

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

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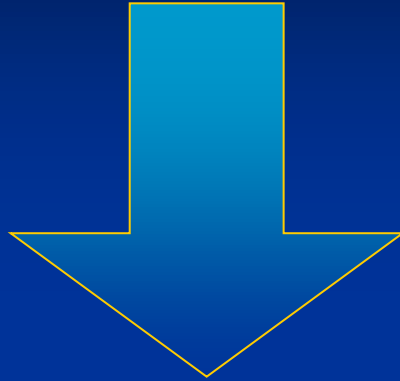
Yearly Burden of Occupational Morbidity and Mortality

- Morbidity and mortality
 - 5,800 Deaths (8th leading cause)
 - 228,00 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.

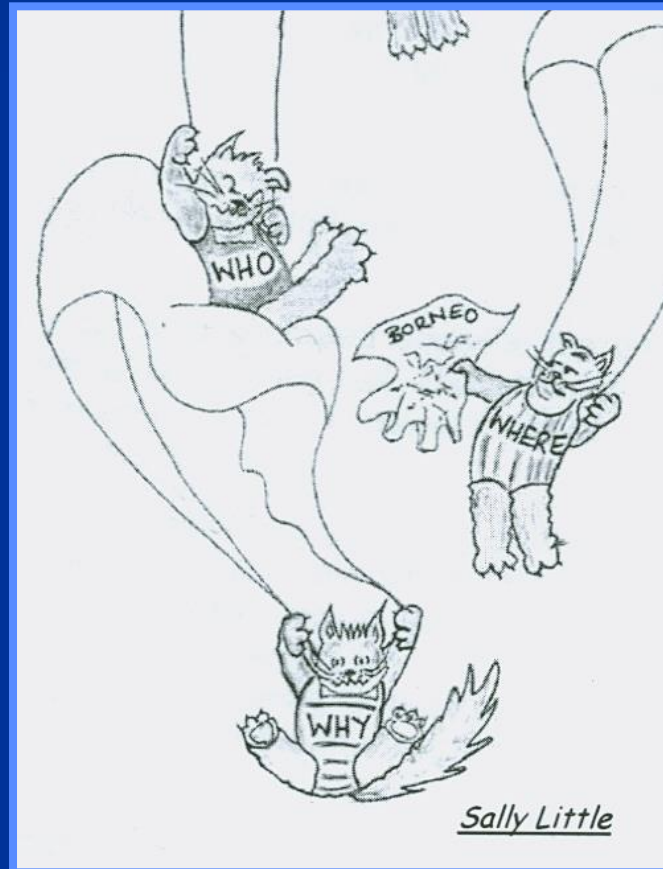
The cats started to die.

The rats flourished,

and people were threatened by typhus and plague.

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

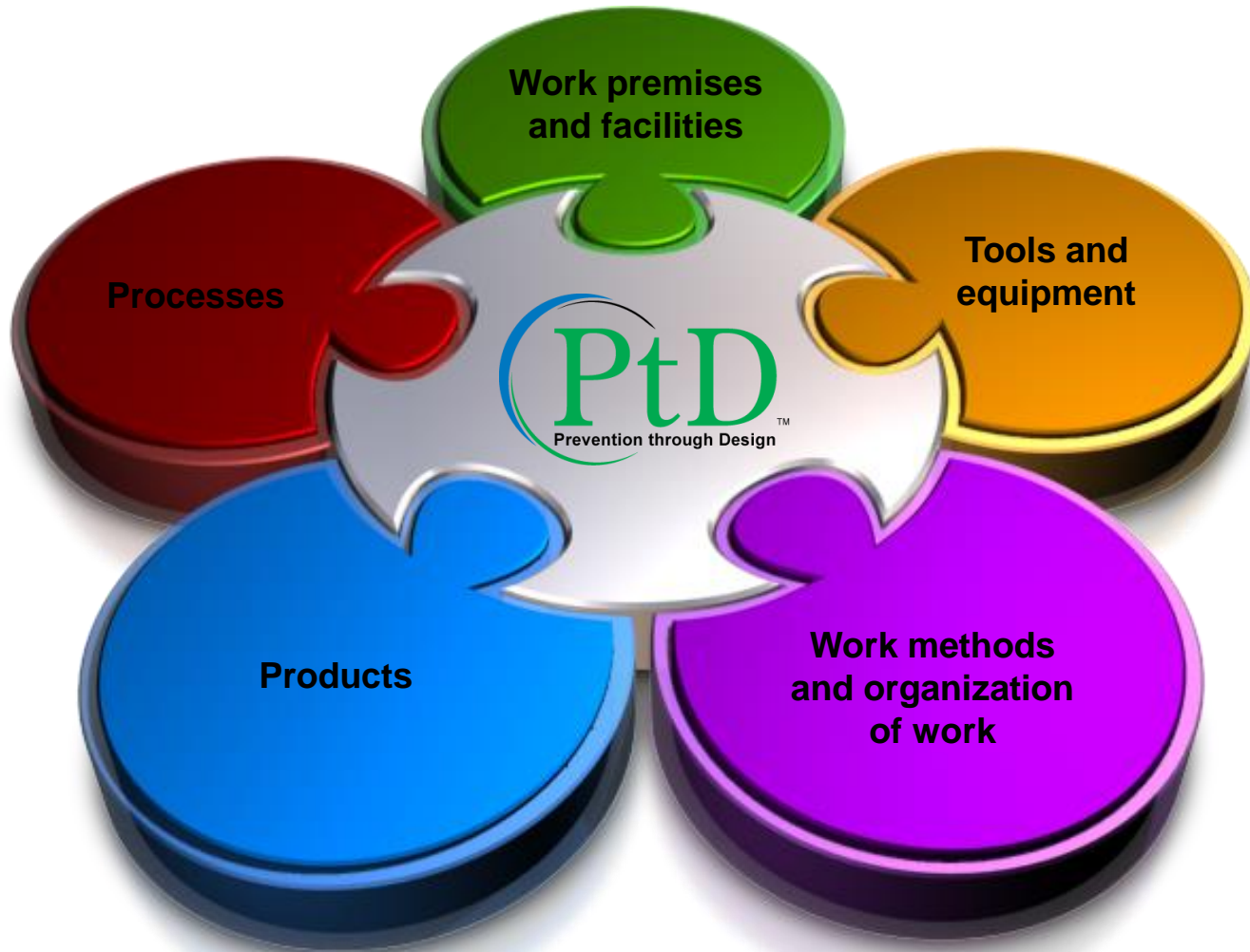
Operation Cat Drop illustrates the interconnectedness of life, the importance of starting with community knowledge and creating collaborative solutions ... and what happens if you don't.



