AAPA's 14th International Flexible Pavements Conference

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Health and safety aspects of working with bitumen – past and present

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AUSTRALIAN ASPHALT PAVEMENT ASSOCIATION

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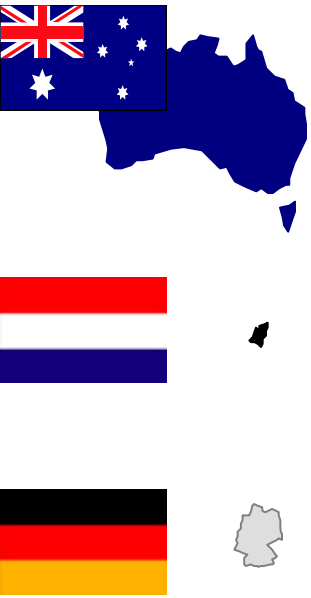

population	size	% water	waterways	commercial ships	population density	roads	% unpaved	hot mix	bitumen
10^6	10^6 km^2	%	km	#	km^{-2}	10^3 km	%	Mt	Mt
22	7.7	<1	2000	45	2.8	810	58	10	1.0
17	0.04	18	6200	700	410	140	0	10	0.4
81	0.36	2.3	7500	420	230	640	0	55	3.0

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Content

- Historical overview of the key studies
- IARC review
- REACH implementation in Europe
- Health, safety and environmental initiatives in Europe



Drivers for Health Concerns

- Presence of poly-cyclic aromatic hydrocarbons
- Smell
- Exposure to fume
- Fear of lung and/or skin cancer development.
- Occupational exposure limits
- Health risk uncertainty – public and regulators
- Interesting area for academic research (health)

Historical Overview – key events

- 1908 – 1989 Epidemiology studies in paving & roofing workers
- 1960 – 1997 Cancer studies in animals – mainly skin painting
- 1984 IARC Monograph 35 – Bitumens
  - ‘sufficient evidence’ for carcinogenicity in animals (extracts of steam-refined and air-refined bitumens)
  - ‘limited evidence’ for carcinogenicity in animals (undiluted steam-refined and cracking-residue bitumens)
  - ‘inadequate evidence for carcinogenicity in animals (undiluted air-refined bitumens)
  - ‘inadequate evidence for carcinogenicity to humans (bitumens alone)

Historical Overview – key events

- 1987 – NIOSH skin painting studies with oxidised bitumen
- 1987 IARC Monograph (Supplement 7)
  - Bitumens – Group 3 (not classifiable as to its carcinogenicity to humans)
  - Extracts of steam-refined and air-refined bitumens – Group 2B (possibly carcinogenic to humans)
- 1994 – Partanen and Boffeta – meta analysis of 11 epidemiology studies (elevated lung cancer risk in roofers but not pavers)

Historical Overview – key events

- 1998
  - Regulatory discussions start in Germany on carcinogenicity of bitumen fume
  - IARC sponsored studies on DNA adducts in animals 1987 – NIOSH skin painting studies with oxidised bitumen
- 1999 – NIOSH hazard review
- 2000 – 2005 Fraunhofer inhalation studies (not carcinogenic to rats)
- 2001
  - IARC cancer cohort study published (slight elevated risk of lung cancer)
  - Publication of MAK cancer conclusions (bitumen fume and aerosol – category 2)

Historical Overview – key events

- 2006 – ACGIH / MAK Dresden health studies symposium
- 2009 – IARC NCC study published (no evidence that exposure to bitumen fume was associated with a risk of developing lung cancer)
- 2010
  - USA skin painting study results available (roofing and paving)
  - REACH dossiers submitted
- 2011 – IARC Monograph update announced.

IARC Monograph Related Activities

- Key health studies published
  - IARC cohort and NCC studies
  - Fraunhofer inhalation studies
  - USA skin painting results
  - Initiation/promotion studies
- Industry ‘Chapter 1’ documents
  - Bitumen : a Global perspective …. (2nd edition EB-AI document)
  - Roads and Roofers equivalent
- Monograph update announced – Oct 2011 (Bitumen and Bitumen Fumes)
- European / USA collaborative meeting with IARC
- Confirmation of the Expert Panel and Industry Observers

IARC Review
Lyon, France: 11-18 October 2011

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans

VOLUME 103: BITUMEN AND BITUMEN FUMES, AND SOME HETEROCYCLIC AROMATIC HYDROCARBONS

- Working group:
  - 18 scientists and representatives of (inter)national health agencies
- 7 observers – the industries eyes and ears
  - A. Riley (EU), J. Freeman (US), Refining
  - A. Kriech (US), Heritage Research Group
  - N. Falette (EU), French Cancer Center
  - W. Fayerweather (US), Roofers
  - M. Acott (US), Pavers
  - J.Melius (US), Workers‘ Union

Ongoing Challenges – IARC monograph

- What will IARC review:
  - Bitumen / oxidised bitumen?
  - Fumes from bitumen / oxidised bitumen?
- Overall conclusions?
  - Category 3 (*not classifiable as to its carcinogenicity to humans)*
  - Category 4 (*probably not carcinogenic to humans*)
  - Category 2a/2b (*probably/possibly carcinogenic to humans)*
- Regulatory impact of IARC conclusion
  - Europe?
  - USA?
  - ROW?
  - GHS?
  - OELs for bitumen fume ?

