



NANEX WP2 – Exposure Scenarios Summary

Please note this ES was not developed as part of a full risk assessment process, and may not necessarily describe exposure conditions for which there are no risks to human health and the environment

Standard Exposure Scenario Format 1: For Uses Of Substances By Workers

Title:	Machining of hybrid advanced composites containing CNT.	Date:	25/05/2010
SubstanceType	CNT	Entered By:	LEIA

Internal reference ID: CNT 1

List of all use descriptors related to the life cycle stage and all the uses under it; include market sector (by PC) if relevant:

List of names of contributing exposure scenarios and corresponding PROCs/PCs

CES 1: Dry cutting of hybrid carbon composites containing CNT
 CES 2: Dry cutting of hybrid alumina composites containing CNT
 CES 3: Wet cutting of hybrid composites (alumina and carbon) containing CNT

CES 1: Name of contributing exposure

Dry cutting of hybrid carbon composites containing CNT

Further specification

Dry cutting using band-saw

Product characteristics

CNT-carbon hybrid composite
 CNTs are produced vertically aligned and then embedded in a matrix (based on carbon fibers) using capillary-driven wetting.
 The carbon hybrid composite has approx 0.05% CNTs by volume of the laminate.

Amounts used

Experiments performed with composites samples with size in the range of approx. 10 X 50 mm (width X length); thickness varied with the composite type.

Frequency and duration of use/exposure

Not clear how often this task would be performed in a real workplace.
 For the experimental research, a cycle of 4-5 cuts were performed which lasted approx. 1-3 min.

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

This experimental research was performed in a lab in order to measure exposure to nanoparticles and fibers during machining of advanced hybrid composites (based on carbon fibers or alumina) containing CNT.
 The research lab had general mechanical ventilation (one room exchange rate per hour). There was no direct air exchange with the outside environment.
 There was no other activities/equipment which could generate nanoparticles. Main door was closed. Typical air conditions during the monitoring periods were: Temperature 20-22°C; RH 39-42%

Technical conditions and measures at process level (source) to prevent release

Technical conditions and measures to control dispersion from source towards the worker

Authors were trying to create a worst-case scenario, thus no LEV during cutting

Organisational measures to prevent /limit releases, dispersion and exposure

Conditions and measures related to personal protection, hygiene and health evaluation

N100 respirators; gloves; lab coats

Additional good practice advice (for environment) beyond the REACH CSA

Exposure Estimation

Exposure levels were dependent on composite thickness and type BUT did NOT vary between composites with and without CNTs.
 No evidences of individual CNTs, bundles of CNTs or CNTs attached to larger particles.

EXPOSURES DATA

Background: 4.82e3 #/cm3 (by FMPS), 11.4 #/cm3 (by APS)
 Exposure data at the personal breathing zone: 1.53e5 #/cm3 (by FMPS, AM), 215.7 #/cm3 (by APS, AM)
 Exposure data at the source: 2.94e5 #/cm3 (by FMPS, AM), 867.1 #/cm3 (by APS, AM)

INSTRUMENTATION: FMPS (TSI 3091); APS (TSI 3321); CPC (TSI 3007); thermophoretic precipitator (TP, Fraunhofer Institute of Toxicology, Germany) and electrostatic precipitator (ESP, courtesy of Dr. A Miller, Spokane Laboratory, NIOSH, WV) for TEM sample collection; sampling of respirable fibers (NIOSH method 7400); TSI Dust Trak

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Title:	Machining of hybrid advanced composites containing CNT.	Date:	25/05/2010
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CES 2: Name of contributing exposure

Dry cutting of hybrid alumina composites containing CNT

Further specification

Dry cutting using band-saw

Product characteristics

CNT-alumina hibrid composite

CNTs are produced vertically aligned and then embedded in a matrix (based on alumina fiber) using capillary-driven wetting.

The CNT volume fraction in the hybrid CNT-alumina composite varied from 0.5 to 4.5% depending on the sample.

Amounts used

Experiments performed with composites samples with size in the range of approx. 10 X 50 mm (width X length); thickness varied with the composite type.

Frequency and duration of use/exposure

Not clear how often this task would be performed in a real workplace.

For the experimental research, a cycle of 4-5 cuts were performed which lasted approx. 1-3 min

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

This experimental research was performed in a lab in order to measure exposure to nanoparticles and fibers during machining of advanced hybrid composites (based on carbon fibers or alumina) containing CNT.

