Overview of Current NIOSH Risk Assessment and Management Activities for Chemicals

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May, 2019

Disclaimer: The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention and should not be construed to present any agency determination or policy.
Scope

- NIOSH’s efforts in chemical risk assessment and management have been reviewed individually but not considered in their entirety.
- This presentation provides an overview of all of these efforts and solicits feedback on them.
Chemicals are one of the most significant occupational hazards

- 52.1 Million workers estimated exposed to chemicals in their work (Calvert et al 2013)

- From 2011-2015
  - 71,140 illnesses or injuries associated with chemical exposures (BLS 2011-2015)
  - 4,836 chemical-related fatalities (BLS 2011-2015)

- Difficult to estimate number of chronic diseases: cancer, pulmonary, cardiovascular, neurologic related to chemicals
  - 2–8% of cancers attributed to occupational exposures (Purdue et al 2015)
  - Severe underestimation has been identified
NIOSH conducts extensive research on chemical hazards and exposure in most every Division, Laboratory, and Office.

The focus of this presentation is on risk assessment and risk management.
Focus of the presentation: Risk Assessment and Management of Chemicals
Current NIOSH Risk Assessment and Management Activities for Chemicals

- Current Recommended Exposure Limit (REL) Development Efforts
- Chemical Carcinogen Policy
- Risk Assessment Practices
- Nanoparticles/Advanced Manufacturing
- Development of IDLH values and Skin Notation Profiles
- NIOSH Pocket Guide/Manual of Analytic Methods
- Respiratory Protective Devices
- Occupational Exposure Banding
- Prevention through Design/Green Chemistry
- Exposome/Cumulative Risk Assessment
- Collaboration on TSCA
- Hazardous Drugs List
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Direction and Authority

NIOSH is mandated by the OSH Act (1970)

“...to develop criteria dealing with toxic materials and harmful physical agents and substances which will describe exposure levels that are safe for various periods of employment, including but not limited to the exposure levels at which no employee will suffer impaired health or functional capacities or diminished life expectancy as a result of his work experiences.”

[OSH Act, 20 USC 22 (a)(3)]
Current Recommended Exposure Limits (REL) under Development

- Glutaraldehyde—widely used
- 1-Bromopropane—replacement for ‘ozone depleters’
- Manganese—neurobehavioral effects
- Diethanolamine—widely used
- Lead—neurobehavioral effects
- Toluene diisocyanate—sensitizer
- Silver nanoparticles—high volume nanomaterials
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History of NIOSH Chemical Carcinogen Policy

- Prior to 2016 NIOSH labeled known carcinogens “as potential occupational carcinogens”
- Went from recommending exposure limits based on 1/1000 lifetime risk to a new approach
Cancer Policy: Three Key Components

- Carcinogen Classification
- Carcinogen Risk Management Limit
- Analytical feasibility
Summary

Classification
Relies on NTP, EPA, and IARC for carcinogen classification

Risk Management Limit
Sets new terminology (occupational carcinogen and RML-CA)

Risk Management Limit
Changes NIOSH policy on target risk to 1/10,000 as a starting point

Analytic Feasibility
When the LOQ or RQL > 1/10,000 risk level, LOQ or RQL = RML-CA

NTP: National Toxicology Program
EPA: Environmental Protection Agency
IARC: International Agency for Research on Cancer
RML-CA: Risk management limit for carcinogens
LOQ: Limit of quantitation
RQL: Reliable quantitation limit
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## Selected History of NIOSH Quantitative Risk Assessment

