International Carbon Black Association

"Statement Regarding the Presence of Polycyclic Aromatic Hydrocarbons (PAH) in Carbon Black"

Industrially manufactured Carbon Black is produced by pyrolysis of hydrocarbons at high temperatures under controlled process conditions. This results in the formation of unavoidable trace levels of organic impurities, such as PAHs. These impurities are firmly bound to the Carbon Black surface under normal handling and use.

Investigations at the University of Düsseldorf demonstrated that PAHs adsorbed onto the Carbon Black surface are not "bioavailable"[1)]. The purpose of the study was to determine if body fluids would leach PAHs from the Carbon Black surface, where the PAHs could interact with tissue. The study found that the PAHs were not leached by artificial lung fluid from the Carbon Black surface.

Another study performed at Münster Analytical Solutions demonstrated that PAHs coming from Carbon Black, once incorporated into a rubber matrix, were not migrating to aqueous simulants representing typical human or environmental liquids like sweat, saliva or rainwater[2)]. These results were subsequently confirmed by Bergmann et al.[3)].

Those PAHs can only be extracted from the surface of the Carbon Black itself under vigorous laboratory conditions such as Soxhlet extraction with strong organic solvents e.g. toluene, at elevated temperatures. Based on such laboratory analyses, most Carbon Black grades will typically have PAH levels[4)] not exceeding 0.1 %. To this end, the Carbon Black industry contributed to the development of the International Test Standard ASTM D7771-11, "*Standard Test Method for Determination of Benzo-α-Pyrene (BaP) Content in Carbon*

Black". Please note that these extraction conditions are not at all representative of normal industrial processing or environmental conditions.

Furthermore, various Carbon Black applications and finished articles are regulated in their overall PAH content or in their potential PAH migration level. For instance in December 2013 the European Commission issued Regulation (EU) No. 1272/2013 restricting PAHs in several consumer articles. As per this regulation, "*articles shall not be placed on the market for supply to the general public, if any of their rubber or plastic components that come into direct as well as prolonged or short term repetitive contact with the human skin or the oral cavity under normal or reasonably foreseeable conditions of use, contain more than 1 ppm of any of the 8 EU carcinogenic PAHs*". For toys and childcare items, the level of each of the 8 EU carcinogenic PAHs is further reduced to 0.5 ppm.

It must be noted that these PAH restrictions apply to finished articles and not to raw materials like Carbon Black. Should you need to assess the suitability of some Carbon Black grades for these kinds of applications, please contact your supplier directly.

When evaluating exposure to Carbon Black, note that in the various products and finished articles containing Carbon Black in a wide range of loadings, the Carbon Black itself is not readily available, nor is it exposed to the outside environment. The Carbon Black is embedded and firmly bound into a polymeric matrix (e.g. rubber, plastics, coatings, ink, etc.). As a result, Carbon Black itself cannot migrate out of the products or finished articles, thus reducing the probability of exposure to PAHs.

In consideration of all this, the risks to human health associated with the presence of PAHs originating from the Carbon Black in the final products or finished articles is extremely low.

[1] Borm, PJ., Cakmak, G., Jermann, E., Weishaupt, C., Kempers, P., van Schooten, FJ., Oberdorster, G., Schins, RP. Formation of PAH-DNA adducts after in vivo and vitro exposure of rats and lung cells to different commercial carbon black. *Toxicol. Appl. Pharmacol.*, 2004 June, 1:205(2):157-67.

[2] Hamm, S., Frey, T., Weinand, R., Moninot, G., Petiniot, N. Investigations on the extraction and migration behavior of polycyclic aromatic hydrocarbons (PAHs) from cured rubber formulations containing carbon black as reinforcing agent. *Rubber Chemistry & Technology*, Volume 82 (2009), Issue 2.

[3] C. Bergmann, J. Trimbach, M. Haase-Held, A. Seidel. "Consequences of European Directive 2005/69/EC for Tire Industry", KautschukGummiKunstoffe, October 2011.

[4] Listed in the EU Directive 2005/69/EC of the European Parliament relating to restrictions on the marketing and use of certain dangerous substances and preparations (polycyclic aromatic hydrocarbons in extender oils and tyres).

*Note: polycyclic aromatic hydrocarbons are also referred to as polynuclear aromatic hydrocarbons