



Health and Bitumen

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Bruxelles

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- How do producers communicate to users?
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What are the Health Hazard associated with Bitumen?



- Bitumen is transported and usually handled hot!
- Bitumen contains small amounts of H₂S
- Bitumen is black like coal tar and has some technical properties similar to coal tar. In the past, coal tar was used in the paving and roofing industries and is classified as carcinogenic. Use of coal tar is therefore no longer allowed.
- Bitumen and Bitumen emissions contain low levels of Polycyclic Aromatic Hydrocarbon or Compounds (PAH – PAC) some of which are classified carcinogenic
- Following exposure to Bitumen emissions, occasional irritation to the respiratory tract has been reported.

Let's review the risks: Hot

- Bitumen is usually handled hot
 - Transport: around 180° C
 - Hot-Mix: 140 to 180° C
 - Roofing plants: 160 to 230° C
 - Mastic: below 230° C
- Burns
 - Bitumen at 180° C will provoke third degree burns
 - In extreme case, people could die.
- Transport:
 - At loading: water in tanker, bitumen projections
 - During transport: accidental release
 - At discharge: Bitumen projections (hose rupture, connection leaks, tank overflow)

Let's review the risks: H₂S

- Bitumen contains small amounts of H₂S.
- H₂S above a certain concentration can induce a loss of conscience and in some case death
- Risk is associated with confined spaces like, tanks, truck tank or working indoor.
- Main activities when this could occur:
 - At loading: when opening the hatch and close to the hole during loading
 - At discharge: when opening the manhole
 - Operating in confined places

Let's review the risks: Bitumen is different from Coal Tar

- Coal Tar comes from the Pyrolysis of coal ⇔ Bitumen from the distillation of crude oil.
- The Chemical composition of Coal Tar is very different from the one from Bitumen.
- Coal Tar PAH Content is 10.000 times the Bitumen PAH content
- Coal Tar was used extensively in % before 2nd world war and gradually disappeared till mid 1970s.
- IARC: Occupational Exposure of working with Coal Tar in paving is evaluated category 1 while with Bitumen is evaluated 2B.

Let's review the risks: PAH in Bitumen

PAH	PAH in Bitumen ^{32,33,34}	PAH in bitumen fumes (personal samples*) ³⁵	
	mg/kg (ppmw)	µg/m ³	Standard deviation
Naphthalene	2.5 - 3.0	5.5 (8/9)**	2.9
Acenaphthene	BDL - 0.7	3.3 (1/9)	7.8
Acenaphthylene	NR	3.3 (2/9)	8.5
Fluorene	0.3 - 0.5	0.47 (1/9)	0.84
Phenanthrene	0.3 - 7.3	0.82 (2/9)	2.2
Anthracene	BDL - 2.0	0.063 (1/9)	0.074
Fluoranthene	BDL - 2.0	0.98 (1/9)	2.6
Pyrene	0.2 - 8.3	NA	
Chrysene	<0.1 - 11	NA	
Benzo(a)anthracene	BDL - 3.3	NR	
Perylene	BDL - 39	NR	
Benzofluoranthenes	BDL - 1.2	0.65 (1/9)	1.7
Benzo(e)pyrene	<0.1 - 13	0.78 (1/9)	1.7
Benzo(a)pyrene	BDL - 4.6	0.16 (1/44)	0.072
Dibenzanthracenes	BDL - 3.3	NR	
Indeno(1,2,3-cd)pyrene	BDL - 2.4	NR	
Benzo(ghi)perylene	<0.1 - 4.6	NR	
Anthanthrene	BDL - 0.1	NR	
Dibenzo(al)pyrene	BDL - <0.6	NR	
Dibenzo(ai)pyrene	BDL - <0.6	NR	
Coronene	BDL - 1.9	NR	

* Personal exposure monitoring at terminals and refineries
 ** Results represent arithmetic mean of samples; (numbers in parentheses indicate numbers of samples above the limit of detection/number of samples)
 NA = Not Applicable
 NR = Not Reported
 BDL = Below Detection Limit
 Note: data on PAH content of bitumen and those for PAH in fumes are from different studies. See references for further details.