<table>
<thead>
<tr>
<th>Agent</th>
<th>Adverse Effect</th>
<th>Dose-response assessment</th>
<th>Risk Characterization</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,3-butadiene</td>
<td>leukemia</td>
<td>toxicologic, Weibull time-to-tumor regression model, animal to human extrapolation</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Dankovic et al. 1993]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>epidemiologic and toxicologic, literature review</td>
<td></td>
<td></td>
</tr>
<tr>
<td>asbestos</td>
<td>lung cancer, asbestosis</td>
<td>epidemiologic, Poisson regression, additive relative rate function (cancer), power function (asbestosis)</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Stayner et al. 1997]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cadmium</td>
<td>lung cancer</td>
<td>epidemiologic, Poisson and Cox PH regression, additive relative rate function</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Stayner et al. 1992a; Stayner et al. 1992b]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>carbon nanotubes and nanofibers</td>
<td>non-malignant adverse lung effects</td>
<td>toxicologic, NOAEL and BMD assessments</td>
<td>PoD/UF</td>
<td>[NIOSH 2013b]</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>coal mine dust</td>
<td>coal workers’ pneumoconiosis, progressive massive fibrosis, pulmonary dysfunction</td>
<td>epidemiologic, logistic and multiple linear regression</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Kuempel et al. 1997]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diacetyl and 2,3-pentanedione</td>
<td>pulmonary dysfunction</td>
<td>epidemiologic, linear extrapolation, multiple regression</td>
<td>extrapolation, excess lifetime risk, $10^3$ target risk</td>
<td>[NIOSH 2016a]</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>diesel exhaust</td>
<td>lung cancer</td>
<td>toxicologic and epidemiologic (review)</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Stayner et al. 1998]</td>
</tr>
<tr>
<td>Agent</td>
<td>Adverse Effect</td>
<td>Dose-response assessment</td>
<td>Risk Characterization</td>
<td>Reference</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>EGME, EGEE, EGMEA, EGEEA</td>
<td>reproduction, developmental, hematotoxic effects</td>
<td>toxicologic, NOAEL and LOAEL assessments</td>
<td>PoD/UF</td>
<td>[NIOSH 1991]</td>
</tr>
<tr>
<td>hexavalent chromium</td>
<td>lung cancer</td>
<td>epidemiologic, Poisson regression linear ERR model</td>
<td>extrapolation, excess lifetime risk, 10⁻³ target risk</td>
<td>[NIOSH 2013a; Park et al. 2004]</td>
</tr>
<tr>
<td>noise</td>
<td>material hearing impairment</td>
<td>epidemiologic, logistic regression</td>
<td>extrapolation, excess lifetime risk with no target risk level specified</td>
<td>[NIOSH 1998; Prince et al. 2003]</td>
</tr>
<tr>
<td>radon</td>
<td>lung cancer</td>
<td>epidemiologic, Cox proportional hazards regression</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Hornung and Meinhardt 1987; NIOSH 1987]</td>
</tr>
<tr>
<td>silica</td>
<td>lung cancer</td>
<td>epidemiologic, Poisson regression, additive relative rate function</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Rice et al. 2001]</td>
</tr>
<tr>
<td>silica</td>
<td>non-malignant lung disease</td>
<td>epidemiologic, Poisson regression, additive relative rate function</td>
<td>extrapolation, excess lifetime risk, target risk unspecified</td>
<td>[Park et al. 2002]</td>
</tr>
<tr>
<td>titanium dioxide</td>
<td>lung cancer</td>
<td>toxicologic, nonlinear extrapolation, BMD model averaging quantal endpoint</td>
<td>extrapolation, excess lifetime risk, 10⁻³ target risk</td>
<td>[NIOSH 2011]</td>
</tr>
</tbody>
</table>

1. Analysis may have considered multiple adverse effects. The adverse effect shown in the table was selected as the primary effect in the risk assessment.
2. The dose-response assessment refers to the primary source supporting final models and/or recommendations on risk-based exposure limits.