Australian Study 2000-2002

- 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

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

Education

Develop/disseminate education programs

Expand education reach

PtD in textbooks

Expand curricula

Include PtD in licensure and certification exams

Practice

Share successful practices

Identify PtD tools/equipment

Share successful processes

Demonstrate business value

Integrate PtD into org. behavior

Expand incident investigation

Show value of worker involvement

Build PtD into existing systems

Prevent or reduce occupational injuries, illnesses, and fatalities

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

Improve surveillance

Investigate PtD ROI

Investigations identify design-related factors

Investigate motivators and barriers

Investigate effective designs

Policy

Research

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



Goals:

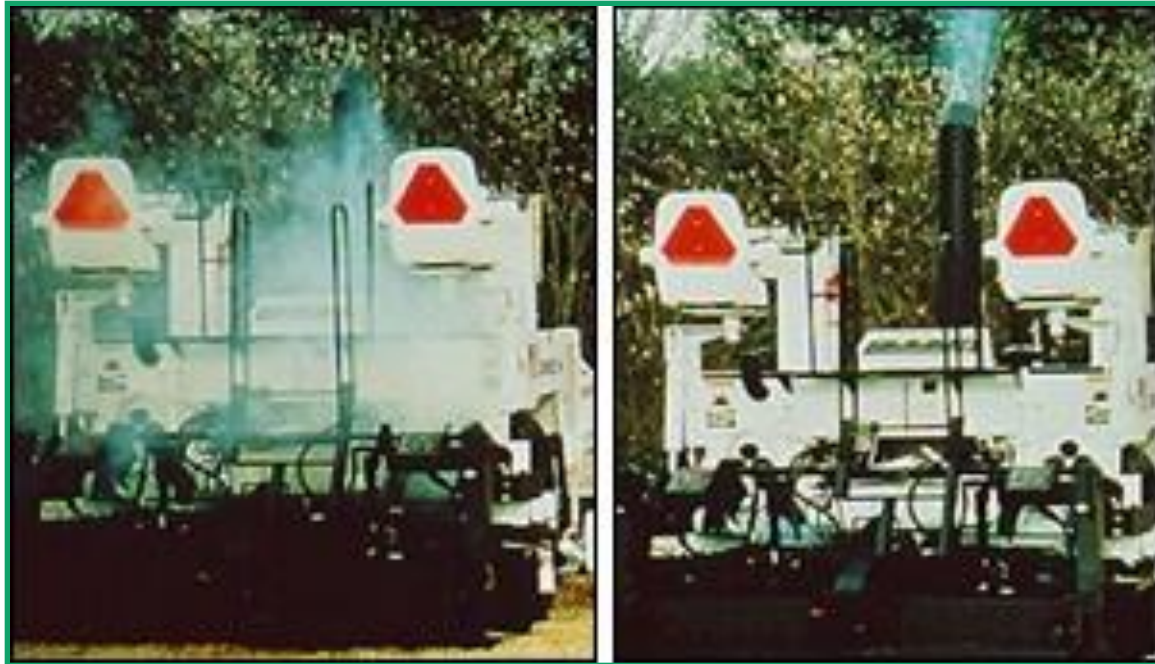
1. Operations: efficiency & productivity
2. H&S: P-RCS compliance

Solution:

Make the spaces NOT P-R confined spaces

- Provide access/egress
- Design for continuous human occupancy

Industry-Wide Equipment Re-Design Protects Workers' Health



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

Source: Cervarich MB [2008] Prevention through Partnerships. PtD in Motion, Issue 2.

