



## **Awarding and promoting excellence in initiatives to control noise and prevent hearing loss**

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### **ABSTRACT**

**How can we capture the impact of noise control? The National Institute for Occupational Safety and Health and the National Hearing Conservation Association are helping answer this question through the Safe-in-Sound Excellence in Hearing Loss Prevention Award™. The award gathers, organizes and disseminates information on proven approaches to reduce the risks associated with noise exposure. By disseminating evidence-based strategies, Safe-in-Sound™ aims to enable other organizations to effectively advance hearing loss prevention practices. The award highlights accomplishments and reminds a larger audience of the importance of controlling noise. Some winners report that the award provides leverage and opportunities to expand the reach of the current approaches within their organizations. Furthermore, several Safe-in-Sound™ solutions have been adopted by other organizations or in other geographical regions. Beyond recognizing those that have reached a pinnacle of achievement, the award motivates winners to pursue additional program improvements and to reach higher goals. In addition, the award has facilitated the adoption of successful noise control activities and strategies for workers not traditionally considered in typical workplace hearing loss prevention programs (e.g. musicians, military personnel).**

### **1 INTRODUCTION**

The preferred approach for hearing loss prevention is to eliminate hazardous noise at the source. However, the American workplace tends not to consider engineering controls for noise, as these are viewed as complicated and cost-prohibitive to implement. Correcting this misperception is a fundamental need as repercussions stemming from this misperception include:

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- A critical gap in the understanding of economic benefits of implementing noise engineering controls, and
- Pervasive and reflexive use Personal Protective Equipment (PPE) to protect workers' hearing – a strategy proven to be ineffective due to poorly chosen or incorrectly worn PPE.

Although approaches designed to promote the control of noise already exist, they are not widely practiced. This scenario is partially explained by the gap in literature on engineering noise controls aimed at users and safety professionals. In the past decade, professional organizations, occupational health agencies, researchers and policy makers have recognized the need for evidence on the effectiveness of interventions designed to reduce or prevent workplace injuries and illnesses.<sup>1</sup> While many workplaces implement recommended interventions for noise control, few publications exist documenting the effectiveness of these actions in the field. Peer-reviewed information on the effectiveness of the many strategies and approaches currently in use could help correct weaknesses, or further encourage their adoption and expansion. A systematic review of interventions to prevent noise-induced hearing loss in the workplace, found 12 studies that described 107 uncontrolled case studies of immediate reductions in noise levels of machinery ranging from 11.1 to 19.7 dB(A) as a result of purchasing new equipment, separating noise sources or installing panels or curtains around sources.<sup>2</sup> However, as the studies lacked long-term follow-up and dose measurements of workers, they were not incorporated in the report's conclusions.

Both in the environmental and occupational health arenas, incentive schemes, benchmarks, and awards are receiving increasing attention for their role in promoting excellence and adoption of preventive interventions.<sup>3,4</sup> Some Australian occupational health and safety jurisdictions provide incentives for interventions that include the control of noise or chemical exposures, or other initiatives to improve occupational health.<sup>5</sup> The Institute of Noise Control Engineering (INCE) and the INCE Foundation manages four awards (<https://internoise2018.org/awards.php>). They are the Excellence in Noise Control Engineering Award, Distinguished Noise Control Engineer Award, Laymon N. Miller Award for Excellence in Acoustical Consulting, and the Martin Hirschorn IAC Prize – Best Paper Award. In this paper, we focus on the Safe-in-Sound™ initiative, which was launched to gather, organize and disseminate information on proven approaches to reduce the risks associated with noise exposure.

## **2 SAFE-IN-SOUND EXCELLENCE IN HEARING LOSS PREVENTION AWARD™**

In 2007, the National Institute for Occupational Safety and Health (NIOSH, <https://www.cdc.gov/niosh/about/default.html>) partnered with the National Hearing Conservation Association (NHCA <http://www.hearingconservation.org/>) to create the Safe-in-Sound Excellence in Hearing Loss Prevention Award™ ([www.safeinsound.us](http://www.safeinsound.us)). In 2018, the partnership was extended to include the Council for Accreditation in Occupational Hearing Conservation (CAOHC <http://www.caohc.org/>). By obtaining information on real-world, evidence-based strategies and disseminating them, Safe-in-Sound™ aims to enable other groups to effectively advance proven approaches in hearing loss prevention.

