Prevention through Design (PtD) and other NIOSH efforts to reduce exposure through process change

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The findings and conclusions in this presentation have not been formally disseminated by the National Institute for Occupational Safety and Health and should not be construed to represent any agency determination or policy.
Yearly Burden of Occupational Morbidity and Mortality

- Morbidity and mortality
  - 5,800 Deaths (8th leading cause)
  - 228,000 Illnesses
  - 3.9 million Serious injuries

- Comprehensive estimates of US costs of occupational injury and disease
  - Direct and indirect: $128 billion - $155 billion

- Social consequences of occupational morbidity and mortality
  - Pain; impact on families, community, and personal mental health
Anticipation

- A prior action that takes into account or forestalls a later action
- The act of looking forward
Anticipation

Prevention through Design
Parachuting cats into Borneo!

In the early 1950s, the Dayak people of Borneo had an outbreak of malaria. **WHO solution:** spray large amounts of DDT to kill the mosquitoes that carried it. The mosquitoes died. The malaria declined; so far so good.

But... People's roofs began to fall down on their heads. The DDT killed a parasitic wasp that controlled thatch-eating caterpillars. The DDT-poisoned insects were eaten by geckoes. The geckoes were eaten by cats. The cats started to die.

The rats flourished, and people were threatened by typhus and plague.

The WHO was had to parachute 14,000 live cats into Borneo.

**Operation Cat Drop** illustrates the interconnectedness of life, the importance of starting with community knowledge and creating collaborative solutions... and what happens if you don't.

*Sally Little*
Main finding: design continues to be a significant contribution to work-related serious injury.

37% of workplace fatalities involved design-related issues.

In another 14% of fatalities, design-related issues may have played a role.
**Mission:** To prevent occupational injuries, illnesses, and fatalities through the inclusion of prevention principles in all designs that impact workers.
Incorporates Hierarchy of Controls

Prevention through Design using Hierarchy of Controls

**Elimination**
Eliminate the hazard during design or re-design

**Substitution**
Substitution of less hazardous materials, processes, operations, or equipment

**Engineering Controls**
“Design-in” engineering controls to minimize risk

**Warnings**
Automatic and manual warning systems; signs and labels

**Administrative Controls**
Training, well-designed work methods & organization

**PPE**
Available, effective, easy to use

Control Effectiveness

Financial Value
Prevention through Design National Initiative

- Stakeholder input
  - Agriculture, Forestry and Fishing
  - Mining
  - Construction
  - Manufacturing
  - Wholesale and Retail Trade
  - Transportation, Warehousing and Utilities
  - Services
  - Healthcare and Social Assistance

- Strategic planning
  - Research
  - Education
  - Practice
  - Policy

- Implementation
- Performance and Sustainability

**GOAL**
Prevent or reduce occupational injuries, illness, and fatalities

- Time Line
  - 2007
  - 2008
  - 2011
  - 2014
A National initiative on PtD has been inaugurated by NIOSH and a group of collaborating organizations

American Industrial Hygiene Association
American Society of Safety Engineers
Association of Equipment Manufacturers
The Center for Construction Research and Training (CPWR)
Kaiser Permanente
Liberty Mutual
National Safety Council
Occupational Safety and Health Administration
ORC WorldWide™
Regenstrief Center for Healthcare Engineering
Factors Influencing Goals Development

**Prevent or reduce occupational injuries, illnesses, and fatalities**

**Education**
- Develop/disseminate education programs
- Expand education reach
- PtD in textbooks
- Expand curricula
- Include PtD in licensure and certification exams
- PtD consensus standard
- Add PtD to existing standards, regulations and guidelines
- Gov. agencies adopt PtD
- Define PtD vision and outcomes
- Include PtD in sustainable design and construction practices

**Practice**
- Share successful practices
- Identify PtD tools/equipment
- Share successful processes
- Demonstrate business value
- Integrate PtD into org. behavior
- Improve surveillance
- Investigate PtD ROI
- Investigations identify design-related factors
- Investigate motivators and barriers
- Investigate effective designs
- Expand incident investigation
- Show value of worker involvement
- Build PtD into existing systems

**Policy**

**Research**
Using PtD to “design-out” permit-required confined spaces

Goals:
1. Operations: efficiency & productivity
2. H&S: P-RCS compliance

Solution:
Make the spaces NOT P-R confined spaces
- Provide access/egress
- Design for continuous human occupancy

Source: Carolyn Jones, San Francisco Public Utilities Commission
Industry-Wide Equipment Re-Design Protects Workers’ Health

Before and after photos of asphalt fume emissions from highway-class pavers

Warm-mix asphalt: achieving worker safety, environmental and cost goals

- Cooler paving sites
- No asphalt fume
- Able to haul for longer distances
- More consistent pavement quality
- 95% re-used/recycled

Mechanical Devices Reduce Risks to Workers and Improve Patient Safety

Mechanical lifting devices reduce worker injuries and worker compensation expenses AND improve patient safety.

Re-Design Protects Miners’ Hearing While Demonstrating Positive ROI

Design improvements to the onboard conveyor of a continuous coal mining machine to reduce noise exposures. Coating the chain conveyor and flight bars protects mine operators’ hearing and extends the life of the chain.

