

Workplace design solutions

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH



Supporting Prevention through Design (PtD) Using Business Value Concepts

Prevention through Design (PtD)

PtD addresses worker exposure to hazards during the design stages of a project. One of the best ways to prevent and control occupational injuries, illnesses, and fatalities is to “design out” or minimize hazards and risks. NIOSH leads a national initiative called Prevention through Design (PtD). PtD’s purpose is to promote this concept and highlight its importance in all business decisions. For more information, see <http://www.cdc.gov/niosh/topics/ptd/>

Contents

- ▶ Prevention through Design 1
- ▶ Methods of the NIOSH Study: Determining Reasons for PtD Adoption 2
- ▶ Case 1 2
- ▶ Case 2 2
- ▶ Case 3 3
- ▶ Conclusions 3
- ▶ Recommendations 3
- ▶ Acknowledgments 3
- ▶ References 3
- ▶ Suggested Citation 4

Prevention through Design

Prevention through Design (PtD) can be defined as anticipating and designing out or eliminating safety and health hazards in facilities, work methods and operations, processes, equipment, tools, products, new technologies, and the organization of work [NIOSH 2013]. PtD concepts include all prevention considerations in the design, re-design, and retrofit of new and existing tools, equipment, structures, and work processes to reduce or prevent occupational injuries, illnesses, and fatalities [NIOSH 2010]. Unique to PtD concepts is the focus on workers who execute the designs or have to work with the products of the design, redesign, or retrofit [NIOSH 2014a]. It has been well documented that using PtD design concepts or principles is the most effective and reliable type of prevention (see NIOSH PtD website; <http://www.cdc.gov/niosh/topics/PTD/>). Furthermore, when examined using concepts of a business case (which captures the reasoning for initiating or continuing a project or task), PtD solutions have been shown to be good business decisions, whether the analysis includes

financial or non-financial measures.* [AIHA 2009; Occidental College 2002].

The National Institute for Occupational Safety and Health (NIOSH) launched a PtD initiative in 2007 with the purpose of encouraging the inclusion of prevention considerations in all designs that affect workers. As the NIOSH PtD initiative progressed, it was found that many promising engineering design solutions (those grounded in PtD principles) were not being transferred from research into practice. The failure to implement known effective solutions suggested that occupational safety and health (OSH) decisions may be based on other benefits beyond the usual goal of injury reduction or cost savings. Understanding the reasons businesses use programs and practices grounded in PtD became the objective of a NIOSH study. Identifying the different benefits of adopting PtD design solutions can help companies better appreciate and integrate PtD principles into their overall safety management systems.

This document highlights some ways that employers make decisions concern-

*For more information about implementing and promoting PtD solutions, see Renshaw [2013] and Toole et al. [2013].

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



ing PtD solutions that are known to reduce injuries and illnesses so that readers will better understand how to encourage the use (or implementation) of PtD solutions. It is not an economic evaluation of these solutions nor a comprehensive business case analysis, but presents the reasoning used by a select number of employers for adopting PtD solutions. Furthermore, it shows that there may be different types of adoption criteria such as outcome measures that use a dollar basis (financial measures) and those using a non-dollar basis (non-financial measures).

This document presents some of the reasons that companies have adopted PtD design solutions captured in prior research studies through interviews of those involved in adopting the specific solutions. Although not all business case steps were examined, the reasons for adoption can be found in the eight steps of the AIHA [2010] Value Strategy or CDC [2009] Business Case Guidelines. If safety and health practitioners employed all steps as they explore solutions to problems found in their worksite, it is more likely that they could justify the resources necessary to adopt the PtD solution of interest.

Methods of the NIOSH Study: Determining Reasons for PtD Adoption

For this NIOSH study, three PtD engineering design solutions were selected that represented unique work processes in different industries [Biddle 2013]. To determine what may have prompted these companies to adopt the PtD solutions, the study reviewed prior research findings and interviewed workers and those who were responsible for safety and health programs. The study examined the application of selected components of a traditional business case to determine the anticipated or known effects that a decision can have on the financial and non-financial performance of a company.