REACH – Bitumen 2010 Assessments and Issues

- **1st phase registrations complete**
  - Bitumen Category – 8 substances
  - Oxidized Asphalt – single substance
- **Registration by manufacturers and importers based on CONCAWE dossiers**
- **Neither bitumen category, nor oxidized asphalt classified as hazardous for Health or the Environment**
  - Only identified health effect is irritation of the upper respiratory tract
  - Exposure scenarios not required
  - Data gap / testing proposal for reproductive and developmental toxicity
  - DNELs (based on protection from respiratory tract irritation)
    - 2.9 mg/m^3 THC (Worker, 8 h average),
    - 0.6 mg/m^3 THC (General Population, 24 h average)
- **Eurobitume 'uses' document updated and aligned with information in CONCAWE dossiers**

REACH SDSs

- All substance SDSs needed to be updated to meet revised REACH Annex II
- Format and content changed.
- Include:
  - REACH registration numbers
  - Revised (CLP/GHS) hazard classification (if appropriate)
  - Prescribed uses
  - DNELs
  - Exposure scenarios and risk reduction measures (if appropriate)
- … Oxidised bitumen
- SDSs for mixtures will be updated later

Ongoing Challenges – REACH

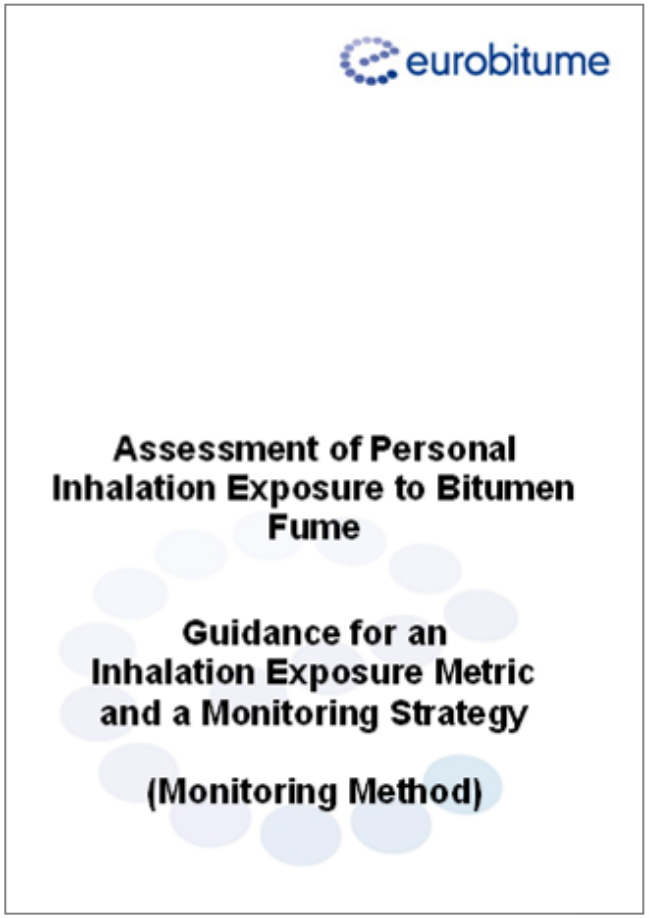
- Possible hazard classification of oxidized asphalt (bitumen)
- Introduction of PI to differentiate Air-rectified from Highly Oxidized
- **If** classified as hazardous…..
  - Exposure scenarios will need to be developed
  - Occupational exposure data will be needed (particularly downstream users)
  - Risk characterisation ratio needed
  - Workplace risk reduction measures
  - Possible restrictions on use
  - Impact on downstream users (Customers)

Other EU industry developments

- Fume exposure measurement protocol
- Safe Loading & Delivery of bitumen
- Life Cycle Inventory update

Fume exposure measurement protocol

- Practical guidance for the assessment and quantification of potential worker exposure to inhalable bitumen fumes
- Recommendations for an appropriate sampling technique
- Guidance regarding data interpretation
- Recommended strategy dealing with existing exposure data or occupational limits



Guide for safe loading & delivery of bitumen

- Best practices for loading & delivery of bitumen
- Design and layout of loading & delivery points
- Personal Protective Equipment Guidelines
- Delivery vehicle equipment
- Legal context framing the delivery process: e.g. responsibilities, ADR, National legislation
- Establish an evaluation questionnaire for surveying the site and the delivery process (site survey)
- Can be adapted to various countries at the request of Eurobitume members

BP Bitumen
For roads that perform

bp

Bitumen Life Cycle Inventory Update

- Update of the 1999 life cycle inventory of Bitumen
- Output useable for Bitumen end users (ISO compliant)
  - To investigate the sensitivity of certain aspects of bitumen manufacturing regarding Life Cycle Inventory.
- New aspects include:
  - Crude basket update
  - Transportation route of crude
  - Manufacturing routes
  - PMB manufacturing
  - Bitumen emulsion manufacturing
  - Infrastructure
- Most up to date source information used
- Independently peer-reviewed
- Report finalised and available for download and in hard copy

Summary

Environment

- Bitumen is green
  - Ability to recycle / reuse road asphalt
  - Negligable environmental emissions/release in-situ
  - Low environmental impact

Safety

- Bitumen is handled and applied hot and workers need to be protected through good practice.

Health

- Bitumen is not hazardous to man or the environment
- Risk of irritation from fumes needs to be managed through exposure reduction e.g. temperature reduction
- REACH legislation asks for regular reassessments