Awards are presented for 1) excellence and 2) innovation in hearing loss prevention. For the Excellence Award, applications are evaluated on criteria focused on hearing loss prevention programs in the workplace. The Innovation Award, by contrast, is meant to recognize individuals

or organizations for their dedication to fostering, creating and implementing innovative solutions to real workplace hearing loss prevention challenges. These advances can include policy development, program development and implementation, advocacy and outreach efforts as well as unique product applications and their effectiveness. The Innovation Award is not intended to be an endorsement of a commercial product. Representatives of the winning enterprises/organizations are invited and offered support to attend the annual conference of the National Hearing Conservation Association, where they present their award-winning stories and receive an engraved crystal award.

The Safe-in-Sound Award™ has facilitated the extension of successful hearing loss prevention activities and strategies to workers not traditionally considered in typical workplace hearing loss prevention programs (e.g. musicians, military personnel, workers in services and construction).<sup>6</sup> Furthermore, several real-world, cost-effective examples focus on “Buy-Quiet” and “Quiet-by-Design” initiatives. These are programs guiding purchasers to compare the noise emission levels of different models of equipment, and whenever possible, select the quieter model.

Despite the challenges of confidentiality, trade secrets and legal constraints that may inhibit the publication of noise control efforts, the award process has resulted in the acquisition of high-quality field data related to noise exposure monitoring and successful noise control outcomes. These interventions have led to elimination of the need for hearing conservation programs or in reducing the number of workers enrolled in these programs. In an effort to more widely disseminate the practicality, feasibility and impacts of noise control in the workplace, several strategies are presented in this report. A few award-winning examples for the manufacturing industry are summarized in the next section. Details of other award-winning strategies can be seen at <http://www.safeinsound.us/winners.html>.

## **2.1 Examples of Manufacturing Industry Safe-in-Sound™ Winners**

### *2.1.1. Northrop Grumman Systems Corporation, Electronic Systems Sector, from Linthicum, Maryland.*

Northrop Grumman Electronic Systems (NGES) is a developer, manufacturer, integrator and supporter of advanced electronic and maritime systems for U.S. and international customers for national security and non-defense applications. The Electronic Systems Sector headquarters employs 4000 employees in Linthicum, MD. Northrop Grumman Electronics Systems was recognized for their commitment and implementation of hearing loss prevention strategies in a highly unique and challenging work environment.

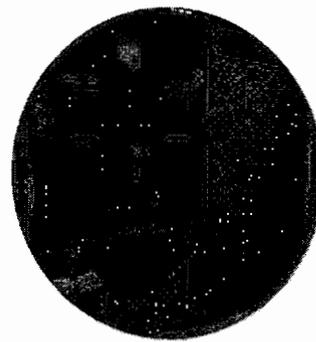
Specifically, NGES has implemented a process to identify and effectively control hazardous noise sources that have reduced or eliminated individual worker daily noise exposures and the need for most of their workers to be enrolled in a hearing loss prevention program (refer to Table 1). In the instance submitted for their Safe-in-Sound Award™ application, a piece of equipment called Thermotron is used to raise and lower the temperature of electronic equipment several times during the work shift. This requires two 25 horsepower compressor, one 8 horsepower blower, plus other small blowers. Table 1 lists the noise levels before and after the installation of equipment, which can be seen in Figure 1.

Table 1. Noise results around the area of the Thermotron, before and after installation of controls.

Location	Before	After
3' off floor at fan end	91.8 dBA	80.3 dBA
Middle of inlet flex	91.9	80.3
Fan housing	97.1	82.3
Fan discharge flex	90.7	83.5
Silencer casing	83.1	83.1
Silencer exhaust	96.0	86.3



Before noise control - 91.9 dBA



After noise control - 80.3 dBA

Figure 1. Photographs of the Thermotron before and after the implementation of noise controls. More details at <http://www.safeinsound.us/swf/NGC/index.html>

In winning the Safe-in-Sound Award™, Northrop Grumman Electronic Systems was also recognized for how well they execute interventions for those workers who remain in a hearing conservation program, and for their vision in developing a community outreach program for employees and their families. This initiative extends their efforts to prevent noise-induced hearing loss and tinnitus beyond the workplace, and addresses non-occupational noise hazards as well.