To determine the reasons for adopting or not adopting PtD solutions, the research

team used the American Industrial Hygiene Association (AIHA) Value Strategy [AIHA 2009], which is largely based on the Centers for Disease Control and Prevention (CDC) Business Case Resource Guide [CDC 2009]. The Value Strategy is a process that explores organizational objectives and priorities that can be used by decision makers to allocate resources in the organization. For example, the Value Strategy would include the financial benefits arising from a reduction in occupational injury and illness expenses or an increase in production levels. Alternatively, the Value Strategy would include benefits, such as changes in employee morale, company reputation, or employee turnover where the changes are not presented in dollars and hence are non-financial benefits. The Value Strategy is a common method for developing a business case for engineering solutions in the business community. As a result, the business case concepts (as defined in the Value Strategy process) were used to help identify reasons for their decisions. The eight steps of this process used in the study can be summarized as follows [AIHA 2009]:

1. Identify key business objectives and hazards
2. Prioritize value opportunities (How does the intervention influence business objectives?)
3. Assess risk reduction
4. Select approach for the business case
5. Identify changes in health status, risk management process, and business process
6. Assess the effects of those changes in financial and/or non-financial terms
7. Determine the overall value of the PtD design solution
8. Present the value of the solution to the company (the Value Proposition)

The example case studies below describe decisions that led to the adoption of each PtD engineering design solution, as well as the effects of the implementation of the PtD solution:

Case 1

Engineering and administrative controls for patient lifting were implemented in six

nursing homes of a healthcare corporation as part of a best practices program to reduce the rate, severity, and associated costs of musculoskeletal disorders. The program included mechanical lifting equipment, written policies on safe lifting, worker training, staff input, and support from management and peers [Collins and Bell 2010].

After implementing the solution, the number of nonfatal injuries dropped from an average of 47 per year to 16 per year. Workers' compensation costs were also greatly reduced. The annual average reduction was \$140,000.

The company had made the decision to invest in this safe patient lifting program solely on the basis of improving worker health outcomes and reducing workers' compensation costs. The company did not require any additional cost-benefit analysis to appreciate the economic viability of adopting this solution [Biddle 2013; Collins et al. 2004; Collins and Bell 2010].

Case 2

An ergonomic analysis of the wine grape harvesting industry in Northern California conducted by the University of California Davis and funded by NIOSH revealed substantial risk of overexertion injuries. The main factors for these injuries were lifting, carrying, and wielding tubs used to collect and transport wine grapes as they were harvested. As the result of recommendations from this initial study, several wine grape harvesting firms adopted a smaller tub that reduced each load by 11 pounds [Myers et al. 1998].

A second study conducted by NIOSH nearly 10 years later derived business cases for wine grape harvesting firms that had adopted the smaller tubs. Interviews with managers revealed that the most important outcome associated with this design solution was meeting the business objective of improving worker morale in this physically demanding hand-harvest process. Workers indicated that the smaller tub was preferred, as they experienced less fatigue and fewer aches and pains. Managers indicated that this improvement was a major

factor in workers' decisions to remain with the company for longer periods, thus eliminating the need for finding, hiring, or retraining workers with the unique skill sets necessary to maintain production goals. Meeting these business objectives also eliminated the need for management to determine the precise financial impact of this benefit. The managers who were interviewed were not aware of whether the specific changes in injury rates were due to the smaller tubs and seemed to think that the additional cost of \$1,000 per year for the new tubs was inconsequential [Biddle 2013; Durai et al. 2000].

Case 3

The chemicals used in dry cleaning processes in the garment cleaning industry have long been recognized as contributing to ozone depletion and environmental pollution. Perchloroethylene (or PERC), the most commonly used solvent in the dry cleaning process, presents serious health risks to workers as it can have respiratory and dermal effects, as well as effects on the liver, kidneys, and nervous system [EPA 1993; Ellenbecker and Geiser 2011; NIOSH 1997]. Efforts have been undertaken by EPA and several other organizations (Center for Neighborhood Technology, Pollution Prevention Center, Toxics Use Reduction Institute) to help the dry cleaning industry try alternative processes and chemicals for garment cleaning. Results were compiled to provide insight into the business case for implementing wet cleaning, a water- rather than solvent-based process. The benefit of eliminating worker exposure to hazardous chemicals in the cleaning process was evaluated by comparing the costs of dry methods (PERC-based) with those using wet cleaning chemicals.

