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Nanotoxicology and Health session

Presentation summary

Title: “Genotoxicity of multi-walled carbon nanotube reference materials in mammalian cells and animals”

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The carcinogenic hazard of carbon nanotubes (CNTs) have been evaluated by the International Agency for Research on Cancer (IARC). The categorization as possibly carcinogenic agent to humans was used for multi-walled carbon nanotubes called MWCNT-7, whereas other types of CNTs were not classifiable because of missing data and it was not possible to pinpoint unique CNT characteristics that cause cancer. Recent studies on MWCNTs encompass samples called NM-400 to NM-403 from the European Commission’s Joint Research Centre (JRC) repository of nanomaterials. We have reviewed the literature on these JRC materials and MWCNT-7. The review consists of 36 publications, with results on cell culture experiments (22 publications), animal models (9 publications) or both (5 publications). There is only an overlap of eight publications between this database and the publications in the IARC monograph on CNTs. However, the results come mainly from cell cultures and/or measurements of DNA strand breaks by the comet assay and the micronucleus assay (82 out of 97 outcomes). A meta-analysis of cell culture studies on DNA strand breaks showed a genotoxic response by MWCNT-7, less consistent effect by NM-400 and NM-402, and least consistent effect by NM-401 and NM-403. Results from other in vitro tests indicate strongest evidence of genotoxicity for MWCNT-7. There are too few observations from animal models and humans to make general conclusions about genotoxicity. A recent study on intrapleural injection of MWCNT-7, NM-401 or NM-403 did not indicate genotoxicity in mesothelial epithelial cells, but MWCNT-7 (and NM-401 that has similar dimensions as MWCNT-7) caused inflammation and increased the reactive oxygen species production in pleural lavage cells. Overall, in vitro studies suggest a genotoxic mechanism of action of MWCNTs, whereas there are currently too few in vivo studies to assess whether or not MWCNT reference materials are also genotoxic in animals.