#### 2.1.2. 3M facilities in Alexandria, MN and Hutchinson, MN

3M has 180 plant locations worldwide which produce over 50,000 products. Two of their plants were recognized for their strongly integrated approach to worker hearing health including

statistically driven noise exposure assessments, implementation of a Buy Quiet program, and noise control for existing equipment. Their interventions started by identifying areas with the highest risk to workers for noise exposure which led to control and ultimately the reduction of noise sources. Of the original 203 employees from the 3M Alexandria Hearing Conservation Program, 199 did not need to remain enrolled due to the reduction in noise levels to below 85 dBA time-weighted average (TWA) across 24 different areas of the facility.

The plant also reported a noticeable culture shift in the way employees and engineers approached noise-related issues. The Engineering Department has also shown a change in procedures, as they now require any new equipment being brought into the facility to be engineered below 78-79 dBA. Regarding cost, 3M was able to remove 11 of the 24 areas from hearing conservation program at zero cost (by improving the noise assessment, involving in-house personnel in the interventions, and by using existing materials). Many of the controls implemented in these areas were simple changes to existing processes, and included but were not limited to reconditioning brakes, reduction of air pressures, installation of vibration dampening pads, and planned equipment relocations. The cost of noise control to provide sufficient noise exposure reductions for removal of employees from the hearing conservation program for the other 13 areas was approximately US\$250,000, well below the original budget of US \$500,000. The cost of specific interventions ranged from zero to US \$65,000. In the example below (Figure 2), in the area where slitting occurs, racking was installed and the noisiest equipment was relocated to where employees are not affected by it, and there was no direct cost to this change. Another example are is provided in Figure 3, while Figure 4 includes floor plans of one of the areas where noise exposure used to exceed 85 dBA. It shows the reduction in the area and in the required enrolment in a Hearing Conservation Program (HCP), and the number of employees enrolled at the moment of the nomination.



Before controls: 85 dBA, after controls: 68-75 dBA

*Figure 2: Photograph of area where no-cost noise control intervention was implemented.*

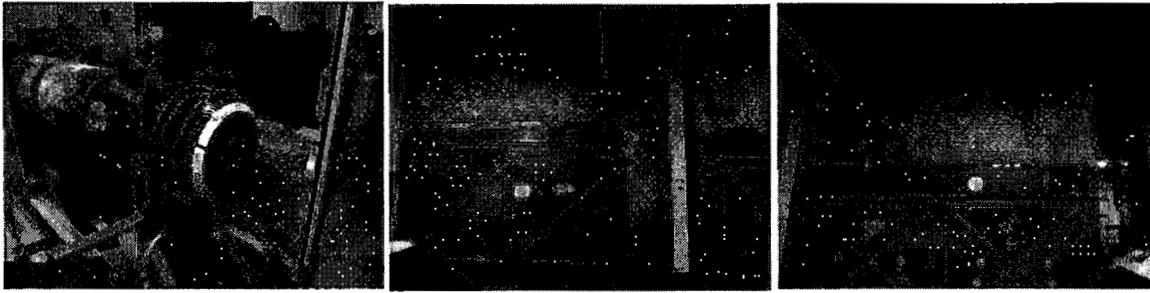


Figure 3 displays an area of manufacturing where modifications were made to a brake and acoustical enclosures were installed. The direct cost was US \$14,000, and exposures levels went from 87.9 dBA to 72-79 dBA. For details see <http://www.safeinsound.us/swf/2016/3M/index.html>