Wet cleaning processes proved to be a better financial option based on initial investment in equipment and operating expenses, such as energy expenses, detergent, and machine maintenance, when compared with all other potential chemical substitutes. Given the reduction in exposure to toxic chemicals, it can be expected that the number of occupational illnesses would decline. Companies could

have picked another "dry" chemical to meet the new regulations, but many chose "wet" not only because it was less expensive to operate, but because it afforded the companies a claim to social responsibility by introducing "green" solutions. As such, companies were able to market the wet-cleaning process as a "green" solution and present themselves as firms who truly care about the environment, which can increase their share of garment cleaning customers [Biddle 2013, Occidental College 2008; Sinsheimer et al. 2004].

Conclusions

The NIOSH PtD study showed that companies can have very different reasons for adopting a PtD engineering design solution. When a PtD solution is being considered for use, all possible benefits, both financial and non-financial, should be explored and included in the business case analysis. Reasons for making business decisions at individual companies need to be understood and addressed to ensure that effective PtD solutions are adopted and that PtD principles are integrated into the overall occupational safety and health management system.

Recommendations

Safety and health professionals at all levels and positions in the organization should do the following to promote adoption of PtD design solutions [AIHA 2009; AIHA 2010; Biddle et al. 2011]:

- ▶ Understand and align PtD solution strategies with the company's strategic business objectives, core mission, and goals.
- ▶ Solicit input from the company's safety and health management chain about their decision making techniques.
- ▶ Identify and seek support from key decision makers who are responsible for (or can influence the adoption of) the PtD solution.
- ▶ Secure the support of senior management for adopting the PtD solution.
- ▶ Derive and present the business case, including financial and non-financial

benefits of the design solution alongside the more commonly conducted risk assessment to demonstrate the benefit of the PtD solution to the company. For more information see the CDC Business Case Resource Guide and the AIHA Value Strategy Manual

Acknowledgments

This document was prepared by Elyce Biddle, West Virginia University, and Susan Afanuh of NIOSH.

References

- AIHA [2009]. Strategy to demonstrate the value of industrial hygiene. Falls Church, VA: American Industrial Hygiene Association. www.aiha.org/votp_NEW/index.html
- AIHA [2010]. Value strategy manual. Silverstein B, ed. Falls Church, VA: American Industrial Hygiene Association. https://webportal.aiha.org/Purchase/ProductDetail.aspx?Product_code=96386daf-54d1-df11-9db1-005056810034
- Biddle E [2013]. Business cases supporting PtD solutions. *Professional Safety* March:56–64.
- Biddle E, Carande-Kulis VG, Woodhull D, Newell S, Shroff R [2011]. The business case for occupational safety, health, environment and beyond. In: Burke RK, Clarke S, Cooper CL (eds.) *Occupational Health and Safety*. Burlington, VT: Gower Publishing Co., pp. 47–70.
- CDC [2009]. Investing in health and safety: a business case resource guide. By Carande-Kulis V, Biddle E, Sotnikov S. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.
- Collins JW, Wolf L, Bell J, Evanoff B [2004]. An evaluation of a "best practices" musculoskeletal injury prevention program in nursing homes. *Injury Prevent* 10: 206–211.
- Collins JW, Bell J [2010]. Translating injury prevention research into workplace practice (invited keynote presentation). In: *Safer and more productive workplaces: proceedings of the 46th annual conference of the Human Factors and Ergonomics Society of Australia*. Sydney, Australia: HFESA, Inc, pp. 2–12.

Durai V, Miles JA, Meyers JM, Faucett JA, Janowitz IL, Tarter ME, Tejada DG, Smith RH, Weber EA [2000]. Harvesting aids for reducing ergonomics risk factors in wine grape hand harvesting. Davis, CA: University of California, Agricultural Ergonomics Research Center. <http://ag-ergo.ucdavis.edu/papers/2000AsaeVineInterven.pdf>

Ellenbecker M, Geiser K [2011]. The origins of the Massachusetts toxics use reduction program. *J Cleaner Production* 19(5):389–396.

