

Toxics Use Reduction Institute Science Advisory Board Meeting Minutes
March 28, 2022
Virtual Zoom Meeting
1:30 PM

Members Present: Dave Williams (Chair), Robin Dodson (Vice Chair), Christy Foran, Lisa Cashins, Denise Kmetzo, Christine Rioux, Helen Poynton

Members not present: Amy Cannon, Rich Gurney, Heather Lynch, Wendy Heiger-Bernays

Program staff present: Liz Harriman (TURI), Heather Tenney (TURI), Hayley Hudson (TURI), Michael Ellenbecker (TURI), Tiffany Skogstrom (OTA), Caredwen Foley (OTA), Sandy Baird (MassDEP), Kari Sasportas (OTA)

Others present: Carol Holahan (Foley Hoag ACC), Christina Bramante (Nano-C), Raza Ali (ACC), John Monica (Offit Kurman), Katherine Robertson (MCTA), Tom Lada (Nano-C), David Jones (Arxada LLC), Spencer Clifford (ACC), Laura Spark (Clean Water Action)

Welcome & Introductions

The chair noted that this meeting is being conducted remotely, consistent with [An Act Extending Certain COVID-19 Measures Adopted during the State of Emergency](#). This Act includes an extension, until April 1, 2022, of the remote meeting provisions of Governor Baker's March 12, 2020, Executive Order resulting from the outbreak of the 2019 novel coronavirus, known as "COVID-19."

Board members introduced themselves, program staff were announced, and attendees were asked to put their name and affiliation in the chat.

Approve February Meeting Minutes

A motion was made to approve the February meeting minutes as written, and there was a second.

A roll call vote was conducted, and the minutes were approved by the seven members present, with six in favor and one abstention.

Program Updates

The TURI Continuing Education Conference is being held April 13th in Marlborough. TURI's new Director Baskut Tuncak will be the keynote speaker.

Carbon Nanotubes and Fibers Petition: Continued work focused on Multi-walled Carbon Nanotubes

At the last meeting, the board agreed on a preliminary statement for pulmonary toxicity: "MWCNTs are known or reasonably anticipated to cause pulmonary inflammation and fibrosis."

This meeting continued deliberations on MWCNT by discussing other effects including cancer, mesothelioma, environmental effects, genotoxicity, and neurotoxicity.

Cancer

- In reviewing many of the cancer studies, they focus mainly on rats/mice and almost all the exposure routes were studied. Most studies saw mesothelioma or lung cancer. Dose responses were strong and overall evidence was strong.
- Overall, the dataset of information is consistent with evidence and a conclusion for carcinogenic effects.
- Rahman (2017) showed biopersistence and ongoing damage.
- Also, Fukushima (2018) and Kasai (2016) showed a cycle of cell damage and repair leading to development of tumors.
- A hallmark of cancer is the inflammation pathway, and it is really important in understanding how cancer works. IARC has flagged MWCNT for reevaluation.
- Overall, there is adequate evidence in animals and less information for humans.

Genotoxicity

- Fraser (2020) was one of the most important studies and cited micronuclei formation across the board.
- Scala (2021) saw indication of DNA breakage in the lungs.
- Nahle (2020) showed granuloma or micronuclei formation as an indication of genotoxicity.
- The cytotoxicity that appears in many studies is a result of chronic or severe inflammatory or immune response trying to get rid of the toxin. It does not appear to be directly genotoxic and appears to be more of a response to inflammation. Therefore, in general, single cell assays were not relevant for determining genotoxicity.

Environmental Effects

- One study [Marchi, 2019] on tubeworms with functionalized CNTs showed oxidative stress on the worms.
- Several studies showing effects on different biota; e.g., daphnia magna and a frog study both found effects on reproduction; bacteria study showed damage to cell membrane
- Lower, more environmentally relevant concentrations stayed in the water column, rather than settling out.
- Currently, very low concentrations are found in the environment, but half-lives in suspension of several days allows time for frog or fish embryos to be exposed. An additional study [Wu, 2019] was noted that showed impacts to the soil microbial community and effects on microbial diversity.
- The persistence and inability for MWCNT to be broken down are a concern. Additionally, MWCNT may degrade into hazardous breakdown products. Some evidence found polycyclic aromatic hydrocarbons as intermediates breakdown products.
- There is a tendency to bioaccumulate or biopersist in tissues - these materials are not being excreted.