The research lab had general mechanical ventilation (one room exchange rate per hour). There was no direct air exchange with the outside environment.

There was no other activities/equipment which could generate nanoparticles. Main door was closed. Typical air conditions during the monitoring periods were: Temperature 20-22°C; RH 39-42%.

Technical conditions and measures at process level (source) to prevent release

Technical conditions and measures to control dispersion from source towards the worker

Authors were trying to create a worst-case scenario, thus no LEV during cutting

Organisational measures to prevent /limit releases, dispersion and exposure

Conditions and measures related to personal protection, hygiene and health evaluation

N100 respirators; gloves; lab coats

Additional good practice advice (for environment) beyond the REACH CSA

Exposure Estimation

Exposure levels were dependent on composite thickness and type BUT did NOT vary between composites with and without CNTs.

No evidences of individual CNTs, bundles of CNTs or CNTs attached to larger particles.

EXPOSURES DATA

Background: 4.82e3 #/cm3 (by FMPS), 11.4 #/cm3 (by APS)

Exposure data at the personal breathing zone: 0.28e5 #/cm3 (by FMPS, AM), 62.2 #/cm3 (by APS, AM)

Exposure data at the source: 0.38e5 #/cm3 (by FMPS, AM), 285.3 #/cm3 (by APS, AM)

INSTRUMENTATION: FMPS (TSI 3091); APS (TSI 3321); CPC (TSI 3007); thermophoretic precipitator (TP, Fraunhofer Institute of Toxicology, Germany) and electrostatic precipitator (ESP, courtesy of Dr. A Miller, Spokane Laboratory, NIOSH, WV) for TEM sample collection; sampling of respirable fibers (NIOSH method 7400); TSI Dust Trak

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Title:	Machining of hybrid advanced composites containing CNT.	Date:	25/05/2010
SubstanceType	CNT	Entered By:	LEIA

CES 3: Name of contributing exposure

Wet cutting of hybrid composites (alumina and carbon) containing CNT

Further specification

Wet cutting: rotary cutting wheel with water to flush dust particles during machining.

Product characteristics

CNT-carbon hibrid composite
CNT-alumina hibrid composite

Amounts used

Experiments performed with composites samples with size in the range of approx. 10 X 50 mm (width X length); thickness varied with the composite type.

Frequency and duration of use/exposure

Not clear how often this task would be performed in a real workplace.
For the experimental research, a cycle of 4-5 cuts were performed which lasted approx. 1-3 min

Human factors not influenced by risk management

Other given operational conditions affecting workers exposure

This experimental research was performed in a lab in order to measure exposure to nanoparticles and fibers during machining of advanced hybrid composites (based on carbon fibers or alumina) containing CNT.
The research lab had general mechanical ventilation (one room exchange rate per hour). There was no direct air exchange with the outside environment. There was no other activities/equipment which could generate nanoparticles. Main door was closed. Typical air conditions during the monitoring periods were: Temperature 20-22°C; RH 39-42%

Technical conditions and measures at process level (source) to prevent release

Wet cutting uses water to flush dust particles during machining.
Cutting wheel is covered with guards (help to reduce aerosol emission)

Technical conditions and measures to control dispersion from source towards the worker

Authors were trying to create a worst-case scenario, thus no LEV during cutting

Organisational measures to prevent /limit releases, dispersion and exposure

Conditions and measures related to personal protection, hygiene and health evaluation

N100 respirators; gloves; lab coats

Additional good practice advice (for environment) beyond the REACH CSA

Exposure Estimation

Exposure data were not significantly above background.
No evidences of individual CNTs, bundles of CNTs or CNTs attached to larger particles.

INSTRUMENTATION: FMPS (TSI 3091); APS (TSI 3321); CPC (TSI 3007); thermophoretic precipitator (TP, Fraunhofer Institute of Toxicology, Germany) and electrostatic precipitator (ESP, courtesy of Dr. A Miller, Spokane Laboratory, NIOSH, WV) for TEM sample collection; sampling of respirable fibers (NIOSH method 7400); TSI Dust Trak

References

Ref Title: Exposure to nanoscale particles and fibers during machining of hybrid advanced composites containing carbon nanotubes
Author: Bello D, Wardle BL, Yamamoto N, deVilloria RG, Garcia EJ, Hart JA, et al.
Journal: J Nanopart Res
Ref Year: 2008