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## **Noise Control Strategies: Lessons from Safe-in-Sound Excellence in Hearing Loss Prevention Awards™**

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### **ABSTRACT**

In the environmental and occupational health arenas, recognition of benchmarks, awards, and incentive schemes are receiving increasing attention for their role in promoting excellence and adoption of preventive interventions. Few awards or incentive programs exist worldwide specifically focused on noise control and the prevention of occupational hearing loss. In 2007, the National Institute for Occupational Safety and Health (NIOSH) partnered with the National Hearing Conservation Association (NHCA) to create the Safe-in-Sound Award™ for Excellence and Innovation in Hearing Loss Prevention ([www.safeinsound.us](http://www.safeinsound.us)). The objectives of this award program are to recognize effective and innovative initiatives, and to share leading edge information to a broader community. Fifteen awards have been presented to date. The award process has resulted in the acquisition of high quality field data related to noise exposure monitoring and successful noise control outcomes leading to the elimination of the need for a hearing conservation program or in the reduction of number of workers enrolled in the program. In addition, award recipients demonstrated a strong return on investment from noise control initiatives such as “Buy-Quiet” and “Quiet-by-Design”. A summary of specific strategies and examples of outcomes are provided in an effort to more widely disseminate the practicality, feasibility, and significant individual worker impacts of noise control in the workplace.

### **1. INTRODUCTION**

The risk of noise-induced hearing loss (NIHL) and the need for public health policy, early intervention and preventive programs addressing such risk have been well recognized for decades. Industry has also been required to comply with regulatory requirements to control hazardous noise exposures and implement hearing conservation programs.<sup>1</sup> Yet, despite these regulations, evidence shows that hearing conservation programs need to be improved and innovative strategies developed and disseminated.<sup>2-4</sup>

Since 1970, the National Institute for Occupational Safety and Health (NIOSH) has provided evidence-based direction targeting the prevention of occupational hearing loss through research mandated as part of Public Law. 91-596 (available at [www.osha.org](http://www.osha.org)). The mission of the NIOSH Hearing Loss Prevention Cross-Sector Research Program is to provide national and global leadership to reduce the prevalence of occupational hearing loss. Since 2005, NIOSH research has focused on four strategic goals; 1) contribute to the development, implementation, and evaluation of effective hearing loss prevention programs; 2) reduce hearing loss through

interventions targeting personal protective equipment; 3) develop engineering controls to reduce noise exposures and 4) improve understanding of occupational hearing loss through surveillance and investigation of risk factors. Traditionally, NIOSH has encouraged the use of a hierarchy of controls that prioritizes controlling the source of exposures (primary prevention), as this approach is potentially more effective and protective than those involving personal protective equipment (<http://www.cdc.gov/niosh/topics/engcontrols/>). Following the hierarchy normally leads to the implementation of inherently safer systems, ones where the risk of illness or injury has been substantially reduced. However, regarding noise, published reports on interventions to control it at the source refer primarily to experimental conditions tested in laboratory settings with no mention to field evaluations involving the effect of these conditions on workers' noise exposure.<sup>4-7</sup>

One of the approaches NIOSH took to address its goals involving noise and hearing loss prevention was to make it attractive for industry health and safety personnel to volunteer their success stories by nominating their hearing loss prevention initiatives for an award. The Safe-in-Sound Excellence in Hearing Loss Prevention Award™ was created in partnership with the National Hearing Conservation Association (NHCA) in late 2006 ([www.safeinsound.us](http://www.safeinsound.us)). The objective of this initiative was to obtain information about real world successful hearing loss prevention programs and public health practices currently in use in industry and disseminate it widely. The rationale behind this initiative was that by disseminating evidence-based strategies Safe-in-Sound™ could enable other groups to effectively advance evidence-based hearing loss prevention practice.

