TRANSPORT & ENVIRONMENT

How Concawe, a research group created by BP, Shell and ExxonMobil, undermined European laws designed to protect people from fossil fuel emission-linked cancer risks

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KEY TAKEAWAYS

- *The research group, Concawe, contributed to a recent industry-led push against stronger limits for European workers' exposure to benzene.*
- *The deleterious effects of this toxic chemical are well established; groundbreaking studies on its harm were published as far back as the late 1970s. But the oil industry has long funded studies that contradict the overwhelming scientific consensus on the cancer risks posed by exposure to benzene and other air pollutants linked to petroleum products.*
- *This approach mimics disinformation tactics used by the tobacco, pesticide and oil industries in the US.*
- *Most recently, scientists from the European Chemicals Agency proposed more stringent benzene exposure limits, to come into effect in 2024. These were not adopted. The human cost of this decision is still unknown: but official estimates suggest that the new limits could add at least 99 additional cases of deadly cancer to the burden already borne by workers.*
- *Concawe did not respond to our request for comment*

60 years of 'sound science' for the oil industry

The 'Conservation of Clean Air and Water in Europe' (Concawe) sounds like any other Brussels-based environmental advocacy group. It presents itself as a not for profit organisation which aims to "conduct research programmes to provide impartial scientific information" on "environmental issues"[1].

Its website discloses the numerous studies the 16 million Euro budget[2] research centre has published since 1963 on topics ranging from the health impact of chemicals to the monitoring of emissions from cars.

Only a glimpse at it membership page reveals that it is, in fact, a division of the European Fuel Manufacturers Association[3], which encompasses the biggest oil companies operating in Europe[4]. Further investigation into the group's statutory documents shows that Concawe merged with the EU

[1] Concawe website, "About us", August 2023, retrieved from: https://web.archive.org/web/20230804020844/https://www.concawe.eu/about-us/
[2] Source: Income Statement from Concawe's financial accounts approved by General Assembly on 08-06-2023. P 9
[3] Concawe website, "Organisation/Structure", https://www.concawe.eu/about-us/organisation-structure/
[4] According to Concawe's website, its "membership has broadened to include most oil companies operating in Europe." retrieved from: https://www.concawe.eu/who-are-we/

oil lobby group Europia (now *Fuels Europe*) in 2013[5] and the association's goals now include direct support to Fuels Europe's lobbying on EU legislation[6].

A deep dive into the history of Concawe casts new light on the tactics developed by the oil industry in the US and Europe for 60 years to tackle the growing public awareness of the health impact of its products.

In the early 60s, executives from BP and Shell were behind the inception of a new industry-wide research group on air pollution, with support from representatives of Esso and Mobil (currently operating under ExxonMobil), among others[7]. This was partially inspired by BP's establishment of its own internal research group.

At the time, it seemed like oil companies were willing to "(*identify) possible sources of pollution"* and find "*ways to […] minimise their effects"*, according to the transcript of a speech given by Pat Docksey, BP's head of R&D Department, in 1973[8].

Shell and Exxon already knew a great deal about the detrimental effects of ambient air pollution in the 60s, as previous investigations, based on the disclosure of internal memos and reports, have revealed[9]. A decade earlier, memorandums from a Shell consultant had already detailed the specific risks posed to oil industry workers heavily exposed to air pollutants such as benzene[10].

Docksey's speech contains hints of what appears to be the real motive behind Concawe's creation. It seems clear that the oil industry wanted to mitigate risks related to growing political and public awareness of pollution linked to the use of petroleum products: *"There could be damage in the future and, as the use of petroleum products increased, our share of the total responsibility would increase also*". Later in his speech, Docksey also mentions discussing with Shell "*problems which [was] going to face the oil industry, particularly in Europe*"[11].

Docksey's speech also suggests that Concawe's creation was an attempt by the oil industry to influence the research European policy makers had at their disposal: *"policy, which is primarily a matter of judgment, requires the soundest basis of technical fact that can be achieved".*[12]

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[5]Source: amendments to Concawe Statutory documents in 2013 and 2020 (see p 1 for mention of Europia in both documents)
[6] Source: amendment to article 2 of Concawe statutory documents in 2013. The association's purpose now includes the following phrase: "provide opinions on EU regulatory proposals regarding the oil industry" ("remettre des avis sur les projets législatifs de l'Union Européenne concernant l'industrie pétrolière)
[7] Concawe activity report,'Formation of Stichting Concawe' 2013, available at:
https://www.concawe.eu/publication/formation-of-stichting-concawe-in-1963/
[8] Concawe activity report,'Formation of Stichting Concawe' 2013, p 3 available at :
https://www.concawe.eu/publication/formation-of-stichting-concawe-in-1963/
[9] The Guardian, March 2021
https://www.theguardian.com/environment/2021/mar/18/oil-industry-fossil-fuels-air-pollution-documents
Based on release of documents accessible at:
https://www.climatefiles.com/exxonmobil/1967-imperial-oil-public-relations-assessment-of-air-water-pollution-in-canada/#document/p3/a471809
[10]1950 memorandum to Shell Development Company on "environmental cancer in the petroleum industry", available at:
https://www.documentcloud.org/documents/1373099-00130588#document/p1/a191062
[11] Concawe activity report,'Formation of Stichting Concawe' 2013, p 3 and 4 available at :
https://www.concawe.eu/publication/formation-of-stichting-concawe-in-1963
[12] Concawe activity report,'Formation of Sticking Concawe' 2013,p 5 available at :
https://www.concawe.eu/publication/formation-of-stichting-concawe-in-1963/

Concawe's reporting over the years frequently refers to "sound science"[13] in relation to policy making. This echoes the narrative used by the tobacco and pesticide industries to sow doubt about scientific evidence related the health impact of their products[14].

Growing consensus

Scientists have known - and written about - the risks posed by air pollutants from fossil fuels for more than 50 years.

One such risk is the inhalation of benzene by oil industry workers. The chemical was for many years used in a range of industries as a solvent. Today its sale is heavily regulated in many countries, including those in the EU. However, it remains a component of crude oil and gasoline, meaning that workers in oil extraction, refining, and distribution are still being exposed to its harmful effects. And the risks extend beyond those directly in the industry: emissions from gasoline service stations, vehicle exhausts and industrial activity mean the general population is also in harm's way, as shown by the following evidence.

The first cases of cancer linked to benzene were reported as early as 1928[15].