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

Source: Cervarich MB [2009] Warm-Mix Asphalt: Preventing Exposure at Its Source. PtD in Motion, Issue 5.

Mechanical Devices Reduce Risks to Workers and Improve Patient Safety



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

Source: NIOSH [2006]. Safe Lifting and Movement of Nursing Home Residents. By Collins JW, Nelson A, Sublet V. DHHS (NIOSH) Publication Number 2006 - 177.



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.

Source: Kovalchik PG, Matetic RJ, Smith, AK, Bealko SB [2008]. Application of Prevention through Design for Hearing Loss in the Mining Industry. *Journal of Safety Research* 39(2): 251–254.

E-stop Reduces Risk of Serious Injury or Death



A capstan-type winch with fishing lines wound around



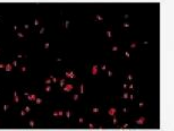
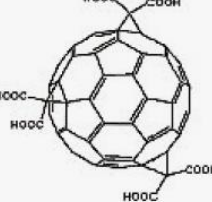

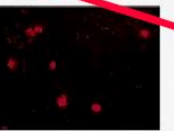
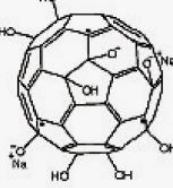


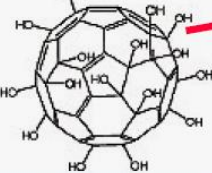

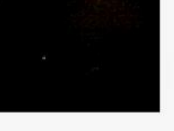


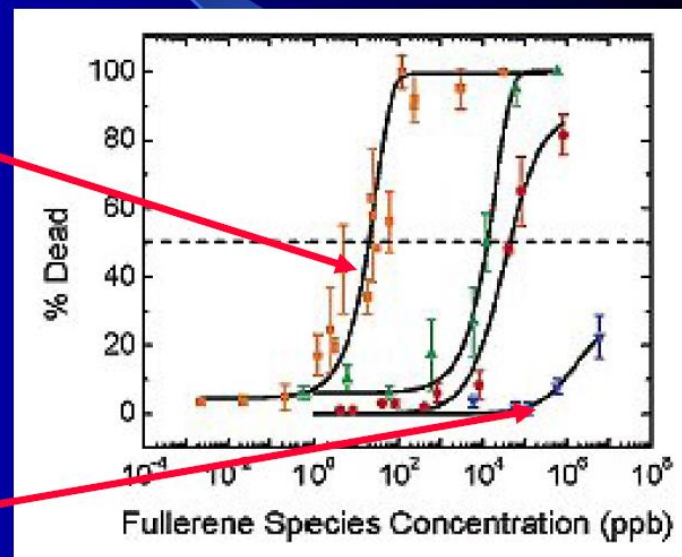
A fishing vessel captain demonstrating the use of an emergency-stop (e-stop) mounted on the winch

Source: Lincoln JM, Lucas DL, McKibbin RW, Woodward CC, Bevan JE [2008]. Reducing Commercial Fishing Deck Hazards with Engineering Solutions for Winch Design. Journal of Safety Research 39(2): 231 – 235.

Health Risk Assessment of Nanomaterials

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

Fullerene Species	Structure	Live Stain	Dead Stain
C_{60}			
C_{63}			
$Na^{+}_{2,3} [C_{60}O_{7-9}(OH)_{12-15}]^{(2-3)-}$			
$C_{60}(OH)_{24}$			



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

Relationship of Hazards & Job Types

Hazards

Old

New

Traditional

e.g. weatherproofing & insulating
→ Reinforce historical warning,

e.g. manufacturing car parts with new materials, e.g., using carbon nanotubes
→ Develop new warnings

Jobs

Installing solar cells and not controlling electrical discharge
→ Repackage warnings, focus on new scenarios
→ Design new products differently

→ Conduct recognition efforts
→ Collect leading indicators
→ Watch for sentinel events
→ Develop new warnings, training and controls

Green

■ **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

Neurologic Illness Associated with Occupational Exposure to the Solvent 1-Bromopropane – New Jersey and Pennsylvania, 2007–2008

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,

MMWR

[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 PtD 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 Technical Report: Prevention through Design Plan for the National Initiative	DraftNIOSHPTdplan.pdf (871kb; 54 pages)
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[DRAFT NIOSH Prevention through Design Sector Strategic Goals - Interactive Goals List](#)