Abbreviations: BMD, benchmark dose; EGEE, ethylene glycol monoethyl ether; EGEEA, ethylene glycol monoethyl ether acetate; EGME, ethylene glycol monomethyl ether; EGMEA, ethylene glycol monomethyl ether acetate; ERR, excess relative rate; LOAEL, lowest observable adverse effect level; NOAEL, no observable adverse effect level; PH, proportional hazards; PoD, point of departure; UF, uncertainty factor.
(DRAFT) NIOSH Practices in Occupational Risk Assessment

National Institute for Occupational Safety and Health

June 6, 2018

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Posted for public comment
https://www.regulations.gov
Enter CDC 2018-0060 in search field
NIOSH Practices In Occupational Risk Assessment

Contents

- Problem Formulation
- Hazard Identification
- Dose-response assessment
- Dosimetry Adjustments for Human Equivalent Concentrations
- Risk Characterization
- Appendices
  - Sources of Errors
  - Emerging Practices

May serve as a major resource for the field
Current NIOSH Risk Assessment and Management Activities for Chemicals

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Concerns about Nanoparticles

- Small particles may be more toxic than large particles
- Vast explosion of the technology in early 2000s
- Wide use of nanomaterials in high volumes in commerce
- Many organizations worldwide issued cautionary reports
- Critical need for guidance
Key NanOEH Questions

- Are they hazardous?
- Is there exposure?
- What is the risk?
- Can they be controlled?
Approaches to Safe Nanotechnology
Managing the Health and Safety Concerns Associated with Engineered Nanomaterials
CURRENT STRATEGIES FOR ENGINEERING CONTROLS IN

Nanomaterial Production and Downstream Handling Processes

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Potential Revolution in Manufacturing

- See and manipulate one atom at a time – building molecular tools
  - Using 35 Xenon atoms to spell out a logo

- Copy nature – mimic self replication

Source: IBM Research
Rapid shift in manufacturing technology

**Subtractive manufacturing**

Starting material → Machining → Final product + Waste material

**Additive manufacturing**

Starting material → Printing → Final product + Waste material

Sources: GAO (analysis), Art Explosion (images). | GAO-15-505SP
# Materials and hazards in additive manufacturing

<table>
<thead>
<tr>
<th>Polymers</th>
<th>Acrylonitrile-butadiene-styrene</th>
<th>Poly(lactic acid)</th>
<th>Propylene fumarate</th>
<th>Poly(vinyl alcohol)</th>
<th>Polystyrene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvents</td>
<td>Dimethyl fumarate</td>
<td>Isopropanol</td>
<td>Acetone</td>
<td>Methyl Ethyl Ketone</td>
<td>2-Butanone</td>
</tr>
<tr>
<td>Metals</td>
<td>Ti-6Al-4V</td>
<td>IN 625 &amp; IN 718 (Ni, Cr)</td>
<td>17-4 PH stainless steel</td>
<td>Cobalt chromium</td>
<td></td>
</tr>
<tr>
<td>Nanomaterials</td>
<td>nFe (steel sintering)</td>
<td>nAg (sintering, conductivity)</td>
<td>nCB, CNT (conductivity, stiffness, tensile strength)</td>
<td>nSiO₂ (polymer strength)</td>
<td></td>
</tr>
</tbody>
</table>

- **Particle Emissions**
- **Outgassing/VOC Emissions**
- **Dermal Toxicity**
- **Reactivity**
- **Flammability**
- **Combustibility**

**Process-induced changes**

**Specific formulation**
Advanced Manufacturing

Additive Manufacturing

3D Printing

Functional Fabrics

Photonics

Flexible Sensors

Light Weighting

Advanced Composites

Clean Energy

Engineered Biology

Some processes and some products.
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Immediately Dangerous To Life or Health (IDLH) Values/Skin Notations

Values to inform escape from hazardous environments

Skin notations to guide chemical handling
Special project: Development of IDLH for peracetic acid

- Limited data to develop an IDLH
- Peracetic acid is crucial for infectious agent control in food supply (poultry processing) and hospitals
NIOSH Project To Develop an IDLH* For Peracetic Acid

*IDLH: Immediately Dangerous to Life and Health

Diagram:
- Sampling & Analytical Methods
- Toxicology Studies
- Field Studies
- Risk Assessment
- IDLH/STEL
- Controls & Risk Management

Legend:
- Arrows indicate the flow of activities.
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NIOSH Pocket Guide and NIOSH Manual of Analytic Methods