In 1977, the US National Institute for Occupational Safety and Health (NIOSH) conducted a landmark study on benzene exposure to workers involved in Pliofilm manufacture. Workers occupationally exposed to benzene in 1940-49 were followed for vital status up to 1975. It found evidence[16] that the exposure increased participants' risk of developing leukaemia. This led to the issuance of the first US standard on benzene occupational exposure in 1978, though this was not enforced until 1987. In 2006, the US Environmental Protection Agency stated in a report that "benzene is the most significant contributor to cancer risks from all outdoor air toxics" and limited the chemical's concentration levels in fuel[17].

In the 90s, academic studies documenting health issues linked to the inhalation of ambient air pollutants started to accumulate. This led to an important 1995 study published by the US American Cancer Society that found an association between air pollution from particulate matter and lung cancer[18].

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[13] Concawe activity report,'Formation of Stichting Concawe' 2013, 3 mentions of 'sound' basis for science on p 4 and 5, available at : https://www.concawe.eu/publication/formation-of-stichting-concawe-in-1963/
Concawe Review, 'Health Research over 50 years', 2013, reference to 'sound science in policy decision making', p 22, available at : https://www.concawe.eu/wp-content/uploads/2017/01/cr221-health_research_over_50_years-2013-00856-01-e.pdf

[14] Foucart, Stéphane, Stéphane Horel, et Sylvain Laurens. Les gardiens de la raison. Enquête sur la désinformation scientifique. La Découverte, 2020 https://www.editionsladecouverte.fr/les_gardiens_de_la_raison-9782348046155, p 44 "aux origines de la *sound science*"

[15] Delore, P. "Leucemie aigue au cours de l'intoxication benzenique. Sur l'origine toxique de certaines leucemies aigues et leurs relations avec less anemies graves." J de méd de Lyon 9 (1928): 227-233.

[16] PeterF. Infante, JosephK. Wagoner, RobertA. Rinsky, RonaldJ. Young, Leukæmia in benzene workers, The Lancet, Volume 310, Issue 8028,1977, Pages 76-78,cISSN 0140-6736, https://doi.org/10.1016/S0140-6736(77)90074-5

[17] Environmental Protection Agency, Federal register / vol. 71, no. 60 / Wednesday, 29 March, 2006 / proposed rules- control of hazardous air pollutants from mobile sources, available at : https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-control-hazardous-air-pollutants-mobile

[18] Pope CA 3rd, Thun MJ, Namboodiri MM, Dockery DW, Evans JS, Speizer FE, Heath CW Jr. Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults. Am J Respir Crit Care Med. 1995 Mar;151(3 Pt 1):669-74. doi: 10.1164/ajrccm/151.3_Pt_1.669. PMID: 7881654. Available at : https://pubmed.ncbi.nlm.nih.gov/7881654/ and https://www.atsjournals.org/doi/10.1164/ajrccm/151.3_Pt_1.669

Around the same time, and stretching into the mid-2000s, concerns about particulate matter from diesel exhausts grew. Several studies published in 2012 established that workers exposed to diesel exhaust fumes had an increased risk of developing lung cancer. One of the most notable research project was carried out on miners by the US National Cancer Institute (NCI) and NIOSH in 2012[19]; another was conducted on workers in the trucking industry and published in 2008[20].

Bert Brunekreef, Emeritus Professor of Environmental Epidemiology at the University of Utrecht, told Transport & Environment (T&E) in an interview that those studies generated an "*enormous amount of discussions on what needed to be done about long term exposure to particulate matter*".

In response to growing evidence that the use of fossil fuels was linked to cancer risks, the International Agency for Research on Cancer (IARC) launched several scientific reviews. The agency is a branch of the World Health Organization; its monographs form the basis of the most authoritative worldwide resource to identify cancer-causing substances.[21] IARC monographs are not legally binding. They are, however, viewed globally as authoritative and are frequently used to update governmental classifications and regulations that protect people's health. For instance, its new classification of glyphosate in the mid-2010s has triggered an intensive debate on the authorisation of pesticide use in the EU. Peter Infante, an epidemiologist and a former director of the office that reviews health standards at the US Occupational Safety and Health Administration, said in an interview that the IARC hosts the '*best programme in the world to identify carcinogens*'.

The agency classified benzene as a "carcinogenic to humans" pollutant in 1979[22], on the basis that it caused leukaemia. It also classified diesel exhaust as "probably carcinogenic" in 1989[23].

Then, in the 2010s, it announced its intention to launch a review of its classification of diesel emissions and to conduct its first-ever review on outdoor air pollution.

This must have immediately worried the oil industry.

Casting doubt

In the 2010s, the IARC launched two scientific reviews on the carcinogenicity of diesel exhaust and ambient air pollution. It wanted to understand whether there was sufficient evidence to raise its

[19] Silverman DT, Samanic CM, Lubin JH, Blair AE, Stewart PA, Vermeulen R, Coble JB, Rothman N, Schleiff PL, Travis WD, Ziegler RG, Wacholder S, Attfield MD. The Diesel Exhaust in Miners study: a nested case-control study of lung cancer and diesel exhaust. J Natl Cancer Inst. 2012 Jun 6;104(11):855-68. doi: 10.1093/jnci/djs034.
and Attfield MD, Schleiff PL, Lubin JH, Blair A, Stewart PA, Vermeulen R, Coble JB, Silverman DT. The Diesel Exhaust in Miners study: a cohort mortality study with emphasis on lung cancer. J Natl Cancer Inst. 2012 Jun 6;104(11):869-83. doi: 10.1093/jnci/djs035.
[20] Garshick E, Laden F, Hart JE, et al. Lung cancer and vehicle exhaust in trucking industry workers. Environ Health Perspect 2008; 116: 1327–32
[21] IARC, 2019, "IARC Monographs on the Identification of Carcinogenic Hazards to Humans", https://monographs.iarc.who.int/wp-content/uploads/2018/07/QA_ENG.pdf . Since 1971, more than 1000 agents have been evaluated.
[22] Dana Loomis, Kathryn Z Guyton, Yann Grosse, Fatiha El Ghissassi, Véronique Bouvard, Lamia Benbrahim-Tallaa, Neela Guha, Nadia Vilahur, Heidi Mattock, Kurt Straif, Carcinogenicity of benzene, The Lancet Oncology, Volume 18, Issue 12, 2017, Pages 1574-1575, ISSN 1470-2045, https://doi.org/10.1016/S1470-2045(17)30832-X. available at : https://www.sciencedirect.com/science/article/pii/S147020451730832X
[23]Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1-458. PMID: 2483415; PMCID: PMC7681614.

classification from “probably carcinogenic to humans” to “carcinogenic to humans” - the highest category in the institution’s ranking.

Documents, an analysis of academic studies’ funding disclosure, as well as interviews with academics from inside and outside the IARC, suggest that Concawe participated in an industry campaign to influence the review and block the strengthening of the classification.