## 2. METHODS

The Safe-in-Sound Award™ implements a rigorous systematic review process to capture and evaluate the successes and lessons learned from examples of excellence in hearing loss prevention programs. Applications to the Award are submitted online and undergo a series of reviews including: pre-screen for completeness; preliminary scores; first-round decisions; supplemental information requests; second-round decisions; selective site visits and final award decisions (<http://www.safeinsound.us/application.html>). Applicants describe all aspects of their hearing loss prevention program, including noise control. Crystal awards are presented annually at the NHCA annual conference by the NIOSH director or his or her representative. The first awards were presented in 2009. Current and past award winners can be reviewed at <http://www.safeinsound.us/winners.html>. Safe-in-Sound Award™ winner values and characteristics were summarized by Meinke and Morata.<sup>8</sup>

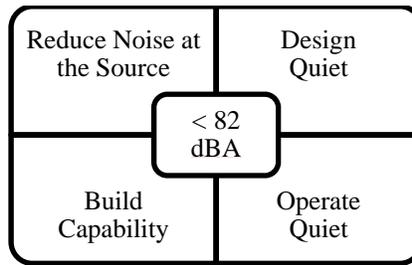
Noise control has emerged as a cost-effective primary preventive strategy implemented by several of the award recipients. Successes have also been demonstrated by using “Buy-Quiet” and “Quiet-by-Design” initiatives. “Buy Quiet” and “Design Quiet” programs are those where purchasers compare the noise emission levels of different models of equipment, and whenever possible, select the quieter model. Some winning examples obtained from manufacturing and construction industries will be described in the next section.

## 3. NOISE CONTROL EXAMPLES

### A. Manufacturing Industry

**2012 recipient Colgate-Palmolive** (CP) is a global company with 35,000 employees in over 200 countries. CP manufactures dental care, personal care, home care and pet nutrition products. CP leverages resources and timely, responsive communication across the world-wide corporation to

implement innovative, up-to-date solutions which both improve the work place and reduce its environmental impact. Examples of their interventions include: 1) completion of numerous noise-control studies throughout each business unit to identify *all* noise sources affecting worker exposure; 2) development and implementation of many pilot-program noise control measures; 3) documentation of cost and noise reduction results; 4) dissemination of an internal CP handbook on noise control; 5) development of online, on-demand webcast training in noise control engineering available in six languages; 6) establishment of checklists for sustaining low-noise levels; and 7) the adoption of buy-quiet and design-quiet policies – even to the point of offering their own noise control engineers to engage and assist equipment manufacturers in developing quieter machinery. Key elements of Colgate Palmolive’s noise reduction strategy are illustrated in Figure 1. Note that CP follows the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value® or local regulations, whichever is more stringent. Accomplishments are detailed at <http://www.safeinsound.us/swf/colgate/index.html>. Examples of the noise reduction results achieved are presented on Table 1.



**Figure 1:** Key elements of Colgate Palmolive’s Noise Reduction Strategy, in the Safe-in-Sound Award application example; see <http://www.safeinsound.us/swf/colgate/index.html>.

**Table 1:** Examples of Colgate Palmolive’s noise reduction results in the Safe-in-Sound Award application; see <http://www.safeinsound.us/swf/colgate/index.html>.

<u>Noise Reduction Projects</u>	<u>Reduction</u>
Air Wand	22 dB
AISA 3000	6 dB
Case Former	10 dB
Ceiling Sala Michelangelo	5-10 dB
Con-Air Dryers	9 dB
Cumberland Grinder	8 dB
Filler Outfeed	26 dB
HDPE Blending Room	6 dB
Mufflers	17 dB
Palletizer Systems	5 dB
Trimmer in Feed	9 dB

Their results were achieved by applying internal expertise to establish synergistic partnerships across diverse departments to solve problems. These partnerships engage all organizational levels (employee, supervisor, management, contractor, supplier etc.) and leverage the advocacy

of key individuals at the worker level to provide day-to-day program support, resource procurement and accountability. For example, advances in noise reduction across the corporation were achieved through a partnering of the Noise, Energy, and Maintenance corporate teams with external consultants and suppliers. Recognizing that compressed air was both a significant source of noise (~30% of all over-exposures) and energy consumption (~15%), CP created a “Noise, Energy & Maintenance Team”. Team members collaborated to create a guidance document to optimize system operation, minimize air leaks and provide guidance on appropriate use of air tools. This effort involved; 1) measuring, documenting and optimizing air pressure settings for all pneumatic devices, 2) maintaining the pneumatic equipment and monitoring the optimized settings over time and 3) locating and repairing compressed air leaks from cracked hoses, failed seals, etc. In addition, 45 air wands were replaced in the award application example (see Figure 2). Noise dosimetry results indicated that worker doses were reduced from 112.8 to 90.1 dBA 8-hr time-weighted average (8hr-TWA). This change also resulted in energy savings, providing the greatest noise reduction per dollar invested.