Let's review the risks: PAH in Bitumen

- **Risk = Hazard * exposure**
- **Some** PAH are classified as carcinogenic (Hazard)
- PAH content in Bitumen is very low
- Exposure to bitumen emissions is very low
- Studies commissioned to evaluate Health impact (Mainly paving):
 - Human studies
 - IARC Epidemiology study (2004) and follow-up Nested Case control Study (2009) => no increase in cancer due to exposure to Bitumen emissions.
 - Animal studies:
 - Fraunhofer inhalation study (2006) on paving fume condensate => no carcinogenic effect
 - US Skin Painting study on paving fume condensate (2010) => no carcinogenic effect
 - US Skin Painting study on BURA fume condensate (2010) => weak carcinogenic reaction.
 - Numerous mechanistic studies
- Bitumen in situ (road or roof) does not release any emissions.

IARC Monograph Report



- **IARC**

- The International Agency for Research on Cancer, part of the World Health Organisation. They are based in Lyon
- Mission
 - IARC's mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer prevention and control.
 - Monograph evaluations (Bitumen has been scheduled for many years)
- Monograph
 - Review of published peer reviewed scientific studies (Human, Animal and Mechanistic)
 - Review by independent scientists
 - State representatives and Industry observers are allowed to attend but not vote
 - Evaluate **HAZARDS not RISK.**

IARC Monograph Report

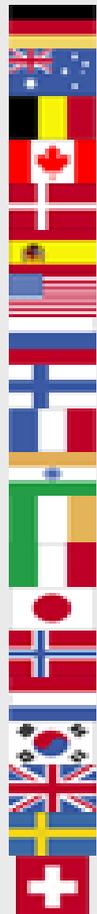


- **Process**

- Monograph on Bitumen and Bitumen fumes (emissions) + Heterocyclic PAC from 11 to 18 October in Lyon
- Review process
 - 4 Working Groups: Exposure, Cancer in Humans (Epidemiology), Cancer in Animals (Toxicology), Cancer mechanism (Mechanistic).
 - 14 WG voting experts, 2 non-voting invited specialists
 - 2 National representatives (ANSES France) non voting.
 - Plenary sessions regrouping all WG members
- The evaluations are:
 - Group 4: The agent is probably not carcinogenic to humans.
 - Group 3: The agent is not classifiable as to its carcinogenicity to humans.
 - Group 2B: The agent is possibly carcinogenic to humans.
 - Group 2A: The agent is probably carcinogenic to humans.
 - Group 1: The agent is carcinogenic to humans.



Evaluation table and impact of mechanistic evaluation



		EVIDENCE IN EXPERIMENTAL ANIMALS			
		Sufficient	Limited	Inadequate	ESLC
EVIDENCE IN HUMANS	Sufficient	Group 1			
	Limited	↑ 1 strong evidence in exposed humans ... agent acts through a relevant mechanism Group 2A	↑ 2A belongs to a mechanistic class where other members are classified in Groups 1 or 2A Group 2B (exceptionally, Group 2A)		
	Inadequate	↑ 1 strong evidence in exposed humans ... ↑ 2A strong evidence ... mechanism also operates in humans Group 2B	↑ 2A belongs to a mechanistic class ↑ 2B with supporting evidence from mechanistic and other relevant data Group 3	↑ 2A belongs to a mechanistic class ↑ 2B with strong evidence from mechanistic and other relevant data Group 3	↓ 4 consistently and strongly supported by a broad range of mechanistic and other relevant data Group 3
	ESLC		Group 3		Group 4

IARC Monograph Report



After an 8-day comprehensive review, the Working Group concluded that:

- occupational exposures to oxidized bitumens and their emissions during roofing are ‘probably carcinogenic to humans’ (Group 2A);
- occupational exposures to hard bitumens and their emissions during mastic asphalt work are ‘possibly carcinogenic to humans’ (Group 2B); and
- occupational exposures to straight-run bitumens and their emissions during road paving are ‘possibly carcinogenic to humans’ (Group 2B).
- These evaluation replace all previous evaluations (1985/87)
- IARC evaluations are based on Hazard not Risk!