The oil industry-backed research group secured observer status for meetings of the 24 independent academics who formed the working group tasked by the IARC with reviewing and voting on the solidity of the scientific evidence[24].

In June 2012, a consultant named John Gamble - a former epidemiologist for Exxon[25] - attended the IARC working group meetings on the carcinogenicity of diesel exhaust on, among others, Concawe’s behalf[26]. Indeed, he was representing a coalition of several industries, gathered under the umbrella of the “IARC review stakeholder group”, which included Concawe as well as the US oil industry lobby association (American Petroleum Institute), other European and US trade associations representing the automotive sector such as ACEA (European Automobile Manufacturers Association), and the US EMA (Truck and Engine Manufacturers of America)[27]. Moreover, John Gamble disclosed receiving “significant research funding” from Concawe to the IARC at the time[28].

One way that Concawe appears to have tried to influence the IARC’s review was to fund him and other consultants to publish critical reviews of the literature in scientific journals prior to the working group’s meetings.

In 2010, John Gamble published his first critical review on the evidence of carcinogenicity of diesel exhaust in what several independent academics consider to be an industry-friendly academic journal. The review concluded that “*support(ing) a traditional diesel exhaust–lung cancer hypothesis requires more studies*”[29]. The author disclosed that the study received financial support from Concawe[30].

[24] IARC Monograph 105 Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1–458, p6

[25] Gamble J. Lung cancer and diesel exhaust: a critical review of the occupational epidemiology literature. Crit Rev Toxicol. 2010 Mar;40(3):189-244. doi: 10.3109/10408440903352818. PMID: 20156057. Available at : https://pubmed.ncbi.nlm.nih.gov/20156057/ - Declaration of interest section

[26] IARC Monograph 105 Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1–458, p6

[27] IARC Monograph 105 Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1–458. – section on disclosure of Observer conflicts of interest, p 6

[28] IARC Monograph 105 Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1–458. – section on disclosure of Observer conflicts of interest, p 6

[29] Gamble J. Lung cancer and diesel exhaust: a critical review of the occupational epidemiology literature. Crit Rev Toxicol. 2010 Mar;40(3):189-244. doi: 10.3109/10408440903352818. PMID: 20156057.doi: 10.1093/annhyg/meq022. Available at : https://pubmed.ncbi.nlm.nih.gov/20156057/ - Abstract

[30] Gamble J. Lung cancer and diesel exhaust: a critical review of the occupational epidemiology literature. Crit Rev Toxicol. 2010 Mar;40(3):189-244. doi: 10.3109/10408440903352818. PMID: 20156057.doi: 10.1093/annhyg/meq022. Available at : https://pubmed.ncbi.nlm.nih.gov/20156057/ - Declaration of interest section

Then, a few days prior to attending the IARC working group meetings as an industry observer[31], John Gamble published another literature review[32] in which he highlighted limitations in several prominent academic studies on the link between lung cancer and diesel exhaust, including the 2012 US NCI/NIOSH study on miners[33]. The paper, published in the same previously referenced industry-friendly journal, states that *"the weight of evidence is considered inadequate to confirm the diesel-lung cancer hypothesis*"[34].

The article's conflict of interest section disclosed that both John Gamble and another co-author received financial support from Concawe for their work on the review. They were also both formerly employed by ExxonMobil[35]. Another co-author, a well-known university professor and former IARC director named Paolo Boffetta, disclosed funding from the Mining Awareness Resource Group (MARG), which is a lobby group representing the mining industry in the US.[36]

According to a scientist within the IARC monograph programme at the time, John Gamble raised the same criticisms regarding studies showing association between lung cancer and diesel exhaust during the IARC working group meetings.

These objections were in vain: in June 2012 the IARC working group established that there was "sufficient evidence" for the carcinogenicity of diesel-engine exhaust and strengthened its classification of the substance as "carcinogenic to humans"[37]. Commenting on the claims from the literature reviews sponsored by the oil industry, a scientist within the IARC monograph programme told T&E: "*Each study's limitations are considered carefully by the working group*" but that "*the totality of evidence showed there was sufficient evidence that diesel exhaust was carcinogenic to humans".* According to him, the pieces of research decried by the oil industry-backed coalition were among "*the most informative*" studies in guiding the working group's decision.

George Thurston, Professor of Medicine and Population Health at the NYU School of Medicine, also considers that further academic work has shown since 2012 how '*robus*t' the NCI/NIOSH miners studies actually were, despite critiques by Gamble & al. He considers the literature review sponsored by the oil industry to be' *an outdated and incomplete review of the state of knowledge on the diesel exhaust literature*'.

In response to our questions, Paolo Boffetta stated that they *"interpreted some critical pieces of the epidemiologic evidence on the association between diesel exhaust and lung cancer in a different way*

[31] The meetings of the IARC working group on the evaluation of carcinogenic risks related to diesel and gasoline engine exhaust were on June 5-12 2012. source : IARC Monograph 105 Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1–458, p3

[32] John F. Gamble, Mark J. Nicolich & Paolo Boffetta (2012) Lung cancer and diesel exhaust: an updated critical review of the occupational epidemiology literature, Critical Reviews in Toxicology, 42:7, 549-598, DOI: 10.3109/10408444.2012.690725, available at: https://www.tandfonline.com/doi/full/10.3109/10408444.2012.690725 Received 22 Mar 2012 Accepted 01 May 2012, Published online: 02 Jun 2012

[33] ibid, section on "NCI/NIOSH Studies of non-metal miners exposed to diesel exhaust (Attfield et al., 2012; CitationSilverman et al., 2012)"

[34] ibid, Abstract

[35] ibid, Declaration of interest section

[36] ibid

[37] IARC Monograph 105 Diesel and gasoline engine exhausts and some nitroarenes. IARC Monogr Eval Carcinog Risks Hum. 1989;46:1–458, p 467

compared to the IARC Expert Group". He denies that *"MARG and other companies had (a) role in any aspect of the research"* and considers that *"good-faith disagreement is a key component in the advancement of science"*.

Mr Gamble did not respond to our request for comment.

Nevertheless, critiques of the robustness of the association between lung cancer and diesel exhaust did not stop after the IARC published its new classification. In July 2012, John Gamble published a fierce critique of the IARC monograph in the form of an editorial[38] published in the Journal of Clinical Toxicology, stating that: "*Sometimes IARC conclusions that are based on epidemiology have been controversial, if not mistaken or misinterpreted".* He also insisted that *"The recent IARC conclusion on diesel engine exhaust is likely to be controversial as it is based on potentially incorrect interpretations of major studies because of limitations in the scientific assessment".*[39]

The editorial also outlined several proposed modifications to the monograph governance regarding conflict of interest with industry, highlighting how '*opinions should be judged on factual accuracy and logic rather than source*' and that '*closed process that does not encourage open scientific debate or alternative viewpoints*'. He later goes on, calling for '*everybody'* to be able to *'provide comments to the final draft monographs*'[40] , a privilege which he did not hold when he was an industry observer. Other industries, such as the American Chemistry Council, also later attempted to amend IARC conflict of interest rules to allow more room for observers[41].