Neurotoxicity/Translocation

- Two papers together indicate persistent inflammation effects on the blood brain barrier and the immune system. Translocation into the brain is quite small and associated with the inflammation effects.
- Evidence suggests potential pulmonary and cardiac effects.
- Some studies showed after intraperitoneal injection of MWCNT they translocated into the liver, spleen, kidney and lung. Inhalation studies found they only translocated to the nasal cavity, larynx, trachea and brain.
- Once in tissues, they tend to stay; therefore, if exposure were to continue, greater accumulation may occur.
- Even if MWCNT did not accumulate the inflammatory effects on the vascular system and the brain is certainly concerning.
- Evidence is compelling especially in animal studies. They are highly mobile, and their diameter is so small they are probably likely to be more readily able to transpose vs asbestos.

Mesothelioma

- Strong animal evidence of malignant mesothelioma and studies indicate relevance to humans.
- Several studies compare effects of MWCNTs and asbestos, e.g., Chernova (2017) notes the loss of tumor suppression gene similar to asbestos effect.
- Animal inhalation studies show penetration into the pleural space.
- Mesothelioma effects may be limited to CNTs that are longer than the macrophages, due to the same mesothelioma mechanism of frustrated phagocytosis that occurs with asbestos.

Recommendation Statement

- The board summarized all the information discussed today to create a summary statement/recommendation for MWCNTs.
- Based on strong evidence of lung cancer and/or mesothelioma in animals, MWCNTs are reasonably anticipated to cause lung cancer and/or mesothelioma in humans.
 - A board member noted that we need to define what we mean by MWCNTs and if it will it pertain to all MWCNTs.
- There is evidence for environmental persistence leading to concern for accumulation of MWCNTs causing environmental hazard, including animal toxicity, oxidative stress and reproductive effects. There are additional concerns for the potential for toxic intermediate break-down products.
- MWCNTs are known or reasonably anticipated to cause pulmonary inflammation and fibrosis with evidence for biopersistence and chronic inflammation of the lungs resulting in genotoxicity.

Motion: Motion to list MWCNTs based on the evidence of pulmonary toxicity, biopersistence, lung cancer, mesothelioma, and environmental persistence. There are additional concerns for genotoxicity and toxic environmental degradation products.

- There was a roll call vote to approve the motion as written with seven in favor.

Chair Vote

- The chair asked for nominations for a new chair of the board. Robin Dodson was nominated for chair. A roll call vote was conducted, and all seven members approved.

- Christine Rioux was nominated for vice chair. A roll call vote was conducted, and all seven members approved.

Visitor Questions/Comments

There was an opportunity to have any visitor comments or questions at this time, and there were none.

Remote Meeting

Heather gave an update on the extension of the remote meeting option until July 15th. The board may want to consider a vote on remote participation for when the remote meeting option ceases.

Next Meeting

Heather will send a When2Meet for a meeting at the end of April.

A motion was made to adjourn, and there was a second; the vote was unanimous.

Visitor Comments (inserted verbatim from zoom chat)

From Caredwen Foley, MA OTA to Everyone 01:32 PM

Caredwen Foley, MA OTA

From Laura Spark to Everyone 01:33 PM

Laura Spark, Clean Water Fund/Clean Water Action

From djones4 to Everyone 01:33 PM

David Jones, Arxada LLC

From Raza Ali | ACC to Everyone 01:33 PM

Raza Ali, American Chemistry Council

From Tom L to Everyone 01:33 PM

Tom Lada, Nano-C Inc.

From Spencer Clifford to Everyone 01:33 PM

Spencer Clifford, American Chemistry Council

From Tiffany Skogstrom to Everyone 01:33 PM

Tiffany Skogstrom, OTA Director

From Carol Holahan to Everyone 01:34 PM

Carol Holahan, Foley Hoag LLP

From Katherine Robertson to Everyone 01:35 PM

Kathy Robertson, MCTA

From iPhone to Everyone 01:35 PM

John Monica, Offit Kurman, P.C.

From Christina Bramante to Everyone 01:38 PM

Christina Bramante

Christina Bramante, representing Nano-C

From Helen Poynton (she/her) to Everyone 03:24 PM

There is evidence for environmental persistence of MWCNTs and the potential for toxic intermediate break-down products leading to concern that concentrations could accumulate to levels causing environmental risk.

There is evidence for environmental persistence of MWCNTs leading to concern that concentrations could accumulate to levels causing environmental hazard. There is additional concern for the potential for toxic intermediate break-down products.

From Laura Spark to Everyone 03:49 PM

For Clean Water, which filed the petition, I am thankful as this reflects what we wanted to see.

From Denise Kmetzo to Everyone 04:11 PM

Motion to list MWCNTs based on the evidence of pulmonary toxicity, biopersistence, lung cancer, mesothelioma, and environmental persistence. There are additional concerns for genotoxicity and toxic environmental degradation products.