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National Prevention through Design (PtD) Initiative

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Abstract

Introduction: The most effective means of preventing and controlling occupational injuries, illness, and fatalities is to “design out” hazards and hazardous exposures from the workplace. There is a long history of designing for safety for the general public and to a lesser degree for workers. **Method:** We now have the experience and insight from thoughtful, previous efforts to call for a comprehensive national strategy to implement a Prevention through Design (PtD) Initiative. **Results:** This paper describes that initiative in terms of four overarching areas where action can be directed: practice, policy, research, and education. To obtain stakeholder input for issues in these four areas and to focus implementation efforts, eight sector divisions of the economy will be addressed. A seven year strategy is envisioned. Published by Elsevier Ltd.

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1. Introduction

The global burden of occupational injury, illness, and death is still significant. Nationally, each year more than 55,000 people die from work-related hazards, 294,000 are made sick, and 3.8 million are injured. The annual direct and indirect costs have been estimated to range from \$128 billion to \$155 billion (Schulte, 2005; Leigh & Robbins, 2004). Moreover, the social consequence of occupational morbidity and mortality impacts families, communities, and personal mental health. If the workplace is to be safe and healthy, preventing or controlling hazards and risks is of paramount importance. This is the essence of the Prevention through Design (PtD) Initiative. PtD can be defined as:

The practice of anticipating and “designing out” potential occupational safety and health hazards and risks associated with new processes, structures, equipment, or tools, and organizing work, such that it takes into consideration the construction, maintenance, decommissioning, and disposal/recycling of waste material, and recognizing the business and social benefits of doing so.

For a National PtD initiative to be successful, it is not enough that design professionals (engineers, architects, industrial designers, etc.) consider occupational safety and health. There is a need for business decision makers, including those who purchase products and services, to seek and insist on specifications that prevent and minimize occupational safety and health risks. There has to be a demand for safer designs to protect workers. Thus, the PtD Initiative will need to focus both on the supply of innovative design solutions at the beginning of a project, and on creating the demand among business decision makers who will value and request them. To some extent, the prevention of occupational morbidity, mortality, and injury through design represents a cultural shift in the way all aspects of work are viewed. Thought needs to be given to the tools we use, the way we sit and stand, the physical and mental demands of jobs, and the physical and social way we interact with the workplace environment. This change in perspective moves the responsibility of occupational safety and health considerations away from individual workers and up the hierarchy of controls. Those at the top of the chain of command must implement prevention-based designs, systems, and processes.

The time is right for a national PtD Initiative in the United States, as considerable prerequisite work has been done and a critical mass of investigators and practitioners can be assembled to develop and implement a national initiative (Christensen, 2007; ASCC, 2006;

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Prevention through Design (PtD) National Initiative

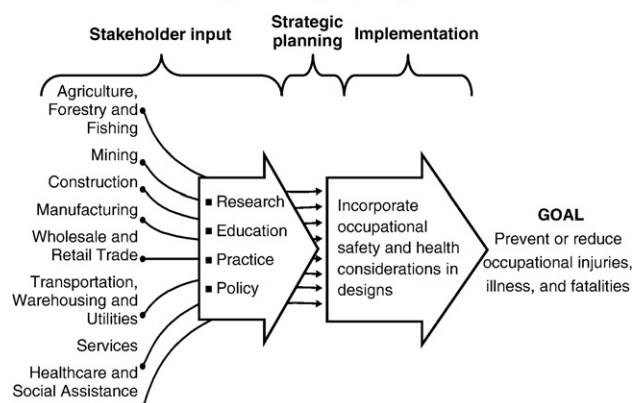


Fig. 1. Framework of the National Initiative.

Driscoll, Harrison, Bradley, & Newson, 2005; Receveur, 2005; Ferguson, Marras, & Barr, 2005; Woods & Buckle, 2005; Abdallah, Genaidy, Salem, Karwowski, & Shell, 2004; Hecker, Gambatese, & Weinstein, 2004; Morris, Wilson, & Koukoulaki, 2004; NOSHC, 2004; Christensen, 2003; Hecker & Gambatese, 2003; Baron, Estill, Steege, & Lulich, 2001; Rechnitzer, 2001; Blotzer, 1999; Christensen & Manuele, 1999; Denney, 1998; Harrison, 1998; Morrissey, 1998; Mazlish, 1997; Zak & Campbell, 1997; Jarvinen, Kuivanen, & Viitaniemi, 1996; Kedjidian, 1995; HSE, 1994; OSHA, 1994; Waters, Putz-Anderson, Garg, & Fine, 1993; Hinze & Wiegand, 1992; Bloswick, 1990; Schroy, 1986; Talty, 1986; Kellen & Sklet, 1985). We now have experience and insight from these past research efforts that we can call on for a comprehensive national strategy to implement a PtD initiative. Moreover, the importance of design for safety and health has been brought home by such disasters as Bhopal, the Challenger explosion, and the myriad of occupational injuries, illnesses, and deaths that can be linked to design flaws or omissions (Driscoll et al., 2005; Behm, 2005). Recognizing and defining the business value of PtD, such as that proposed by the ORC Worldwide Occupational Safety, Health and Environmental Networks (<http://www.orc-dc.com/rohsei.htm>), will add strength to the list of important considerations for this national strategy.