The IARC did not modify its guidelines related to industry observers' roles, which state that they can provide comments during meetings but can't participate in the drafting and voting process of the scientific review[42].

Letters sent by the IARC to the editor of the scientific journal which published John Gamble's editorial accessed by T&E also show that the WHO Cancer Agency referred to "*numerous errors of facts"* made by the author in his editorial, "*which* [it] *refrain*[ed] *from detailing"*.

[38]Gamble JF (2012) IARC Evaluations of Cancer Hazards: Comment on the Process with Specific Examples from Volume 105 on Diesel Engine Exhaust. J Clinic Toxicol 2:e106., available at : https://www.longdom.org/open-access/iarc-evaluations-of-cancer-hazards-comment-on-the-process-withspecific-examples-from-volume-105-on-diesel-engine-exhaust-48288.html
the editorial was received on July 24, 2012; Accepted on July 25, 2012; and Published on July 27, 2012
[39] ibid
[40] ibid
[41] Public comments on IARC Preambule, 2018, Available at: https://Monographs.iarc.fr/wp-content/uploads/2018/11/Preamble_PublicComments.pdf
[42] IARC website, Guidelines for Observers at IARC Monographs Meetings, available at : https://monographs.iarc.who.int/guidelines-for-observers-at-iarc-monographs-meetings/

I am writing with reference to the Editorial entitled "IARC Evaluations of Cancer Hazards: Comment on the Process with Specific Examples from Volume 105 on Diesel Engine Exhaust" by John F Gamble, published in the *Journal of Clinical Toxicology* on 27 July, 2012 (*J Clinic Toxicol* 2012, 2: e106; doi: 10.4172/2161-0495.1000e106).

When this Editorial was published, the author's affiliation was incorrectly stated as "IARC Scientific Advisory Committee". Because John Gamble has never served on a scientific advisory committee of IARC and has no affiliation at all with the organization, we notified the Editor-in-Chief of the *Journal of Clinical Toxicology*, Professor Ken Ichiro Inoue. Dr Kurt Straif, Head of the IARC Monographs Section, sent an email to Professor Inoue on 5 October, 2012, informing him that the affiliation was wholly misleading and required a full and explicit correction as a matter of urgency. Dr Straif included the text of a correction to be published and to be linked to the Editorial, and stated that "a simple correction of the online article will not suffice".

Dr Gamble's Editorial contains numerous errors of fact, but we refrain from detailing these.

Documents accessed by T&E also suggest that another member of the industry coalition represented by John Gamble tried to influence the working group's evaluation. In a letter sent to the IARC in January 2012, the Truck and Engine Manufacturers of America (EMA) lobby group highlighted what it called '*a major flaw in the key assumption*' in an exposure study[43] done as part of the same research project conducted by the US NCI/NIOSH on Miners about exposure to diesel exhaust -which was also criticized by the consultants funded by Concawe- contending that they would not be "*scientifically valid"*. The letter also included references to several already-published papers, as well as some that were soon to be published by "*colleagues*" within the trucking industry, requesting the IARC to share

[43]Stewart PA, Coble JB, Vermeulen R, Schleiff P, Blair A, Lubin J, Attfield M, Silverman DT. The diesel exhaust in miners study: I. Overview of the exposure assessment process. Ann Occup Hyg. 2010 Oct;54(7):728-46. Available at : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2953554/

them with the working group.

> Significantly, Dr. [redacted] and colleagues are currently working on an additional paper analyzing the correlation between diesel engine PM and CO emissions utilizing a very broad range of emissions data sets. An abstract of that paper, which we anticipate will be published as an SAE technical paper within the next two months, also is attached for your reference. We will send you a copy of the final published report as soon as we can. As with the prior published papers, this pending work confirms that there is no reliable CO/PM correlation among different engines, and certainly no correlation of the type assumed by NIOSH/NCI. This is extremely significant, because if the NIOSH/NCI exposure estimation methodology is fundamentally flawed and invalid, which it clearly appears to be, then so too are the epidemiology results that are based on that methodology. Stated differently, if there is no reliable correlation between CO and PM emissions (expressed as REC) from diesel equipment in mines, the results and interpretation of any epidemiology study relying on REC levels, estimated from CO measurements, as an index of exposure will not be scientifically valid.
>
> Please forward this letter and the attached peer-reviewed papers and abstract to the IARC Working Group as soon as possible, as we understand that work has already begun on Monograph Volume 105, and this information is critically important to ensuring that the Working Group is able to make a fair and objective assessment of the "Diesel Exhaust in Miners Study."

This attempt was unsuccessful and did not prevent the IARC from strengthening its classification of the carcinogenicity of diesel-engine exhaust either in June 2012 .

Subsequently, in 2013, another IARC working group unanimously classified outdoor air pollution and particulate matter from outdoor air pollution as "carcinogenic to humans"[44].

This time, five years later, in 2018, Concawe published a report[45] on its website rebutting the review.

This was prepared by three other consultants, who were sent as observers on Concawe's behalf at the time of the IARC monograph preparation[46], and subsequently concluded that "*better studies are needed to provide a more helpful conclusion for understanding risk than the IARC evaluation that PM [Particulate Matter] is carcinogenic to humans*."[47] This assessment was based on a review of "*the strengths and limitations"*[48] of the scientific literature on air pollution and cancer highlighting that confounding factors such as smoking may have affected the results.