IARC Logic based on level of scientific evidence:

- Oxydised Bit in Roofing: Human: limited, Animal: sufficient, Mechanistic: weak => 2A
- Hard Bitumen in Mastic: Human: limited, Animal: no data, Mechanistic: weak => 2 B
- Straight Run in Paving: Human: inadequate, Animal: inadequate, Mechanistic: strong => 2 B

Let's review the risks

- Carcinogenicity
 - **The risk is extremely low**
 - Based on the information published by IARC to date, the European bitumen manufacturing industry sees no immediate need to update existing health and safety documentation.
 - Awaiting publication of the full report
 - Minimise exposure (Temperature control, Temperature reduction, Extraction devise, etc.). This is a continuing effort in progress already.
 - For exposure at high temperature ($> 230^{\circ}$ C) to Oxidised Bitumen with PI > 2 : Recommend the inclusion in SDS's of a warning of potential hazard for exposure at high.
- Irritation
 - Only isolated cases of mild, reversible respiratory tract irritation in workers.
 - Minimise exposure

How to reduce the risks further?

Burns:

- Guides on Safe Handling of Bitumen
- Personal Protection Equipment
- At Loading: No water, away from loading hole
- At discharge: suction pumps, high level alarms
- Training, risk assessment.

H2S

- At Loading: careful when opening manhole, away from loading hole, stand up-wind, etc.
- At discharge: careful when opening manhole,

PAH and Irritation

- Minimise exposure (Temperature control, Temperature reduction (warm mix, low temp mastic), Extraction devise, etc)

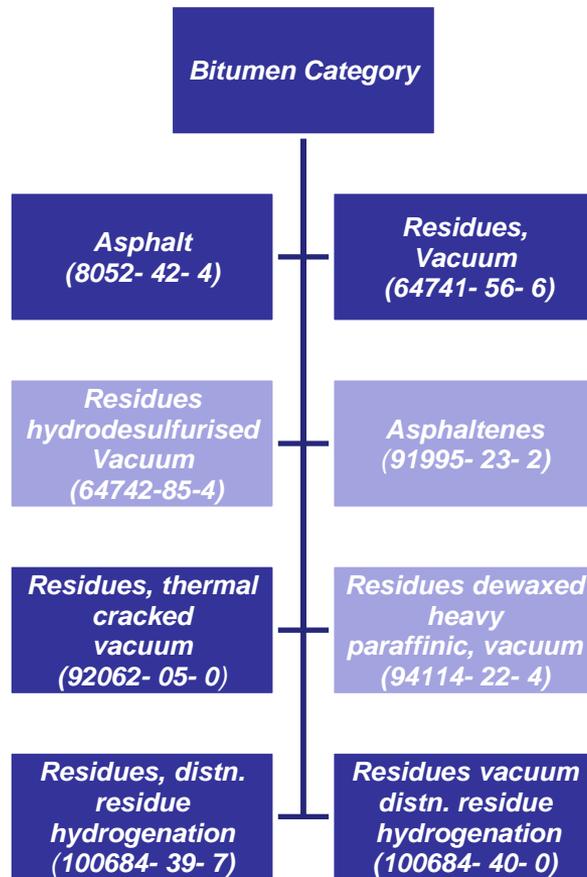
How do producers communicate?