There is a rich history of efforts to build on as a new initiative is planned. All engineering has an inherent focus on safety (ECPD, 1947). A modern appraisal of specific links to design and workers' safety can be seen by efforts beginning in the 1800s, which involved inherently safer designs and the widespread implementation of guards for machinery, controls for elevators, and boiler safety practices. This was followed by enhanced design for ventilation, enclosures, system monitors, lockout/tagout controls, and hearing protectors. More recently, there has been the development of chemical process safety, ergonomically engineered tools, chairs, and work stations, lifting devices, retractable needles, latex-free gloves, and a parade of other safety devices and processes. Systems and safety engineering implicitly have long focused on worker protection to some extent. Since the 1970s, a distinct focus on worker safety and health in design has been manifest in various efforts, such as the Safety and Health Awareness for Preventive Engineering (SHAPE) program (<http://www.cdc.gov/niosh/topics/SHAPE/>); the efforts by the Accreditation Board for Engineering and Technology (ABET) to adopt new evaluation criteria, in 1987, that called for health and safety curricular objectives and specific requirements in design, laboratory, and professional practice instruction; the issuance of the Process Safety Management of Highly Hazardous Chemicals Standard (29CFR 1910.119); the National Safety Council's Integrating Safety Through Design Symposium in 1996; the establishment of the Institute for Safety Through Design; the extensive efforts in construction (e.g., Hecker et al., 2004; Gambatese, Behm, & Henze, 2005); the OSHA Alliance Roundtable on Design for Construction Safety (www.designforconstructioninsafety.org); the Whole Building Design approach (www.wbdg.org/); Project Minerva and Minerva Canada (<http://www.safetymanagementeducation.com/>); Toxics Use Reduction (Roelofs, Moure-Eraso & Ellenbecker, 2000); and various efforts by individual companies, trade associations, unions, insurance companies, and national and international industry consensus standards and guidelines. Additionally, there is growing attention to the broader impacts of designed products and processes on the environment (McDonough & Braungart, 2002).

Table 1

Initial Sponsors for Prevention through Design Workshop

American Industrial Hygiene Association
American Society of Safety Engineers
Center to Protect Workers' Rights
Kaiser Permanente
Liberty Mutual Insurance Company
National Safety Council
Occupational Safety and Health Administration
ORC Worldwide
Regenstrief Center for Healthcare Engineering

These occupational safety and health-related design improvements occurred against the backdrop of design successes in such industries as: nuclear, construction, mining, chemical, manufacturing, health care, transportation, space, medical, pharmaceutical, and food processing (Vedder & Carey, 2005; Burger, von Wielligh, De Wet, Ottermann & Steyn, 2004; Collins, Wolf, Bell, & Evanoff, 2004; Cadwallader, 2003; Gauthier & Charron, 2002; Iqbel & Hashmi, 2001; McCabe & Lippy, 2001; Ferguson, Marras, & Barr, 2005; English, 1992). People deserve and have come to expect safety in the products and services they encounter in their private lives, and as a result of this expectation, they generally are willing to pay for this safety and have the government ensure it. The question is how to achieve these same expectations among employers and workers with regard to worker safety and health. Clearly there is a need for research on the barriers to the incorporation of prevention in designs, the economic costs of not doing so or doing less than is necessary, and which prevention designs are most needed. Although this initiative focuses on design, this should not be seen as down playing the importance of other factors, such as behavior, management, leadership, and personal protective equipment. Many of these factors interact directly with designs that address occupational safety and health.

2. Research, Practice, Education and Policy

The PtD National Initiative will be framed within four functional areas: research, practice, education and policy. *Research* focuses on a broad range of questions pertaining to design effectiveness, linkage of designs to morbidity and mortality, metrics for assessing designs,



Fig. 2. Examples of Prevention through Design (PtD) in each sector.



Fig. 2 (continued).

diffusion of information, and economic and business issues. The second area focuses on influencing the *practices* of design professionals and of those who purchase their products and processes with safer designs (Toft, Howard, & Jorgensen, 2003). Design professionals are driven not only by the science of their profession, but by the demands of the market. If there is a need for designs with integrated safety prevention features, the design community will find ways to incorporate them. So one focus of the practice area is to encourage business to demand safer designs. Another focus is to motivate the professional communities to continually increase their awareness of those design features that can impact worker safety and health. Occupational safety and health professionals need to communicate and work together with designers and engineers in the design phase, as their input on what works and what does not is invaluable. This can be accomplished by impacting the third functional area, *education*, both through the augmentation of curricula, and also by stimulating professional accreditation programs to value PtD issues and include them in their competency assessments (Hanes & Rissignol, 1986; Talty, 1986; Farwell, Rossignol, & Talty, 1995; Thatcher, 2005). Finally, a fourth area focuses on *policy* to support the research and practice advances. The policy area includes: guidance, regulation, recommendations, operating procedures, and standards for incorporating occupational safety and health considerations in design decisions and actions (Robinowitz & Hager, 2000).