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[44] Outdoor Air Pollution, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 109

[45] Concawe, Air Pollution and Lung Cancer: A Review of Issues Affecting the Interpretation of the Epidemiological Literature , 2018 available at: https://www.concawe.eu/wp-content/uploads/Rpt_18-15.pdf

[46]John Andrew Tomenson G. Bruce Copley and David Morgot were listed as Observer for Concawe in Monograph 108. It was also acknowledged that 'their participation was sponsored by Concawe'. A Utrecht University researcher, Gerard Hoek, holding and 'invited specialist' status, also disclosed received significant research funding from Concawe
source: Outdoor Air Pollution, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 109, p 6 and 7 available at : https://publications.iarc.fr/

[47]Concawe, Air Pollution and Lung Cancer: A Review of Issues Affecting the Interpretation of the Epidemiological Literature , 2018 available at: https://www.concawe.eu/wp-content/uploads/Rpt_18-15.pdf p VII

[48] ibid, p V

Ebba Malmqvist, Associate Professor in the Division of Occupational and Environmental Medicine at Lund University, said in an interview that those allegations were unfounded: "*All studies have flaws and it is the weight of evidence that matters - that you see similar results in each study.*"

Of Concawe's 2018 review, Malmqvist says the organisation "*ignored the sum of evidence on the carcinogenicity of air pollution".*

She and other scientists told T&E that industry-sponsored research was used strategically to delay regulators by suggesting that uncertainty remained in the science about oil products' carcinogenicity. The suggestion was that this uncertainty meant regulatory measures to protect people's health did not need to be upheld.

Despite not succeeding in undermining the 2012 and 2013 IARC monographs[49], it appears that Concawe has continued to use the same *modus operandi* more recently to prevent EU regulators from increasing workers' protection against the cancer risks posed by benzene.

Concawe vs the EU

The industrial use of benzene has decreased worldwide and in the EU since its carcinogenic properties became widely publicised. Sales, the level of concentration in fuel, and ambient and occupational exposure have all been regulated.

As a result, both outdoor air concentrations[50] and occupational exposure levels[51] have declined significantly in Europe since the year 2000. However, it remains an ubiquitous pollutant which is present in, among others, the petroleum and refining industries, as well as in the distribution of petroleum products[52].

Six years ago, the EU laid the groundwork for the revision of benzene occupational limits[53], in a bid to strengthen protection for workers. At the time and up until now, industries had to comply with an

[49] For Monograph 105 on diesel exhaust, the IARC working group met in June 2012. For Monograph 109 on air pollution, the IARC working group met in October 2013.

[50] IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume. Benzene, volume 120, 2018, p 70 "> 70% decline during 2000–2014 period", available at : https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Benzene-2018

[51] European Commission, Impact Assessment Accompanying the document Proposal for a Directive Of The European Parliament And Of the Council amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, 22.9.2020; p 30

[52] IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 120 on Benzene, 2018,p 43 :available at : https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Benzene-2018,

[53] "In 2017, the Commission carried out a two-stage consultation to collect social partners' opinions on the possible direction and content of EU action regarding the establishment and/or revision of binding OELs " source : European Commission, 2020, Proposal for a Directive Of The European Parliament And Of the Council amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work.available at : https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020PC0571

average exposure limit of 1 parts per million (ppm)[54], roughly around the same levels proposed in the US following the release of the 1977 NIOSH study and which have been implemented since 1987[55].

Documents show that Concawe authored and funded several studies to support an active behind the scenes lobbying campaign against the EU's proposed limit revisions.

E-mails exchanges and documents accessed by T&E show that Concawe first tried to influence the scientific review done by the Risk Assessment Committee (RAC) of the European Chemicals Agency (ECHA), in support of the drafting of a proposal for new occupational limits, based on the latest scientific evidence.

From: [redacted] concawe.org]
Sent: 27 June 2017 17:55
To: [redacted] echa.europa.eu>
Cc: [redacted] @concawe.org>; [redacted] concawe.org>
Subject: Concawe activities on Benzene

Dear [redacted]

[redacted], who you have spoken to at the member state committee meeting a couple of weeks ago, has given me your email address to contact you about Benzene.
I understand that you are working on a report on Benzene that will be discussed at the RAC in September.

In an email sent to ECHA in June 2017, Concawe refers to a research project it launched to perform a "*reanalysis of data"* aimed at "*addressing the ongoing low dose benzene debate"*. By that time a range of academic studies by independent researchers had shown an increased risk of benzene exposure at lower average exposure limits than the ones currently in place in the EU and the US; that is, below 1 ppm. Most notably, the US National Cancer Institute reported increased risks of leukaemia around an average 1 ppm exposure level in 1997[56], and at lower than an average 1 ppm exposure levels in 2004[57].

[54] An EU average 1 ppm limit prevails until 2024. Measured or calculated in relation to a reference period of eight hours time-weighted average (TWA).Source: Directive (EU) 2022/431 of the European Parliament and of the Council of 9 March 2022 amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, Annex III, point A, available at : https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022L0431
[55]US Department of Labor, Occupational Safety and Health Administration, 1987 https://www.osha.gov/laws-regs/federalregister/1987-09-11
[56]California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Public Health Goal for Benzene In Drinking Water, 2001, p 85 "The Pliofilm Cohort and the Chinese Worker Cohort, suggest a linear relationship at low doses. Indeed, in the Chinese Worker Cohort elevated excess risk of leukaemia was observed at an average concentration of 1.2 ppm.", available at : https://oehha.ca.gov/media/downloads/water/chemicals/phg/benzenefinphg.pdf
Original study : Hayes RB, Yin SN, Dosemeci M, Li GL, Wacholder S, Travis LB, Li CY, Rothman N, Hoover RN, Linet MS. Benzene and the dose-related incidence of hematologic neoplasms in China. Chinese Academy of Preventive Medicine--National Cancer Institute Benzene Study Group. J Natl Cancer Inst. 1997 Jul 16;89(14):1065-71. doi: 10.1093/jnci/89.14.1065. PMID: 9230889.
[57] Lan Q, Zhang L, Li G, Vermeulen R, Weinberg RS, Dosemeci M, Rappaport SM, Shen M, Alter BP, Wu Y, Kopp W, Waidyanatha S, Rabkin C, Guo W, Chanock S, Hayes RB, Linet M, Kim S, Yin S, Rothman N, Smith MT. Hematotoxicity in workers exposed to low levels of benzene. Science. 2004 Dec 3;306(5702):1774-6. doi: 10.1126/science.1102443. PMID: 15576619; PMCID: PMC1256034.

Those findings were confirmed by studies done in the EU on Norwegian workers in 2008[58] and 2015[59]. Studies had also shown that the risks posed at very low levels of exposure may have been underestimated due to the way benzene metabolises[60]. The potential underestimation of risks at low exposure levels was recognised in a ruling from the US Environmental Protection Agency in 2007[61].

The outcome of the research project commissioned by Concawe and referred to by email sent to the ECHA, would on the contrary, clearly undermine all of the above findings.

Authors of the research papers[62] and opinion paper[63] referred to in the email, and published in the Journal of Chemico-Biological Interactions, included Concawe executives[64] and consultants from research firms Cox Associates and the UK Health & Safety Laboratory, which both received funding

[58] Kirkeleit J, Riise T, Bråtveit M, Moen BE. Increased risk of acute myelogenous leukaemia and multiple myeloma in a historical cohort of upstream petroleum workers exposed to crude oil. Cancer Causes Control. 2008 Feb;19(1):13-23. doi: 10.1007/s10552-007-9065-x. Epub 2007 Sep 29. PMID: 17906934.