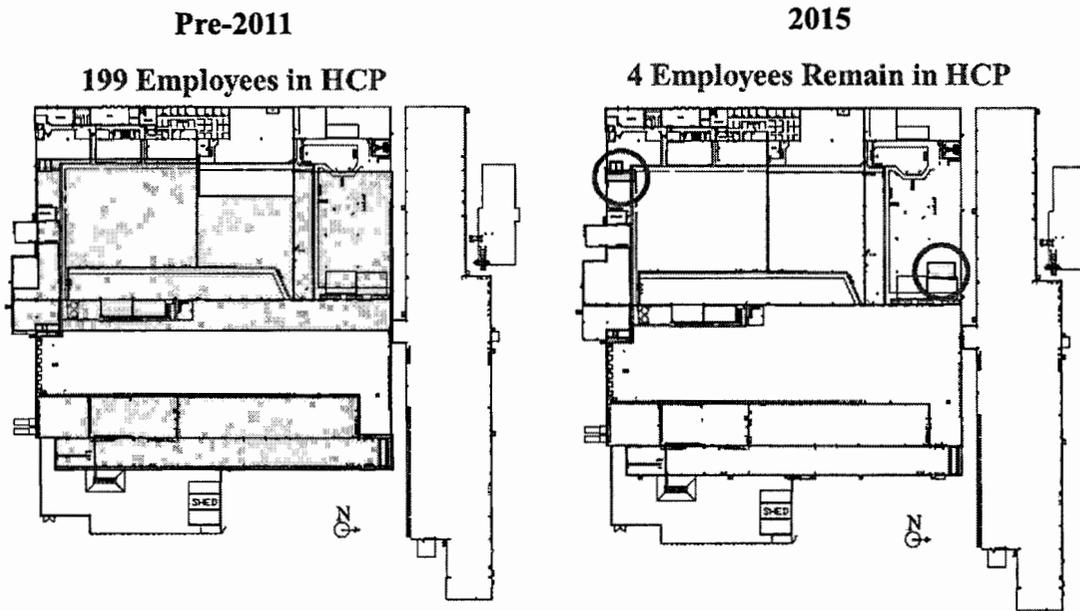


Figure 4. Floor plans indicating the areas where noise exposure exceeded 85 dBA, and required enrolment in a Hearing Conservation Program (HCP), and the number of employees enrolled.

Employees continue to use hearing protection where needed and in off-the-job functions, and are diligent in bringing concerns of excessive noise to the Environmental Health and Safety department.

Other examples of successful noise control projects from the manufacturing industry are detailed at <http://www.safeinsound.us/archive.html>.

### 3 DISCUSSION

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 expanded or adopted by other entities, or in other geographical areas (<http://www.safeinsound.us/impact.html>). 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 as a result of the award. In summary, the Safe-in-Sound Award™ is highlighting 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, as the rationale behind this initiative is that by disseminating evidence-based strategies, Safe-in-Sound™ will enable other groups to effectively advance hearing loss prevention practice. Perhaps the real value of this award program is to change the perception that noise control is not feasible, practical or desirable.

Since the developmental phase of the Safe-in-Sound Award, we were confronted by the question “How this award could be evaluated in the short and long term?” or “How can one tell whether it is making progress towards its goal?” The Safe-in-Sound™ web site traffic gives us some short term indications of growing interest in the award program and in the profiles of the award winning strategies. Another objective measure of the interest generated by the award is provided by the quantity and quality of nominations to the award. Multiple quality nominations have been received since its creation. But perhaps, a more relevant marker of impact is the citations of project work by others. Such citations indicate that there was considerable uptake of the deliverables of this project. Examples include: Safe-in-Sound highlighted by NIOSH and former award recipients at Reducing Employee Noise Exposure in Manufacturing—Best Practices, Innovative Techniques, and the Workplace of the Future Workshop (a follow-up to the 2010 National Academy of Engineering (NAE) Technology for a Quieter America (TQA) Report). It was organized by the Institute for Noise Control Engineering and NIOSH, and hosted by NAE in 2014. A report was published by the NAE in 2016 (Reducing Employee Noise Exposure in Manufacturing: Best Practices, Innovative Techniques, and the Workplace of the Future <https://inceusa.org/pub/>).

Safe-in-Sound was also highlighted in OSHA’s August 2013 OSHA Technical Manual (OTM), Section III: Chapter 5 – Noise (APPENDIX G—ALTERNATIVES FOR EVALUATING BENEFITS AND COSTS OF NOISE CONTROL). The chapter provides technical information and guidance to help Compliance Safety and Health Officers evaluate workplace noise hazards [https://www.osha.gov/dts/osta/otm/new\\_noise/appendixg.pdf](https://www.osha.gov/dts/osta/otm/new_noise/appendixg.pdf).

### 4 CONCLUSIONS

In its 10 years, the Safe-in-Sound Excellence Award has resulted in the acquisition of high quality field data related to the resulting noise levels in real world scenarios in the workplace. It has also provided insights into the following areas: noise exposure monitoring; use of new technologies including hearing protection fit testing; new approaches for training and hazard communication; and successful noise control outcomes leading to the elimination of the need for hearing conservation programs or in the reduction of number of workers enrolled in such programs.

### 5 ACKNOWLEDGEMENTS AND DISCLAIMER

We acknowledge all who have contribute for the success of this initiative and in particular those who have submitted nominations for the award.

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.

## 6 REFERENCES

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