramme des occurrences



1- BITUMEN FUMES

FUMES

- **The European Union has set an average exposure value for fumes of 5 mg / m³ (8 hours of exposure per day),**
- **The median concentration of the fumes is 0.15 mg / m³,**
- **The percentile 90 is 0.45 mg / m³.**

1- BITUMEN FUMES

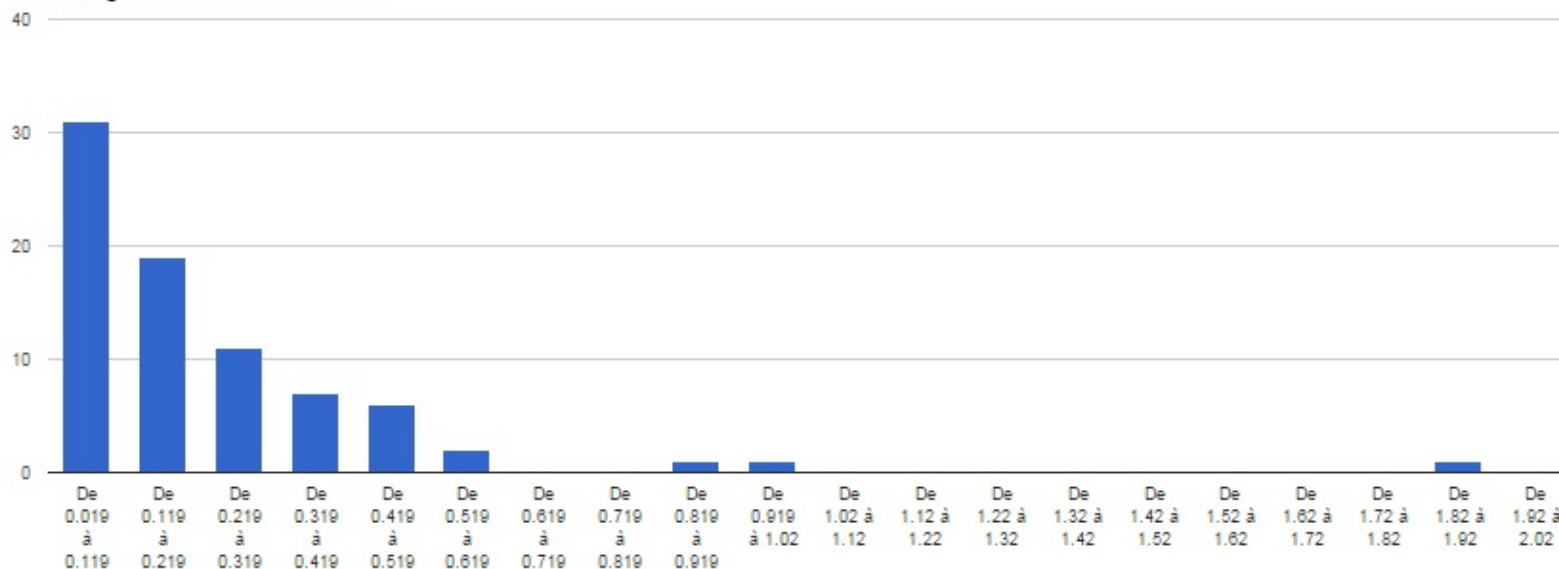
FUMES

<p>Agent chimique : Fumées</p> <p>Unité : mg/m3</p> <p>Valeur objectif : 5</p> <p>Nb de valeurs : 79</p>	<p>Valeur minimale : 0.02</p> <p>Valeur maximale : 1.9</p> <p>Etendue : 1.88</p> <p>Moyenne arithmétique: 0.229</p> <p>% valeurs < limite détection: 25% (20/79)</p> <p>% valeurs < valeur objectif: 100% (79/79)</p>	<p>Percentile 5 : 0.0595</p> <p>Percentile 50 : 0.15</p> <p>Percentile 75 : 0.283</p> <p>Percentile 90 : 0.452</p> <p>Percentile 95 : 0.521</p>	<p>Filter en cours :</p> <ul style="list-style-type: none"> - Type d'activité : 'Application mécanique d'enrobés', 'Application manuelle d'enrobés', 'Fabrication d'enrobés' - Produits : 'Enrobés à chaud', 'Enrobés tièdes' - Configuration = 'En plein air', 'Souterrain', 'Usine fabric', 'Non connu' <p>Méthode de calcul : Méthode 2</p>
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Histogramme des occurrences

Percentiles

Histogramme des occurrences



1- BITUMEN FUMES

TEMPERATURE DROP OF 30° C REDUCTION FACTOR ON PYRENE

Product	Hot mix asphalt	Warm mix asphalt	Reduction factor
Temperature of laying	160 °C	130 °C	
Configuration	All	All	
Number of values	94	21	
% values < detection limit	53%	48%	
Minimum Value	0,04 ng/m3	0,04 ng/m3	
Maximum Value	474 ng/m3	7,86 ng/m3	
Average	37,4 ng/m3	1,41 ng/m3	26,52
Percentile 50	4,5 ng/m3	0,24 ng/m3	18,75
Percentile 75	9,5 ng/m3	0,985 ng/m3	9,64
Percentile 90	176 ng/m3	4,8 ng/m3	36,67
Percentile 95	243 ng/m3	5,95 ng/m3	40,84

2 – Respirable crystalline silica dust

2- RESPIRABLE SILICA DUST

- Member States: alveolar crystalline silica considered as a hazardous chemical agent or as a carcinogen (process generating alveolar crystalline silica dust)
- Many European countries have legislated occupational exposure to crystalline silica: alveolar crystalline silica dust is a carcinogen in the workplace in Belgium, Denmark, Germany (processes), the Netherlands and Sweden
- **Improvement of the political pressure on the new European Commission:**
 - The European Commission published a proposal to amend the Directive on Carcinogens at Work (CMD) on 13 May 2016 proposing to include in Annex I: Work involving exposure to alveolar crystalline silica dust generated by a process of And Annex III: OEL to 0.1 mg / m³ or 0.05 mg / m³.
 - The transposition of this Directive into the Member States will be effective in 2019 at best

2- RESPIRABLE SILICA DUST

- **Dust is not all the same! There are different sizes of particles, often referred to as dust fractions. When the dust is inhaled, its area of deposition in the human respiratory system mainly depends on the size of the particles.**
- **Three dust fractions are defined in European Standard EN 481: the inhalable, thoracic and alveolar dust fractions defined.**
- **In the case of crystalline silica, it is the alveolar fraction of the dust which is problematic because of its effects on health.**
- **Alveolar dust can penetrate deep into the lungs. The body's natural defense mechanisms can eliminate much of the inhaled alveolar dust. However, prolonged exposure to excessive levels of dust makes it difficult to remove alveolar dust from the lungs. Dust accumulation can, in the long term, lead to irreversible health effects. Because the effects of crystalline silica on health are related to the alveolar fraction of dust.**

2- RESPIRABLE SILICA DUST

- Industry Initiatives (*contact to UEPG and VESF*):
 - NEPSI social dialogue agreement based on good practices (aggregates handling and milling process)
 - Vacuum systems on milling machines meet requirements for both silica dust and asbestos.
- (In Netherlands, vacuum systems are obligatory for front loader milling machines)
- A partnership NAPA/NIOSH has lead to produce a methodology to assess the efficiency of the vacuum systems on milling machines. This method is used to start some standardization works.



Photo RGRA/USIRF

Thanks for your attention