[59] IARC benzene monograph 120, p 130 extract "The Working Group noted the very low levels of exposure in these workers: the upper values of average intensity and cumulative exposure were estimated to be 0.040 ppm and 0.948 ppm-years, respectively" available at :
https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Benzene-2018
In reference to the study : Stenehjem JS, Kjærheim K, Bråtveit M, Samuelsen SO, Barone-Adesi F, Rothman N, Lan Q, Grimsrud TK. Benzene exposure and risk of lymphohaematopoietic cancers in 25 000 offshore oil industry workers. Br J Cancer. 2015 Apr 28;112(9):1603-12. doi: 10.1038/bjc.2015.108. Epub 2015 Mar 24. Erratum in: Br J Cancer. 2015 Dec 1;113(11):1641. PMID: 25867262; PMCID: PMC4453669.

[60] Rappaport SM, Kim S, Lan Q, et al. Evidence that humans metabolize benzene via two pathways. Environ Health Perspect 2009;117(6):946-52. doi: 10.1289/ehp.0800510
Rappaport SM, Kim S, Lan Q, et al. Human benzene metabolism following occupational and environmental exposures. Chem Biol Interact 2010;184(1-2):189-95. doi: 10.1016/j.cbi.2009.12.017

[61] US Environmental Protection Agency, Control of Hazardous Air Pollutants From Mobile Sources, Final Rule, 2007, p 8436: "Because there is a transition from linear to saturable metabolism below 1 ppm, the assumption of low-dose linearity extrapolated from much higher exposures could lead to substantial underestimation of leukaemia risks."
Available at: https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-control-hazardous-air-pollutants-mobile

[62] K. McNally, C. Sams, G.D. Loizou, K. Jones, Evidence for non-linear metabolism at low benzene exposures? A reanalysis of data, Chemico-Biological Interactions, Volume 278, 2017, Pages 256-268, ISSN 0009-2797, https://doi.org/10.1016/j.cbi.2017.09.002. Available at : https://www.sciencedirect.com/science/article/pii/S0009279717304933
Louis A. Cox, A. Robert Schnatter, Peter J. Boogaard, Marcy Banton, Hans B. Ketelslegers, Non-parametric estimation of low-concentration benzene metabolism, Chemico-Biological Interactions, Volume 278, 2017, Pages 242-255, ISSN 0009-2797, https://doi.org/10.1016/j.cbi.2017.08.007. Available at:
https://www.sciencedirect.com/science/article/pii/S0009279717304957?via%3Dihub

[63] Peter J. Boogaard, The low-dose benzene debate needs a sharp blade, Chemico-Biological Interactions, Volume 278, 2017, Pages 239-241, ISSN 0009-2797, https://doi.org/10.1016/j.cbi.2017.06.023. Available at :
https://www.sciencedirect.com/science/article/pii/S0009279717305100?via%3Dihub

[64] Dr Peter Boogaard chaired Concawe's Toxicology Subgroup
from: Concawe, The low-dose benzene debate needs a sharp blade, 2017 p 22, available at:https://www.concawe.eu/wp-content/uploads/2018/02/The-low-dose-benzene-debate.pdf
Hans B. Ketelslegers was a Concawe's Science Executive from June 2015 to March 2019 according to his Linkedin Profile https://www.linkedin.com/in/hansketelslegers/?originalSubdomain=be

from the oil industry, directly or in support of research projects[65]. Their conclusions, based on a reanalysis of a 2008 study authored by Dr Stephen M. Rappaport, an Emeritus Professor of Environmental Health at Berkeley on benzene metabolism concluded that there was no "*increased hazard from benzene at decreased exposure levels*"[66] . Another study[67] funded by Concawe on benzene in 2012 supported the claim that "*existing regulatory standards for benzene, such as occupational exposure limits, are already sufficient to protect worker health for benzene-related leukaemias",* according to the group's own reporting.[68]

Rappaport told T&E those conclusions were flawed, saying they were based on "*an exclusion of critical data which made it impossible for them to observe the low-dose behaviour".*

Concawe was echoing a much earlier stance on the subject of benzene exposure, according to Peter Infante, the former director of the office that reviews health standards at the US Occupational Safety and Health Administration who authored the groundbreaking 1977 US study referred to earlier in this investigation.

Infante says: "*After 1977, the industry argued that benzene caused leukaemia but at high exposure levels only. They paid consultants to produce risk assessments that would show much lower risks of leukaemia at low benzene exposure levels. This was so government regulatory agencies would not lower exposure levels mostly in the general environment.*"

Concawe's article was referenced in the literature review that the ECHA included in its 2017 proposal[69]. But it failed to influence the recommendation: the ECHA suggested that the EU implement an average 0.1 ppm limit[70]. In March 2018, the ECHA's RAC suggested a 0.05ppm limit, based on a review of the scientific literature[71].

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[65] Louis A. Cox, A. Robert Schnatter, Peter J. Boogaard, Marcy Banton, Hans B. Ketelslegers, Non-parametric estimation of low-concentration benzene metabolism, Chemico-Biological Interactions, Volume 278, 2017, Pages 242-255, ISSN 0009-2797, https://doi.org/10.1016/j.cbi.2017.08.007.
Declaration of interest section 'Over the past five years, Cox Associates has received funding from the United States Environmental Protection Agency (US EPA), the American Petroleum Institute (API) and the American Chemistry Council (ACC) and their members to analyze exposure-response relationships and causality"
Available at: https://www.sciencedirect.com/science/article/pii/S0009279717304957?via%3Dihub
and
K. McNally, C. Sams, G.D. Loizou, K. Jones, Evidence for non-linear metabolism at low benzene exposures? A reanalysis of data, Chemico-Biological Interactions, Volume 278, 2017, Pages 256-268, ISSN 0009-2797, https://doi.org/10.1016/j.cbi.2017.09.002. " This paper and the work it describes was funded by Concawe (the scientific division of the European Petroleum Refiners Association) Available at : https://www.sciencedirect.com/science/article/pii/S0009279717304933

[66] Concawe, The low-dose benzene debate needs a sharp blade, 2017 p 22, available at: https://www.concawe.eu/wp-content/uploads/2018/02/The-low-dose-benzene-debate.pdf

