National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

Charles L. Geraci, Ph.D., CIH
Cincinnati, Ohio
February 3, 2011
Public Meeting

Nanotubes and Nanofibers
Occupational Exposure to Carbon
Current Intelligence Bulletin (CIB):
Overview of the Draft NIOSH
Welcome

Meeting Logistics

NIOSH Panel and Experts

For the record, record your comments and attribute all remarks.

Use the microphone so we may accurately and accurately.

When you speak, please indicate your name.

The meeting is being recorded and a transcript will be placed on the NIOSH Docket.
Today's Objectives

- Next Steps
- Discussion
- Comments
- Review Key Elements
- Summarize the Document

BULLETIN
CURRENT INTELLIGENCE

CARBON NANOTUBES AND NANOTUBERS

EXPOSURE TO OCCUPATIONAL

NIOSH
11:00  Welcome

February 3, 2010
Columbus, Ohio
Grand Ballroom A
Millennium Hotel

Occupational Exposure to Carbon Nanotubes and Nanoparticles

The Draft Document: NIOSH Current Intelligence Bulletin:

Agenda - Page 1
Adjourn

Public questions and comments

1:00

1400 N. Harbor Blvd. #130-117 Fullerton, CA 92870 US
International Safety Resources Association, Inc. (ISRA)
on behalf of:

Haddonfield New Jersey USA 08033
21 Walnut Street
Jay Peters

Lowell, MA 01854
Wannacott Mills
600 Suffolk Street

University of Massachusetts Lowell
Director, Toxic Use Reduction Initiative
Professor, Department of Work Environment
Michael J. Ellender, SC.D., CH

12:30
15 minute presentations by interested parties
Several animal studies showed pulmonary fibrosis (early onset, persistent) and granulomatous inflammation from carbon nanotube (CNT) exposure.

Associated with both unpurified and purified CNT (raw metal contaminated).

Effects occurring at relatively low doses.

Ability of CNT to persist and migrate to pleura.

Other adverse effects (e.g. aneuploidy).
Producing CNT or carbon nanotubes (CNF)

- No studies of adverse health effects in workers
- Worker exposure increasing frequency of production and use and asbestos
- Many similarities between CNT/CNF and

Rationale for Development (cont'd)
Conclusion: Develop a CIB

- Practice recommendations are needed.
- To facilitate good risk management, workplace was needed.
- Quantitative risk assessment (QRA) was needed.
- To enable a precautionary approach an occupational exposure limit (OEL) based on a precautionary approach to controlling CNT/CNF exposure is warranted.

While there are many information gaps, there is

Published Studies

Conclusion from Early Review
<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>2009</td>
<td>Notice published in the Federal Register on April 8, 2009, requesting information on carbon nanotubes (CNTs) including single-walled carbon nanotubes (SWCNTs) and multi-wall carbon nanotubes (MWCNTs)</td>
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<tr>
<td>2009</td>
<td>Document concept approved by the NIOSH Leadership Team.</td>
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<td>2010</td>
<td>Draft document forwarded to National Nanotechnology Coordination Office, Clayton Teague, for preview and for the Office of the Director, NIOSH. Draft document cleared for peer review and public comment by the Office of the Director, NIOSH.</td>
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<td>2010</td>
<td>Internal distribution only to NNI participating agencies for their information.</td>
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<tr>
<td>Dec</td>
<td>Peer review plan posted to the NIOSH Peer Review Agenda website (see)</td>
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<tr>
<td>2010</td>
<td>No submissions received in response to this request (see carbon nanotubes (MWCNTs)).</td>
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<td>Date</td>
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<tr>
<td>Jan</td>
<td>Public Informational Webinar Presented to Nanotechnology (NIOSH).</td>
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<tr>
<td>Feb</td>
<td>Public Comment Meeting Planned for Cincinnati, Ohio.</td>
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**HTML**

Visit the NIOSH website (see NIOSH dockets 161-A) for documents on the NIOSH draft document posted for public comment on the NIOSH meeting on February 3, 2011. Written comments due February 18, 2011. Notice published in the Federal Register Inviting Public Comment on the draft document and attendance at a public meeting.

Notice published in the Federal Register Inviting Public Comment (cont.).
Employers

Provide risk management guidance to respiratory hazards to workers and employers

Disseminate information about potential

Develop a rationale for a REL

Conduct a quantitative risk assessment

CNE

Effects seen in animals exposed to CNT and

Review relevant evidence on adverse lung

Goals of the Document
Focused Presentations

- Dr. Douglas Trout: Summarize medical recommendations
- Mr. Ralph Zumwalde: Summarize the risk assessment and current knowledge of exposure assessment and controls
- Dr. Eileen Kuempel: Summarize the hazard evaluation (toxicology)
- Dr. Vincent Castranova
Summary and Wrap Up
Summary of Recommendations

- Identify and characterize processes and job tasks
- Characterize exposure
- Establish procedures for using engineering controls
- Train workers about sources of exposure and how to use controls
Consider implementing medical surveillance screening.
Follow OSHA respirator protection standard.
Develop procedures to clean up spills.
Provide facilities for hand washing.

Summary of Recommendations (cont'd)
Exposure Assessment

- Developed for exposure to other types of aerosols
- Use same industrial hygiene principles as CNT/CF
- Identity high exposure jobs and tasks
- Use activity pattern data
- Regular and systematic
- Evaluation of worker personal exposure to NIOSH Method 5040
Task duration and frequency

Physical form of material

Selection of exposure control

HEPA filters

Otherwise use local exhaust ventilation with

Where possible use source enclosure

For fine dusts and powders use engineering control techniques developed

Engineering Controls
Develop procedures to protect workers during clean-up of spills and contaminated surfaces.

Clean-up and Disposal

Develop guidance and training for good work practices.

Work Practices
In emergency situations, successful control release of exposures have not been or when all technical measures to eliminate or prudent to wear protective clothing and gloves. Health effects to skin from CNT are not known.

Personal Protective Clothing
Follow NIOSH respirator decision logic

Use appropriate filter change out schedules

Protection when properly fit tested

N-95 and N-100 should provide adequate protection

Follow OSHA respiratory protection standards

Workers should be provided with respirators

Cannot reduce CNT/CNF exposure below REL

When engineering controls and work practices

Respirators
Medical Screening and Surveillance

- Records
- Maintain confidentiality of workers' medical records
- Written reports to the worker and employer
- Periodic evaluation
- Initial evaluation
- Inclusion in a medical screening program
- Workers exposed to CNT/CNF may benefit from
Worker Training

- Purpose of medical screening
- Instructions for reporting health symptoms
- Routes of exposure
- Nature of potential exposure
- Understand:

Provide sufficient information to allow workers to
Limitations of the REL: Research Needs

- Whether REL can be achieved in all workplaces is not known.
- Based on limited available exposure data, the REL is achievable.
- Technical issues need resolution.
- Fiber-counts may be better.
- Mass may not be the best metric particle.
Research Needs

- Epidemiologic and surveillance research
- Conducting future epidemiologic studies
- Assessment of value of exposure registers for human studies
- Human studies response
- Assessment of early markers of exposure and mechanistic studies
- Mechanistic studies of CNT/CNF
- Chronic inhalation studies of different types
- Experimental studies
Research Needs (cont'd)

- Determination of effectiveness of engineering controls to control airborne exposures below 7 μg/m³
- Development of improved sampling and analytical methods that more closely align with animal workplace exposures
- Evaluation of NIOSH Method 5040 in various workplaces
- Quantification of workplace exposures, measurement, and controls

Studies of workplace exposures, measurement,