A Guide To Benzene Related Health Issues

Properties : Hazards: Symptoms: Limits

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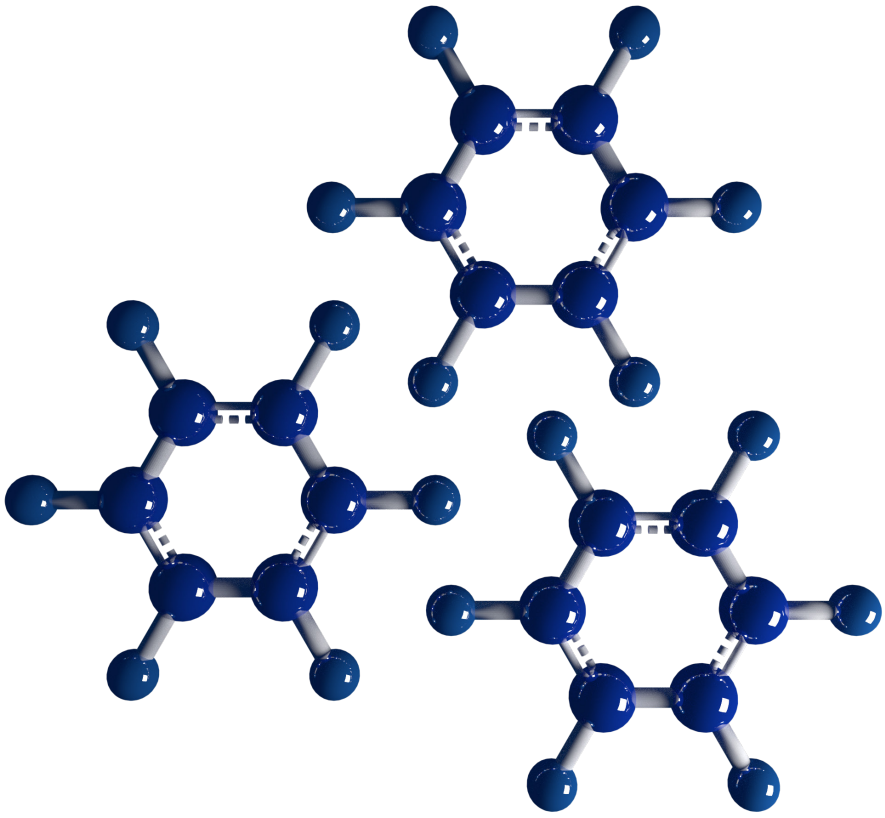

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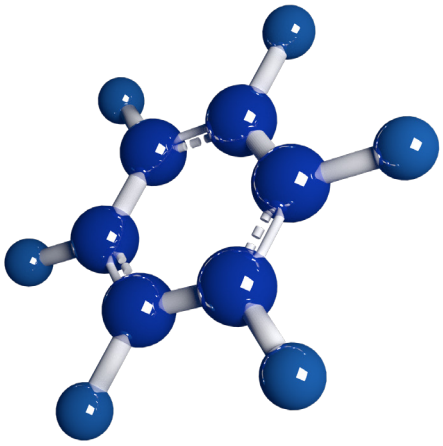
Hazardous chemicals that pose a risk to human health are present in many raw materials such as oil. Normally these are safely transported and contained within process pipework and reaction vessels during normal plant operation. However, routine plant repair and maintenance (planned turnaround) or a fugitive release, due to faulty flanges on valves for example, can potentially expose workers above the legal occupational exposure limit (OEL). Benzene, a hydrocarbon and volatile organic compound (VOC), is one such hazardous chemical. Found in oil refining and is an intermediary in the widespread manufacture of many commonly used plastics. According to the World Health Organisation (WHO) there is no safe level of exposure[1].

Benzene volatises (evaporates) easily and indeed inhalation is the most common method of exposure but it can also be absorbed through the skin or by swallowing material containing it.
The EU-wide and US-OSHA 8 hour time weighted average (TWA) airborne exposure for benzene is currently set at 1 part per million (ppm), equivalent to a concentration of 3.25 mg/m^3 which is well below what most people can detect despite its distinctive 'aromatic' smell i.e. between 2.5 and 5 ppm in air.