E-stop Reduces Risk of Serious Injury or Death

A capstan-type winch with fishing lines wound around

A fishing vessel captain demonstrating the use of an emergency-stop (e-stop) mounted on the winch

Health Risk Assessment of Nanomaterials

*In Vitro Dermal Toxicity of Fullerenes: Size vs. Surface Properties*

C.M. Sayes et al., Nano Letters 4(10):1881-1887, 2004
**Potential Climate-Related Occupational Hazards**

- Increased ambient temperatures
- Air pollution
- Ultraviolet exposure
- Extreme weather
- Vector-borne diseases/expanded habitats
- Industrial transitions/emerging industries
- Changes in the built environment

(Schulte and Chun, 2009)
## Relationship of Hazards & Job Types

<table>
<thead>
<tr>
<th>Traditional Jobs</th>
<th>Old</th>
<th>New</th>
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<tbody>
<tr>
<td>e.g. weatherproofing &amp; insulating</td>
<td>Reinforce historical warning,</td>
<td>e.g. manufacturing car parts with new materials, e.g., using carbon nanotubes</td>
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<td>→ Installing solar cells and not controlling electrical discharge</td>
<td>Repackage warnings, focus on new scenarios</td>
<td>Develop new warnings</td>
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<tr>
<td>→ Design new products differently</td>
<td>Conduct recognition efforts</td>
<td>Collect leading indicators</td>
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<td></td>
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<td>Watch for sentinel events</td>
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<td>Develop new warnings, training and controls</td>
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- **Green jobs must be safe jobs**
  - Apply what we already know to a re-employed / re-deployed workforce
    - Worker training
  - Identify and apply “old” knowledge to new green jobs
    - Apply Prevention through Design approaches based on hazard elimination and risk minimization

- **Green technologies and products must be safe for workers**
  - Support research on new technologies resulting in new hazards and unknown risks to workers and disseminate results
Unintended Consequences

1-Bromopropane

- Replace perchloroethylene and other chlorofluorocarbons
- Reproductive and developmental effects in animals
- Neurologic abnormalities


1-Bromopropane (1-BP) (n-propyl bromide) is a solvent increasingly used as a substitute for ozone-depleting chlorofluorocarbons and similar regulated compounds. 1-BP is used in vapor and immersion degreasing operations and other manufacturing processes, and as a solvent in industries using aerosol-applied adhesives. In some states, 1-BP is used as a solvent in dry cleaning because of restrictions on use of perchloroethylene (tetrachloroethylene), a possible human carcinogen (1). Published studies of workers exposed to 1-BP have raised concerns about occupational health risks associated with exposure (2–5). This report describes two cases involving workers exposed to 1-BP and diagnosed with clinical manifestations of neurotoxicity. The cases, when coupled with previously reported studies of workers exposed to 1-BP, illustrate potential health risks of 1-BP exposure. Clinicians and public health professionals should be alert to potential health effects among workers exposed to 1-BP, particularly in dry cleaning and other workplaces where 1-BP use might be increasing, and effective control methods to limit exposure to 1-BP should be implemented at worksites.

Both cases involved neurotoxic effects that likely resulted from occupational exposure to 1-BP in the electronics and dry cleaning industries. The cases were reported to regional poison control centers in Pennsylvania (2007) and New Jersey (2008) by attending physicians who treated the affected workers. The cases were investigated by federal and state health agencies, and in-depth investigations of the New Jersey case currently are being conducted by the New Jersey Department of Health and Senior Services and CDC.

Case 1. In 2007, a male aged 50 years visited an emergency department in Pennsylvania with a history of confusion,
Document for Public Review and Comment: May 22, 2009

DRAFT NIOSH Technical Report: Prevention through Design Plan for the National Initiative
NIOSH Docket 160

The National Institute for Occupational Safety and Health (NIOSH) is conducting a public review of the NIOSH draft document entitled Prevention through Design Plan for the National Initiative NIOSH Docket Number NIOSH-160. This document has been determined by NIOSH to be a technical report document, in accordance with the Office of Management and Budget (OMB) guidelines under the Federal Data Quality Act of 2000 (Public Law 106-554, Section 1(a)(3)[515]). The overall goal of the review is to enhance the quality and credibility of Agency recommendations by ensuring that the scientific and technical work underlying these recommendations receives appropriate public review. This guidance document does not have the force and effect of law.

Summary

NIOSH has developed draft goals, performance measures, activities and timeframes, based on stakeholder input, to achieve the mission of preventing occupational injuries, illnesses, and fatalities through the inclusion of prevention principles in all designs that impact workers. These goals are included in the draft Prevention through Design Plan for the National Initiative.

NIOSH invites stakeholders to review the draft Prevention through Design Plan for the National Initiative, offer comments, and identify areas where stakeholders can make an impact, either within their business or organization, or on behalf of the National Initiative. NIOSH is interested in stakeholder opinions about the relevance of the goals and the value of the activities to achieve the goals in the draft Plan. NIOSH is also interested in identifying motivators, enablers and barriers to PID implementation. In addition, NIOSH is interested in elements of the Plan stakeholders are planning to implement or have already implemented as well as the success of those implementation efforts.


DRAFT NIOSH Prevention through Design Sector Strategic Goals - Interactive Goals List