**Figure 2.** Replacement compressed air wands adopted by Colgate Palmolive. Several types of wands and quiet design nozzles are commercially available.

**2009 recipient Pratt & Whitney - East Hartford Facility, CT.** Pratt & Whitney, a United Technologies Corp. Company, is a world leader in the design, manufacture and support of aircraft engines, gas turbines and space propulsion systems. At the time of the award, it employed over 8500 workers. The East Hartford facility was recognized for their exceptional commitment to noise control and for promoting the active involvement of the workforce in their efforts. As with CP, Pratt & Whitney also applied internal expertise across diverse departments to address their noise exposures. A unique feature of Pratt & Whitney noise control effort was the widespread provision of sound level meters across the workforce as a screening tool for identifying potentially hazardous noise activities. Teams at the plant cataloged manufacturing processes with noise levels above 85 dBA and then prioritized and implemented more than 500 successful noise reduction projects; some examples are listed on Table 2.

**Table 2:** Examples of Pratt & Whitney - East Hartford Facility noise reduction results in the Safe-in-Sound Award application; see <http://www.safeinsound.us/swf/P&W/index.html>

Noise Reduction Projects	Reduction
Chemical tank blowers	13 dB
Dust collectors	5 dB
Hydro flows	12 dB
Power presses	14 dB
Sweco bowls	12 dB
Turbo tip plating line	11 dB
Vacuum pumps	7 dB
Enclosures for use of hand tools (air guns and polishers, etc.)	22-28 dB

**2013 recipient Vulcan Materials Company (VMC)**, a major producer of construction aggregates; primarily crushed stone, sand and gravel. VMC operates 323 aggregates plants and other production and distribution facilities which serve 19 states, the District of Columbia, the Bahamas and Mexico. VMC was recognized for their commitment and implementation of a quality data-driven hearing loss prevention program that extends beyond simple regulatory compliance. VMC's effort is especially noteworthy when one considers the diverse and ever-changing and challenging work environments that are characteristic of this industry. VMC provides extensive noise measurement and control training and re-training for select employees to function as industrial hygiene support staff. VMC has embraced innovative and cost-effective noise measurement and control strategies. Examples are illustrated in Figure 3.



**Figure 3:** Examples of the different types of noise control developed by the Vulcan Materials Company: a) climate-controlled work booth; b) climate-controlled enclosed cab; and c) cameras used to reduce the need for employees to position themselves in noisy areas while conducting visual inspections of equipment operation, as seen in the Safe-in-Sound presentation; see <http://www.safeinsound.us/swf/VM/index.html>.

VMC's is also leading the advancements in noise monitoring strategies for mobile workers by integrating sophisticated technologies such as GPS, and video into their noise measurement protocols. These novel approaches will benefit other industries in the future and contribute to the goal of eliminating occupational noise-induced hearing loss; see <http://www.safeinsound.us/swf/VM/index.html>.

Other examples of successful noise control projects from the manufacturing industry were provided by the 2013 recipient Johns Manville, 2011 recipient Shaw Industries Group, Fibers Division, Plant WM, GA and 2009 recipient Domtar Paper Company, Kingsport Mill, TN. Their accomplishments are also detailed at <http://www.safeinsound.us/archive.html>.