EPA [1993]. Multiprocess wet cleaning: cost and performance comparison of conventional dry cleaning and an alternative process. Washington, DC: U.S. Environmental Protection Agency, EPA Document No. 744-R-93-004.

Myers JM, Miles JA, Faucett J, Janowitz I, Tejada DG, Weber E, Smith R, Garcia L [1998]. Ergonomic risk factors for musculoskeletal disorders in wine grape vineyard work. University of California. ag-ergo.ucdavis.edu/papers/vineyard-jmm.htm

NIOSH [1997]. Control of health and safety hazards in commercial drycleaning: chemical exposures, fire hazards, and ergonomic risk factors. By Earnest GS, Spencer AB, Smith SS, Heitbrink WA, Mickelson RI, McGlothlin JD, Ewers LM. NIOSH (DHHS) Publication No. 97-150. <http://www.cdc.gov/niosh/docs/97-150/>

NIOSH [2010]. Prevention through Design: plan for the national initiative. DHHS (NIOSH) Publication No. 2011-121. <http://www.cdc.gov/niosh/docs/2011-121/>

NIOSH [2013]. The state of the national initiative on prevention through design. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2014-123. <http://www.cdc.gov/niosh/docs/2014-123/pdfs/2014-123.pdf>

NIOSH [2014a]. The state of the national initiative on Prevention through Design. DHHS (NIOSH) Publication No. 2014-123. <http://www.cdc.gov/niosh/docs/2014-123/>

NIOSH [2014b]. NIOSH workplace safety and health topic page: prevention through design. <http://www.cdc.gov/niosh/topics/ptd/>

Occidental College [2002]. Dry cleaners call switch to non-toxic wet methods a good business decision. (October 29). <https://www.oxy.edu/news/dry-cleaners-call-switch-non-toxic-wet-cleaning-good-business-decision-occidental-report-finds>

Occidental College [2008]. Oxy goes green with professional wet clean. <http://www.oxy.edu/news/oxy-goes-green-professional-wet-clean>

Renshaw F [2013]. Methods for implementing PtD. *Professional safety*. March:50–55.

Sinsheimer PJ, Grout C, Namkoong A, Gottlieb R [2004]. Fashioning a greener shade of clean: Commercialization of professional wet cleaning in the garment care industry. Pollution Prevention Education & Research Center, Los Angeles, CA: Occidental College.

Toole M, Heckel P, Hallowell M [2013]. Policy development: a key factor in promoting PtD. *Professional Safety*. March:41–47.

Suggested Citation

NIOSH [2015]. NIOSH Workplace Design Solutions: supporting Prevention through Design (PtD) using business value concepts. By Biddle E, Afanuh S. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. DHHS (NIOSH) Publication No. 2015-198.

Information

The information in this document is based on research related to Prevention through Design (PtD) initiatives. The complete study, along with other PtD articles, can be found in Biddle E [2013]. Business cases supporting PtD solutions. *Professional Safety* March:56–64.

More information about PtD is available on the NIOSH website at <http://www.cdc.gov/niosh/topics/PtD/>

To obtain information about other occupational safety and health topics, contact NIOSH at:

Telephone: 1–800–CDC–INFO (1–800–232–4636)
TTY: 1–888–232–6348 • CDC INFO: www.cdc.gov/info

or visit the NIOSH website at www.cdc.gov/niosh

For a monthly update on news at NIOSH, subscribe to *NIOSH eNews* by visiting www.cdc.gov/niosh/eNews.

Mention of any company or product does not constitute endorsement by NIOSH. In addition, citations to websites external to NIOSH do not constitute NIOSH endorsement of the sponsoring organizations or their programs or products. Furthermore, NIOSH is not responsible for the content of these websites.

This document is in the public domain and may be freely copied or reprinted. NIOSH encourages all readers of the *Workplace Design Solutions* to make them available to all interested employers and workers.

As part of the Centers for Disease Control and Prevention, NIOSH is the Federal agency responsible for conducting research and making recommendations to prevent work-related illness and injuries.