- Two of NIOSH’s most influential publications
NIOSH Pocket Guide

- Since 1974
NIOSH Manual of Analytic Methods
NIOSH Manual of Analytical Methods (NMAM) 5th Edition

NIOSH Manual of Analytical Methods (NMAM) 5th Edition

NIOSH recommends that the best method available be used for making each measurement. Methods published by others, such as OSHA, MSHA, EPA, ASTM, ISO, or commercial suppliers of sampling and analytical equipment, may have advantages over NIOSH methods for a given sampling situation. (An industrial hygienist should determine the sampling protocol, considering analytical accuracy, cost, and optimum sample number.) Every method should undergo an initial evaluation to demonstrate performance. When a method is used in a laboratory that did not perform the initial evaluation, that laboratory should verify that comparable results can be obtained. NIOSH methods may need to be modified, and if modified, should be re-evaluated. Various OSHA regulations (e.g., benzene) mention performance criteria for evaluating whatever method is...
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NIOSH issues approvals for chemical and particulate hazards

- NIOSH evaluates some applications for Chemical Hazards:
  - Ammonia (AM)
  - Chlorine (CL)
  - Chlorine Dioxide (CD)
  - Chloroacetophenone (CN)
  - Chlorobenzylidene Malononitril (CS)
  - Sulfur Dioxide (SD)
  - Formaldehyde (FM)
  - Hydrogen Chloride (HC)
  - Hydrogen Sulfide (HS)
  - Hydrogen Fluoride (HF)
  - Methylamine (MA)
  - Organic Vapors (OV)
  - Phosphine (PH)
  - CBRN
  - Others as requested
NIOSH Hazard Assessment for CBRN Respiratory Protection

- NIOSH uses 11 test representative agents (TRAs) from 7 Chemical Families to evaluate Chemical, Biological, Radiological, and Nuclear air-purifying respirators (CBRN APRs)
- NIOSH periodically evaluates emerging CBRN threats—informed by intelligence agencies—to ensure current TRAs/Chemical Families remain representative of potential CBRN threats so that CBRN APRs remain protective for emergency responders
- CBRN Hazard Assessment completed in 2018—partnered with DoD and DHS
  - 204 chemicals and 46 radioisotopes evaluated against NIOSH’s current TRAs
  - Example evaluation criteria: chemical/physical properties and anticipated canister filtration behavior
  - 6 chemicals tested against 6 different NIOSH-approved CBRN canister models
  - 2018 Hazard Assessment conclusion: NIOSH’s current TRAs and Chemical Families remain representative of all identified CBRN threats; no change to NIOSH CBRN APR standard at this time.
Current NIOSH Risk Assessment and Management Activities for Respiratory Protection – NIOSH Pocket Guide

- Respirator recommendations for chemicals
- Based on
  - Assigned protection factors
  - Immediately dangerous to life or health
  - NIOSH Carcinogen Policy
  - NIOSH REL
  - NIOSH Selection Logic

Silica, crystalline (as respirable dust)

<table>
<thead>
<tr>
<th>Responder Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIOSH</td>
</tr>
<tr>
<td>Up to 0.5 mg/m³:</td>
</tr>
<tr>
<td>(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, P99, P100, R100, P100. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>Up to 1.25 mg/m³:</td>
</tr>
<tr>
<td>(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.</td>
</tr>
<tr>
<td>(APF = 25) Any supplied-air respirator operated in a continuous-flow mode</td>
</tr>
<tr>
<td>Up to 2.5 mg/m³:</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-face respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter</td>
</tr>
<tr>
<td>Up to 25 mg/m³:</td>
</tr>
<tr>
<td>(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Emergency or planned entry into unknown concentrations or IDLH conditions:</td>
</tr>
<tr>
<td>(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus</td>
</tr>
<tr>
<td>Escape:</td>
</tr>
<tr>
<td>(APF = 50) Any air-purifying, full-face respirator with an N100, R100, or P100 filter. <a href="#">Click here</a> for information on selection of N, R, or P filters.</td>
</tr>
<tr>
<td>Any appropriate escape-type, self-contained breathing apparatus</td>
</tr>
</tbody>
</table>
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Few chemicals have occupational exposure limits (OELs)
Occupational Exposure Banding

Document Objective
To create a consistent and documented process to characterize chemical hazards so timely and well-informed risk management decisions can be made for chemicals lacking OELs.
The NIOSH Occupational Exposure Banding Process for Chemical Risk Management

CURRENT INTELLIGENCE BULLETIN 69

CDC
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
What is Occupational Exposure Banding?