## **B. Construction Industry**

**2012 recipient Bechtel National Inc., BSII, Waste Treatment & Immobilization Plant Project (Richland, WA).** The Hanford Waste Treatment and Immobilization Plant (WTP) is the world's largest radioactive waste treatment plant. It is being designed, constructed, and commissioned by Bechtel National, Inc. Bechtel Waste Treatment & Immobilization Plant Project was recognized for their innovative strategies to address industry specific challenges in the areas of noise monitoring, noise risk evaluation and noise risk communication, for adopting the NIOSH-recommended exposure limit of 85 dBA with the 3 dB exchange rate, for promoting the active involvement of the workforce in their efforts, and for encouraging the adoption of their strategies by other Bechtel sites. Their noise reduction strategy included a comprehensive qualitative noise assessment. All noise sources (tools, stationery equipment and mobile equipment) were compiled into an Inventory of Noise Sources with noise levels and distances from the sources that would constitute a Hearing Protection-Required area. Noise exposure assessment was conducted by craft, task and equipment. The NIOSH Power Tool database (<http://wwwn.cdc.gov/niosh-sound-vibration/>) was also used to complete their inventory. Engineering controls were put in place for stationery equipment and workshops, while portable noise absorbing curtains were made available for workers as needed. Details of their award-winning strategies can be seen at <http://www.safeinsound.us/swf/Bechtel/index.html>.

**2010 recipients New York City Department of Environmental Protection (NYCDEP) and Parsons Brinckerhoff (PB), Inc.** This partnership was recognized for their combined efforts in developing, implementing and overseeing the New York City Construction Noise Mitigation Rule. The NYC DEP and PB established a partnership to address a mayoral charge to update the New York City's Noise Code and create a new law establishing rules for construction noise. This Rule was developed primarily to reduce community noise by establishing noise emission limits and requiring noise mitigation measures for all construction work occurring within New York City. Because of NYC DEP and PB's insight, the rules proactively address work-related exposures, thereby extending its reach and benefits. One example of the use of a "Buy-Quiet" approach was the development of a *Noise Control Product and Vendor Guidance Sheet* (available at [http://www.nyc.gov/html/dep/pdf/construction\\_guidance.pdf](http://www.nyc.gov/html/dep/pdf/construction_guidance.pdf), with a second list for smaller constructions jobs [http://www.nyc.gov/html/dep/pdf/construction\\_guidance\\_small.pdf](http://www.nyc.gov/html/dep/pdf/construction_guidance_small.pdf)). This information helps contractors find and select quieter-type equipment and materials for their job sites. This Guidance Sheet was compiled from noise emission data provided by multiple equipment manufacturers. Details are available online at <http://www.safeinsound.us/swf/NYC/index.html>. Further, NYC DEP and PB Safe-in-Sound Award™ designation was noted in the opening ceremony at Inter-Noise 2012 and in the welcome address by Mayor Bloomberg.

## **4. CONCLUDING COMMENTS**

Prevention of NIHL is frequently an over-looked area of occupational health and safety. The Safe-in-Sound Award™ serves to highlight the real world accomplishments of awardees and remind a larger public audience of the importance of these efforts. Several of the winning approaches are readily adaptable to diverse industries. A large cross-section of workers could benefit if similar noise control efforts are undertaken in the future. The Award application itself may be a catalyst for stimulating a program evaluation from a new perspective... "what are we doing right". Winning organizations/employers reported that the Safe-in-Sound Award™

provided leverage and opportunities to expand the reach of their current approaches; pilot programs have been adopted by other entities or in other geographical regions. Winners indicated having received greater administrative/managerial support with additional resources allocated to their hearing loss prevention efforts. New strategies are spreading corporate-wide and professional/government organizations are discussing new policies, guidelines and/or procedures. The Safe-in-Sound Award™ establishes credibility, especially for those award winners who stretch traditional boundaries with novel or unique approaches. Rather than the awards serving to only recognize those that have reached a pinnacle of achievement, it actually motivates the award winners to pursue additional program improvements and to reach higher goals. Personal commitments are renewed, re-dedicated and re-energized. In addition, the award has facilitated the extension of successful hearing loss prevention activities and strategies toward workers that are not traditionally considered in typical workplace hearing loss prevention programs (e.g. musicians, hunters, military personnel). Input to the website and the award program can be sent to [info@safeinsound.us](mailto:info@safeinsound.us) or to our Twitter account at @SafeinSoundUS. We hope other noise researchers will be encouraged to report on effective noise controls as measured in the field, and consider applying for the award.

## DISCLAIMER

Mention of any company or product does not constitute endorsement by the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH). The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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