3. Structure of the Initiative

The ultimate goal of the PtD Initiative is to prevent or reduce occupational injuries, illnesses, and fatalities through the inclusion of prevention considerations in all designs that impact workers. Leading to this critical endpoint will be a cascade of intermediate goals, objectives, and indicators, within each of the four functional areas, that will provide a systematic pathway toward achieving the ultimate target. Stakeholder input is imperative for defining these intermediate goals and objectives. NIOSH can serve as a catalyst, but ultimately it will be the stakeholders that must actively participate in addressing these aims and objectives, and hence in implementing the initiative.

One approach to obtaining stakeholder input on PtD issues is to utilize the framework that NIOSH follows for the National Occupational Research Agenda (NORA) <http://www.cdc.gov/NIOSH/NORA/>. This framework (Fig. 1) involves the development of occupational safety and health strategic plans for the nation within each of the following eight sectors: agriculture, forestry and fishing; construction; health care and social assistance; manufacturing; mining; services; transportation, warehousing, and utilities; and wholesale and retail trade. For each sector, a council consisting of a broad range of stakeholders has been established. The sector councils are developing these national strategic plans, which will contain both research and intervention/practice goals and agendas. Each strategic plan will provide a road-map for the entire occupational safety and health community as to what is needed, in respect to both research and public health practice initiatives, to accomplish the intermediate goals and objectives developed for each industrial sector. Surveillance data (morbidity, mortality, injury, and hazards) will be used to drive the development of strategic plans for each sector. The information obtained from the surveillance data, as well as the input from stakeholders, also can point to PtD needs and opportunities in each sector. The sector councils, in conjunction with PtD representatives, will identify which sector goals have objectives that can be met by enhanced designs. While the sector councils will identify sector-specific design issues that pertain to their sectors, a significant number of the issues will be common to more than one sector. These issues can be framed in the four broader streams of research, practice, education, and policy, as described earlier. With these concepts as a foundation, the following process has been initiated.



Fig. 3. Main elements of the PtD Initiative.

- A workshop was held in 2007 to obtain stakeholder input to begin the process of developing a PtD strategic plan for the nation (See Table 1 for list of sponsors).
- Stakeholder input on priorities and issues was obtained from each of the eight NORA sectors (see Fig. 2 for examples of PtD in each sector. It should be noted that PtD provides for controls that are to be built into a product or process and are not additions that are optional).
- Stakeholder input on overarching issues was collected by four focus area groups representing practice, policy, research, and education.
- The overarching focus area groups were comprised of representatives of the various sectors, as well as others representing general interest groups.
- Based on the deliberations of the eight sector groups and the four overarching focus area groups (see reports in this issue), a strategic plan will be developed and the members of those groups will be tasked with implementing the plan.
- A representative steering group will be identified to coordinate the implementation of the strategic plan.
- NIOSH will serve as a participant and the secretariat of that steering group. The steering group, working with the sector and the overarching focus area groups, will coordinate the development of tasks and actions to accomplish the plan.

The first phase of the initiative will cover a three year period that will involve development of the strategy and initial implementation (see Fig. 3 for main elements of the PtD Initiative). The implementation will include not only steps to design and conduct various tasks, but also the identification of indicators and measures for assessing success of those tasks and their larger objectives. In the fourth year, a conference will be held to take stock of what has been achieved and to identify what aspects of the strategy and its implementation needs further effort and enhancements. In the successive three years following the conference, these further efforts to address deficiencies in the implementation will be addressed.

An important element that should be included in the initiative is the need for global cooperation or harmonization. Due to the global influence on economies, workplaces, designs, and occupational safety and health, any major initiative, such as PtD, needs to have global input and support. There are many examples, in the United States and other countries, where PtD is being considered (Driscoll et al., 2005; Toft, Howard, & Jorgensen, 2003; Robinowitz & Hager, 2000). Bringing together and sharing these ideas and efforts could strengthen each one individually.

Ultimately this initiative, building on past efforts and current and future actions, will attempt to influence a culture change toward designing for worker safety and health. To reach this objective, coordinated efforts across sectors and within functional areas will be required. All of the partners in this initiative will need to collaborate in ways that influence decision-makers at all levels to think and act on PtD. Designing out hazards, rather than dealing with them when they are inherent in completed designs, should eventually save money, lives, and suffering.

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