[67] Schnatter, R.A., Glass, D.C., Tang, G., Irons, R.D., Rushton, L., 2012. Myelodysplastic Syndrome and Benzene Exposure Among Petroleum Workers: An International Pooled Analysis. Journal of the National Cancer Institute: DOI 10.1093/jnci/djs411. Available at: jnci.oxfordjournals.org/content/104/22/1724.full.pdf+html

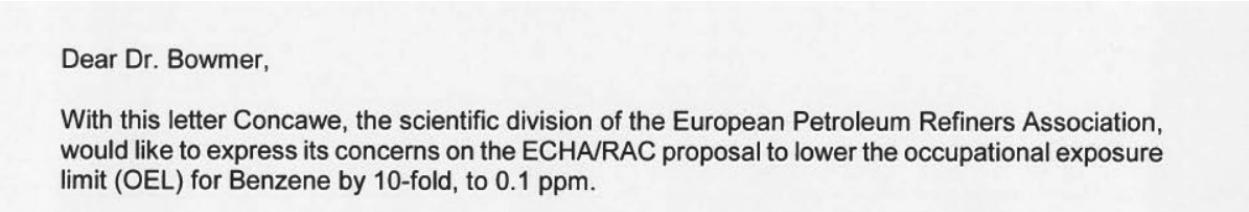
[68] Concawe,A new 'pooled' analysis of benzene effects on human health, 2012, p 19, available at: https://www.concawe.eu/wp-content/uploads/2017/01/cr212-bz_pooled_analysis-2013-00214-01-e.pdf

[69] Proposal by the European Chemical Agency (ECHA) in support of occupational exposure limit values for benzene in the workplace, October 2017, p 124

[70] ibid, p 117

[71] European Chemical Agency, Committee for Risk Assessment RAC, Opinion on scientific evaluation of occupational

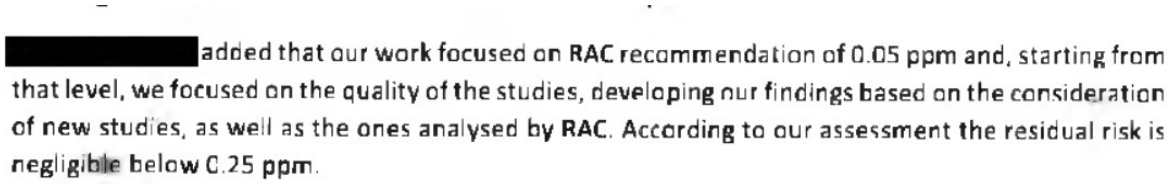
Concawe objected vehemently to the proposed limits. In a letter sent in November 2017 to the ECHA's RAC chairman, it "*express(ed) concerns*" about "*the proposal to lower the occupational exposure limit for benzene*", highlighting "*new scientific evidence, shared with RAC OEL working group, does not support the value proposed by RAC which we consider to be overly conservative and scientifically unjustified*".



Dear Dr. Bowmer,

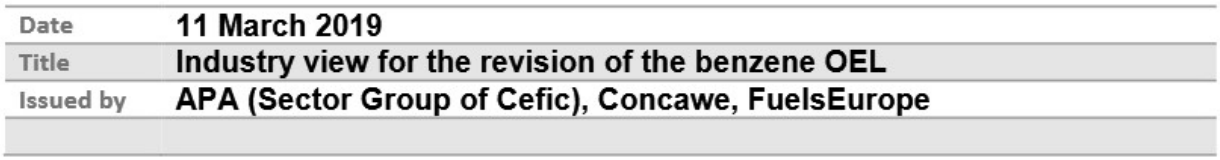
With this letter Concawe, the scientific division of the European Petroleum Refiners Association, would like to express its concerns on the ECHA/RAC proposal to lower the occupational exposure limit (OEL) for Benzene by 10-fold, to 0.1 ppm.

In the minutes of an April 2019 meeting between Concawe and representatives from the Directorate-General for Employment, Social Affairs and Inclusion, a body of the European Commission in charge of drafting legislative proposals related to workers[72], Concawe refers to an analysis of the "*quality of the studies*" used by the RAC, suggesting a *"residual risk negligible below 0.25 ppm"* for workers and "*supporting an Occupational Exposure Limit of 0.5 ppm*" - about 10 times higher than the RAC's proposed limit.



[redacted] added that our work focused on RAC recommendation of 0.05 ppm and, starting from that level, we focused on the quality of the studies, developing our findings based on the consideration of new studies, as well as the ones analysed by RAC. According to our assessment the residual risk is negligible below 0.25 ppm.

T&E has accessed position papers prepared by Fuels Europe, Concawe, and Petrochemicals Europe (Cefic) in March 2019 which show that those exposure levels were put forward as the industry's preferred limit. The paper advocates for a 0.5ppm limit in the short term (three years) and a 0.25 ppm limit thereafter.



Date	**11 March 2019**
Title	**Industry view for the revision of the benzene OEL**
Issued by	**APA (Sector Group of Cefic), Concawe, FuelsEurope**

exposure limits for Benzene, Adopted 9 March 2018, available at: https://www.echa.europa.eu/-/committee-for-risk-assessment-recommends-an-occupational-exposure-limit-for-benzene#:~:text=RAC%20is%20of%20the%20opinion,as%20other%20adverse%20health%20effects.

[72]European Commission, Impact Assessment Accompanying the document Proposal for a Directive of The European Parliament and of the Council amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, 22.9.2020; p 34 provides full details of legislative process on the revision of Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work.

As an outcome of these assessments, Industry suggest taking a stepwise approach in revising the current OEL:

- Short term (< 3 years): implement an EU-wide OEL of 0.5 ppm
- Medium term (5-7 years): implement an EU-wide OEL of 0.25 ppm

Such an approach ensures that workers' health is adequately protected at the same time keeping it workable for industry to implement the necessary measures.

According to Peter Infante, the industry assessment of "safe exposure" levels is misleading: "*Studies have shown significant risks of cancer below that level*". Going further, he and other academics consider that "*There are no safe exposure levels for benzene for workers.*" This is in line with the industry's own position in 1948, when the American Petroleum Institution concluded that "*the only safe concentration for benzene is zero*".[73] The Risk Assessment Committee of the ECHA, on the other hand, suggested in 2018 that an average exposure level of 0.05 ppm '*can be considered to be associated with no significant residual cancer risk*". [74]

Ultimately, in 2022 EU institutions agreed on a final regulatory threshold not too far from the industry position, setting up an interim target of 0.5 ppm from April 2024 to 2026 and a final target of 0.2 ppm thereafter[75]. These numbers were based on a proposal agreed on unanimously by a tripartite body composed of trade unions, representatives of the industry, and EU member states[76]. Sources close to the file say that Business Europe, the European pan-industry lobby group, was formally representing employer organisations within the tripartite body, which however encompassed other industry bodies[77] including a consultant close to the petroleum and chemical industry.

