

Welcome!

Dear AUSA NanoSafe Group members,

Welcome to the November issue of NanoSafe newsletter! This issue focus on safety of nanotubes and nanofibres, including established policies and procedures as well as other interesting articles. We hope you enjoy reading it!

Xin, Julie and Maria

Group News

From 2017, the AUSA NanoSafe newsletter will become quarterly issues to allow sufficient time for contributions and editing.

The 2017 AUSA Conference will be held over 20—22 June in Hobart. The theme of the conference is “Education and Research Safety Environment – Playing devil’s advocate”. [Find out more...](#)

Members of the NanoSafety group are encouraged to submit a nanosafety related abstract after the call is open in December. Hopefully, the group can maintain a specific seminar session with some nanosafety talks and discussions to benefit all group members. Xin will be putting an abstract in. If there are possibilities, the group can host a get together discussion session solely targeting nanosafety.

For group membership enquiry, please contact [Xin](#) directly.

Published Procedures on Nanotube/Nanofibre Safety

There have been many studies on the safety hazards of nanotubes and/or nanofibres as well as a number of published procedures or guidelines.

In Australia, SafeWork in 2012 published a guide ‘[Safe Handling and Use of Carbon Nanotubes](#)’ alongside an [information sheet](#). Interestingly in the guide, two risk management strategies have been described, including risk management by detailed hazard analysis and exposure assessment as well as risk management by control banding. There are detailed and comprehensive control measured suggested in the document under each of the risk management strategy.

The Centre for Disease Control and Protection (CDC) of NOISH published a document, ‘[Occupational Exposure to Carbon Nanotubes and Nanofibres](#)’, in 2013. This document discussed health concerns of both single and multi walled carbon nanotubes and nanofibres as well as risk management strategies. It is interesting that the document included a recommended exposure limit (pg. 38, 8-hr TWA). This is a useful guide if employers want to test for exposure level and use the data for their consideration to control hazards.

Also in 2013, in the UK, Health and Safety Executive published its guide on ‘[Using Nanomaterials at Work](#)’. This guide was built on the previous 2008 information sheet ‘[Risk Management of Carbon Nanotubes](#)’. Both of the documents detailed the single and multiple walled carbon nanotubes, their properties, potential hazards and risk management strategies and the level of fume cupboard or micro-biological safety cabinet ventilation required to manage the nanotubes, although according to this document, it seems conventional ventilation is sufficient. No details of which HEPA filter needs to be used.

In addition, the European Union also published its own document ‘[Guidance on the protection of the health and safety of workers from the potential risks related to nanomaterials at work](#)’ in 2014. This guide focused on the risk assessment and management of all kinds of nanomaterials and only applied control banding approach with indicative ventilation control measures.

Some Interesting Readings on Carbon Nanotubes (CNT)

The health hazards of carbon nanotubes have been characterised relatively well. Hou and Guo (2016) in their paper ‘Safety of Carbon Nanotubes’ summarised various toxicology of these materials. They specified health hazards to the cardiovascular system, respiratory system, the skin, the gastrointestinal tract, the immune system and genotoxicity and carcinogenicity of carbon nanotubes after human exposure and discussed the transportation and biodegradation of them. [Access the article...](#)

A new book ‘Neurotoxicity of Nanomaterials and Nanomedicine’ (to be published in 2017) specified nanomaterials’ toxicity to the nervous system. Chapter 11 of the book is specific for carbon nanotubes. The neurotoxicity of these materials were not greatly studied previously. Chapter 11 also indicated fully functionalised carbon nanotubes (eg. PEG-coated) would have less toxicity to conventional carbon nanotubes. This has been observed by many other studies and may be a useful substitution control when managing carbon nanotubes. [Access the book...](#)

This approach is also supported by a paper in 2013 ‘Asbestos-like Pathogenicity of Long Carbon Nanotubes Alleviated by Chemical Functionalization’. However, this paper did not only discuss neurotoxicity but also the general asbestos-like pathogenicity of carbon nanotubes. The research found that short and fully functionalised carbon nanotubes are less hazardous due to chemical deactivation. This is illustrated by Figure 1. [Read the paper ...](#) This approach offers an illustration of how chemical functionalization can alleviate the reactivity profile of a specific type of long, pristine MWNT, making them safer to use. .

One of the functionalisation methods is described in the paper ‘Structural and proactive safety aspects of oxidation debris from multi-walled carbon nanotubes’ by oxygen debris and the study found that the cytotoxicity of the functionalised carbon nanotubes are not observed. [Access the article...](#)

As mentioned previously, carbon nanotubes have asbestos-like pathogenicity. This is found by directly injecting long multiwalled carbon nanotubes into mice. The paper is published in *Nature*. [Access the article...](#)

Government published guidelines and procedures, as discussed in the previous section, have extensive safety management resources for Work Health and Safety professionals across all industries. A research facility specific safety management framework for carbon nanotubes is published in 2014 by researchers in the engineering disciplines in the Universidad de los Andes. The framework is different from ones published so far in government procedures and it took into consideration carbon nanotube specific characters. This can be an interesting read or useful guide for us in the higher education sector. A simple representation of this framework is included in Figure 2. [Read the article...](#)

Nanomaterials General Safety Management

Although carbon nanotubes are a special category of nanomaterials, safety management controls for all nanomaterials would still apply to them. [This presentation may be of interest](#). It was presented by NIOSH researchers to the NIOSH Board of Scientific Counsellors meeting on Engineering Controls for all engineered nanomaterials.

For people who are interested to use control banding, a newly published 2016 paper compared all current control banding assessment tools. [Read the article...](#)

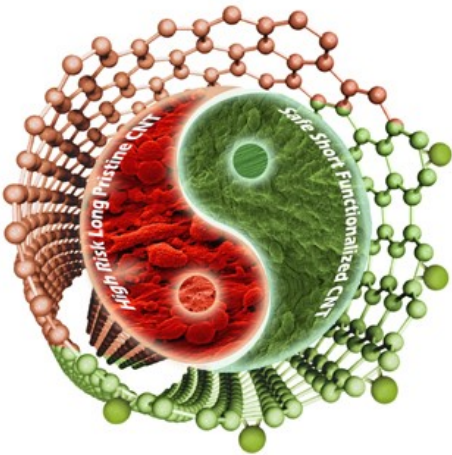


Figure 1. An artistic expression of the functionalization of carbon nanotube and their associated risk level.¹



Figure 2. Sections of the protocol for safety handling of carbon nanotubes.²

Reference

1. University College London 2013, Chemistry resolves toxic concerns about carbon nanotubes. <<https://www.ucl.ac.uk/news/news-articles/0113/130115-chemistry-resolves-toxic-concerns-about-carbon-nanotubes>>.

2. Rendon, FP, Munoz, F & Avila, A 2014, ‘Carbon nanotubes risks, safety and occupational health at research laboratories’, *IEEE 9th IberoAmerican Congress on Sensors*, Bogota, pp.1-5

Contributions