A mechanism to quickly and accurately assign chemicals into “categories” or “bands” based on their health outcomes and potency considerations.

A B C D E

Higher Concentrations Lower Concentrations
## Proposed NIOSH Occupational Exposure Bands

<table>
<thead>
<tr>
<th>Occupational Exposure Band</th>
<th>Airborne Target Range for Particulate Concentration (mg/m$^3$)</th>
<th>Airborne Target Range for Gas or Vapor Concentration (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt;10mg/m$^3$</td>
<td>&gt;100 ppm</td>
</tr>
<tr>
<td>B</td>
<td>&gt;1 to 10 mg/m$^3$</td>
<td>&gt;10 to 100 ppm</td>
</tr>
<tr>
<td>C</td>
<td>&gt;0.1 to 1 mg/m$^3$</td>
<td>&gt;1 to 10 ppm</td>
</tr>
<tr>
<td>D</td>
<td>&gt;0.01 to 0.1 mg/m$^3$</td>
<td>&gt;0.1 to 1 ppm</td>
</tr>
<tr>
<td>E</td>
<td>(\leq 0.01) mg/m$^3$</td>
<td>(\leq 0.1) ppm</td>
</tr>
</tbody>
</table>
IMPORTANT POINT
An OEB is not meant to replace an OEL, rather it serves as a starting point to inform risk management decisions.
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Prevention through Design

- Design out hazards
- Includes designing out chemical hazards
Figure 1. Prevention through Design using hierarchy of controls [Peterson 1973].
PREVENTION THROUGH DESIGN
PLAN FOR THE NATIONAL INITIATIVE
Examples of designing out chemical hazards

- Highway Asphalt paver fume control
- Asphalt warm-mix
- Interagency Chemical Alternative Assessment
- Molecule to market (nanoparticle examples)
- Altered chemistry of ceramic fibers
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Overview of holistic approaches to protect workers

Exposomics

TWE

Cumulative Risk Assessment

Risk Management

Total Worker Health®
Example of an overall exposome correlation globe

(Adapted from Patel and Manrai, 2015)
Exposome/Cumulative Risk Assessment: multiple risks, multiple times
Aggregate Exposure and Cumulative Risk Assessment—Integrating Occupational and Non-occupational Risk Factors

T. J. Lentz, G. S. Dotson, P. R. D. Williams, A. Maler, B. Gadagbui, S. P. Pandalai, A. Lamba, F. Haerl, and M. Mumtaz

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Occupational exposure limits have traditionally focused on preventing morbidity and mortality arising from inhalation exposures to individual chemical substances in the workplace. While central to occupational risk assessment, occupational exposure limits have limited application as a refined disease prevention tool because they do not account for all of the complexity of the work and non-occupational environments and are based on existing health endpoints. To be of greater utility, occupational exposure limits and other risk management tools could integrate broader consideration of risks from multiple exposure pathways and sources (aggregate ADD) as well as the combined risk from exposure to both chemical and non-chemical stressors within and beyond the workplace, including the possibility that such exposures may cause interactions or modify the toxic effects observed (cumulative risk). Although risk assessments of many cases, a variety of methods and tools have been developed or are being used in all risk assessment fields to incorporate such considerations in the risk assessment process. These approaches, which are collectively referred to as cumulative risk assessment, have potential to be adapted or modified for occupational scenarios and provide a useful path forward for occupational risk assessment. Accounting for complex exposures in the workplace and the broader risk faced by the individual also requires a more complete consideration of the composite effects of occupational and non-occupational risk factors to fully assess and manage worker health problems. Barriers to integrating these different exposures, however, and ongoing community-based and worker health-related initiatives may provide mechanisms for identifying and integrating risk from aggregate exposures and cumulative risks from all relevant sources, be they occupational or non-occupational.