According to Dr Tony Musu, who represented the trade union ETUI at the meetings "*the adopted limits were a compromise between the health benefits and the cost to the industry*". This is confirmed by extracts from an impact assessment done by the European Commission that states: "*Option 3 [0.2*

[73] Center for Public Integrity, 2014 https://publicintegrity.org/environment/benzene-and-worker-cancers-an-american-tragedy/, original documents accessible on: https://embed.documentcloud.org/documents/237602 31-api_1948_benzene_ocrpdf#document/p4

[74]European Chemical Agency, Committee for Risk Assessment, Committee for Risk Assessment, Opinion on scientific evaluation of occupational exposure limits for Benzene, 9 March 2018,p 12, available at : https://echa.europa.eu/documents/10162/4fec9aac-9ed5-2aae-7b70-5226705358c7

[75] Directive (EU) 2022/431 of The European Parliament and of The Council of 9 March 2022 amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, Annex III, point A: for benzene, limit value of 0,2 ppm (*Measured or calculated in relation to a reference period of eight hours time-weighted average (TWA)*) transitional measures :"Limit value 1 ppm (3,25 mg/m3) until 5 April 2024. Limit value 0,5 ppm (1,65 mg/m3) from 5 April 2024 until 5 April 2026". available at : https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022L0431

[76]European Commission, The Advisory Committee on Safety and Health at Work, Opinion on an EU Binding Occupational Exposure Limit Value (BOEL) for Benzene under the Carcinogens and Mutagens Directive 2004/37/EC., adopted on 04/06/2019 available on: circabc.europa.eu

[77] The Advisory Committee on Safety and Health at Work encompasses a Governmental Interest Group, a Worker Interest Group, and an Employer Interest Group source: https://www.baua.de/EN/Tasks/Research/Cooperations/ACSH.html

ppm] has been considered as the most balanced option between adequate protection of workers at the EU level and prevention of closure and other severe disadvantages for the industries."[78]

According to estimates from the same report, at least 99 additional cases of leukemias and 79 additional deaths are likely to happen in the next 60 years because of the discrepancy between the adopted limits and the ones proposed by ECHA' scientific committee[79]. Tighter limits would have only entailed a cost equivalent to 0.17% of the industry turnover, according to the same document.

[78] European Commission, Impact Assessment Accompanying the document Proposal for a Directive of the European Parliament and of the Council amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, 22.9.2020; p 38

[79] Ibid. Differences in 'reduction in cases' of leukemia between a 0.05ppm threshold and 0.2 ppm threshold. This number doesn't take into account the 2 years interim value of 0.5 ppm. from Extract from table 11 'multi-criteria analysis on benzene" p 33/34 The number of estimated deaths has been computed using the European Commission 'estimate of current and future burden of disease', i.e, a mortality rate of 80% for leukaemia. P 31 in the European Commission's impact assessment report source : European Commission, IMPACT ASSESSMENT Accompanying the document Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, 22.9.2020;

Impact	Stakeholders affected	OEL options		
		Option 2 0.05 ppm	Option 3 0.2 ppm (ACSH)	Option 4 0.5 ppm (ACSH transitional value)
Economic impacts				
Compliance costs (one-off and recurrent)	Companies	€23,526 million	€7,610 million	€884 million
Compliance costs (one-off)	Companies	€11,329 million	2,461 million	€740 million
Compliance costs (recurrent)	Companies	€12,197 million	5,149 million	144 million
Annualised compliance costs in % of turnover*	Companies	0.17%	0.07%	0.01%
Administrative costs	Public sector	€0.3 million	€0.3 million	€0.3 million
Avoided costs**	Companies	€3 million	€2 million	€1 million
Avoided costs***	Public sector	€3.8 million	€2.5 million	€1.2 million
Single market: competition	No. of company closures	The foundry sector could see closures	No closures	No closures
Single-market: consumers	Consumers	Limited impacts expected - small price increase for fuels		
Single market: internal market	Companies	Limited impacts expected as the currently even competition between EU companies will continue. Only a few Member States (MS) have OELVs lower than current EU value and will face lower costs.		
International competitiveness	Companies	Limited impacts - only foundries could face lower competitiveness	No impacts	No impacts
Specific MSs/regions	MSs that would have to change OELs	All MS	All MS except NL	All MS except five MS****
Social impacts				
Reduction in cases (leukaemia cancer)	Workers & families	281	182	88
Reduction in cases (leukocytopenia)	Workers & families	233	189	103
Avoided costs of ill health, incl. intangible costs*****	Workers & families	€186 - 305 million	€121 - 198 million	€59 - 96 million
Employment	Jobs lost	Few	0	0
	Social cost	No quantification	€0	€0
Environmental impacts				
Environmental releases	Environment	Small positive impact of reduced fugitive and diffuse emissions		
Recycling – loss of business	Recycling companies	No impact expected		

Average exposure levels at workplaces in Europe remain below 0.1ppm, according to official estimates. However, they differ widely amongst sectors and highly depend on specific tasks performed. High exposure levels have been reported notably during maintenance work in refineries or at gasoline pump and during tank cleaning work in the petroleum industry[80].

[80] European Chemical Agency, Committee for Risk Assessment, Committee for Risk Assessment, Opinion on scientific evaluation of occupational exposure limits for Benzene, 9 March 2018, p11 available at : https://echa.europa.eu/documents/10162/4fec9aac-9ed5-2aae-7b70-5226705358c7

The true human cost of not following scientific recommendations for benzene is, however, hard to establish with certainty. Extracts of a consultant report done in preparation for the European Commission impact assessment and accessed by T&E recognised that the estimate of leukaemia cases and thus the health benefits due to lower limits may have been "*underestimated*". The report quotes other estimates provided by a report done by trade union ETUI, as well as another commissioned by insurance companies, which showed an increase of the number of leukaemia cases by a factor of 6 and 10 respectively. According to a source within the European Parliament close to the political negotiations on the new regulation at the time, "*Impact assessments done by the European Commission tend to be pro-business and quite conservative from a health point of view.*"

Concawe did not respond to our request for comment.

Today, one million workers remain exposed to benzene in Europe[81]. As Peter Infante puts it: "*Workers are currently not sufficiently protected against benzene's risks by any government standards.*"

Lead author: Agathe Bounfour

Editor responsible : William Todts

[81] European Commission, Impact Assessment Accompanying the document Proposal for a Directive of the European Parliament and of the Council amending Directive 2004/37/EC on the protection of workers from the risks related to exposure to carcinogens or mutagens at work, 22.9.2020; p 30