The acute (immediate) effects of exposure may be headache, dizziness, drowsiness, confusion, tremors and loss of consciousness which presents additional risks if the employee is working unrestrained at height. It is also a moderate eye and skin irritant.
Regular exposure can lead to chronic (long term) effects including:-

- myeloid leukaemia
- lymphocytic leukaemia
- non-Hodgkins lymphoma
- multiple myeloma
- aplastic anaemia

Individuals who have experienced benzene poisoning requiring treatment show a substantially increased risk of mortality from leukaemia.



Leading & lagging indicators

Health surveillance by conducting a urinary test or blood count can of course show evidence of exposure but these are lagging indicators i.e. after exposure has already taken place by which time damage may have been done.

A preferable leading indicator for benzene exposure would be to monitor using a real-time monitoring instrument such as a photoionisation detector. These can be fixed, portable or personal devices depending on the application or a combination of all three for maximum worker protection. A local and/or central alarm will indicate an unacceptably high concentration and alert workers to evacuate the area or to wear the appropriate respiratory protection.

The future for the OEL?

The table shows the existing OELs indicated as an 8-hour time TWA and 15-minute STEL (where stated) for selected EU member states and agencies in the USA.

Occupational Exposure Limits for selected EU Member States and US Agencies

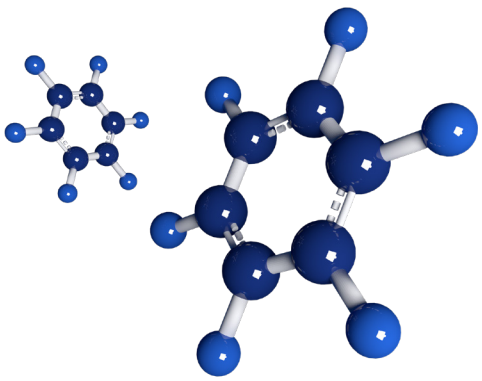
	TWA (8 hours)		**STEL** (15 minutes)	
	ppm	mg/m^3	ppm	mg/m^3
EU inicative value	1	3.25	-	-
France	-	3.25	-	-
UK	1	3.25	-	-
Germany*	0.6	1.9	-	-
Denmark	0.5	1.6	-	-
Sweden	0.5	1.5	3	9
Netherlands	0.2	0.7	-	-
OSHA (USA)	1	3.2	5	15
ACGIH (USA)	0.5	1.6	2.5	8
NIOSH (USA)	0.1	0.3	1	3.2

* Tolerable risk 1:1000

Correct as at 17th October 2017

Recognising the specific concerns over benzene, the EU has turned to the European Chemicals agency (ECHA) to "review and evaluate the information already available and assess the most recent scientific information". The review, entitled Proposal in support of occupational exposure limit values for benzene in the workplace[2] was published for public consultation in October 2017 and final "opinions" will be published by 26th March 2018. The aim of the review will be to make recommendations to the next (4th) amendment to the EU directive on carcinogens[3].

Given the position on exposure by the WHO and, as can be seen from the table, since some individual EU member states have already adopted a significantly lower OEL than the EU-wide indicative value, it is reasonable to expect the ECHA to recommend an order of magnitude reduction in the current OEL i.e. to 0.1 ppm. If photoionisation detectors are to be used as a leading indicator of exposure, this anticipated reduction will require them to have appropriate sensitivity and resolution which should be considered if purchasing instrumentation in the near future.



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References

References

1. https://echa.europa.eu/documents/10162/214b2029-82fd-1656-1910-3e18d0906999
2. http://www.who.int/ipcs/features/benzene.pdf
3. https://osha.europa.eu/en/legislation/directives/directive-2004-37-ec-carcinogens-or-mutagens-at-work

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Ion Science provide a portfolio of handheld, fixed and portable photoionisation (PID) detection instruments for the rapid, accurate detection of volatile organic compounds (VOCs). Find out more about our industry leading range of Benzene detection solutions by clicking on the links below.

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