Keywords: aggregate exposure, cumulative risk, occupational

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INTRODUCTION

Occupational exposure limits (OELs) have traditionally focused on preventing morbidity and mortality arising from inhalation exposures to individual chemical substances in the workplace. While there are other strategies for pursuing or preventing risk prevention and avoidance of occupational hazards, many of which enhance effectiveness when used in conjunction with OELs, the theme of this manuscript is the establishment of OELs and the potential for incorporating new science into this practice. The basic and impacts of OELs
With respect to the second phase of cumulative risk assessment, several techniques have been developed to examine environmental and occupational exposures. Three of the more common techniques are (1) exposure monitoring, (2) exposure modeling, and (3) biomonitoring. These methods are intended to provide estimates of the external exposure concentration to which the target population has been exposed or to provide ...
Current NIOSH Risk Assessment and Management Activities for Chemicals

- Current Recommended Exposure Limits (REL) Development Efforts
- Chemical Carcinogen Policy
- Risk Assessment Practices
- Nanoparticles/Advanced Manufacturing
- Development of IDLH values and Skin Notation Profiles
- NIOSH Pocket Guide/Manual of Analytic Methods
- Respiratory Protective Devices
- Occupational Exposure Banding
- Prevention through Design/Green Chemistry
- Exposome/Cumulative Risk Assessment
- Collaboration on TSCA
- Hazardous Drugs List
Frank Lautenberg Chemical Safety Act (LCSA) for the 21st Century

- Signed into law June 22, 2016
- Makes significant changes to the Toxic Substance Control Act (TSCA)
- EPA requested NIOSH assistance
- Workers are identified as a “susceptible population.”
New TSCA Approach

Risk evaluation

Existing Chemicals → Risk management → New chemicals

Risk management → Existing Chemicals
NIOSH Support of EPA in Implementing the Toxic Substances Control Act

TSCA passed → EPA Develops Process → EPA Addresses Chemicals → Implementation

Input from Federal Agencies → NIOSH Reviewed protocols on first ten chemicals → Collaboration on Risk Assessment
Current NIOSH Risk Assessment and Management Activities for Chemicals

- Current Recommended Exposure Limits (REL) Development Efforts
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- Exposome/Cumulative Risk Assessment
- Collaboration on TSCA
- **Hazardous Drugs List**
Exposure of workers exposed to hazardous drugs

- Approximately 8 million workers are potentially exposed to hazardous medications in the course of their work.
- Exposure may be via inhalation or through direct contact with contaminated sources.

Hazardous Drugs in Healthcare

Healthcare Workers + Handling Hazardous Drugs → Risk Assessment and Risk Management

Cancer Reproductive Health Effects Others
Managing the risk of handling hazardous drugs

- Policies and Procedures for Developing the NIOSH List of Antineoplastic and other Hazardous Drugs in Healthcare Settings
- NIOSH list of Antineoplastic and other Hazardous Drugs in Health Care Settings, 2018 (Since 2004)
- Table 5, risk management guidance
- Broad partnership with various agencies and organizations
Questions for Board of Scientific Counselors

- What chemical guidance priorities should NIOSH focus on?
- Should NIOSH enhance its chemical guidance efforts?
- What areas of chemical hazards is NIOSH not focusing on but should consider?
Acknowledgments

- Kathleen MacMahon
- Christine Whittaker
- R. Douglas Daniels
- Charles Geraci
- Jonathan Bach
- Li Jia
- Sarah Luckhaupt
- Christopher Coffey
- Lee Greenawald
- T.J. Lentz
- Sarah Unthank
- Todd Niemeier
- Laura Hodson
- John Piacentino
- Marie Sweeney
- Lauralynn McKernan
- Jeff Peterson