- Bitumen is a chemical substance => Legislation for Chemical substances:
 - REACH
 - Classification and Labelling
 - Safety Data Sheet

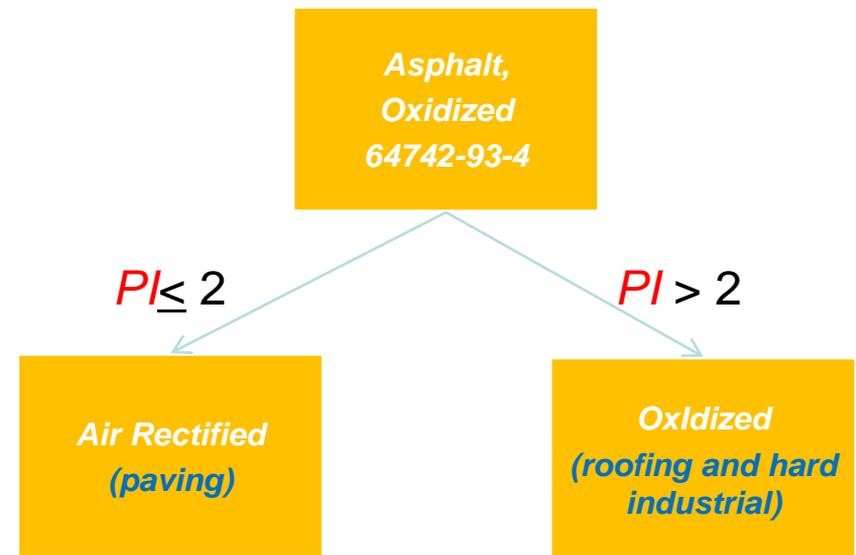
REACH

- **R**egistration, **E**valuation, **A**uthorisation and Restriction of **C**hemicals (**REACH**)
- **EC Regulation [(EC) No 1907/2006]**
 - Ensure a high level of protection of human health and the environment from the risks that can be posed by chemicals,
 - Industry responsible for assessing and managing the risks posed by chemicals and providing appropriate safety information to downstream users.
- **Manufacturers and importers obligated to register their chemicals**
 - ➔ REACH registration dossier and Chemical Safety Report for bitumen category & oxidized asphalt prepared by CONCAWE.
 - ➔ Bitumen manufacturers submitted registration dossiers and Chemical Safety Reports by end November 2010

Manufacturers Approach



Category approach used for hazard and risk assessment, based on similarities in composition, properties and manufacturing processes.



Oxidized asphalt differentiation based on differences in physical properties and composition related to severity of oxidation

Classification, Labelling and Packaging (CLP)

Regulation [(EC) No 1272/2008]

- Aligns the EU system for hazard classification for chemical substances and mixtures to the UN Globally Harmonised System (GHS)
 - Replaces the historic systems contained in the Dangerous Substances and Preparations Directives (67/548/EEC & 1999/45/EC)
 - requires companies to appropriately classify, label and package their substances and mixtures. It aims to protect workers, consumers and the environment through use of appropriate hazard warning labels
- **CONCAWE Report 11/10 “ Hazard classification and labelling of petroleum substances in the European Economic Area – 2010 ” December 2010.**
- C&L recommendations for petroleum substances (DSD & CLP)
 - Summary of supporting data
 - **Bitumen and oxidized asphalt are not classified as hazardous**

Safety Data Sheets (SDS)



- SDS requirements now part of REACH (annex II)
- Format and content (meets GHS standard)
 - Key downstream user communication tool for REACH
- Bitumen and Oxidized Asphalt are not classified as hazardous.
- But bitumen suppliers **voluntarily** supply SDSs to their customers
 - Provides REACH information requirements
 - Safe handling information (hot product, maximum safe handling temperature, transport, H₂S etc.)
 - Health end point: irritation of respiratory tract
 - No 'exposure scenario' annex required

Concluding Remarks

- Burns: Follow procedures and have the right equipment. Maintain awareness: procedures, training, audits, campaigns.
- H₂S: Follow existing procedures.
- Bitumen is not coal tar and never has been.
- Bitumen and Bitumen emissions are not classified as hazardous for Cancer:
 - During application, minimise exposure.
 - Reduce temperature of use.
- Occasional Irritation
 - During application, minimise exposure.
 - Reduce temperature of use.
- In case of doubt contact your supplier.

Use the right equipment



Équipements de sécurité : portez-les !

