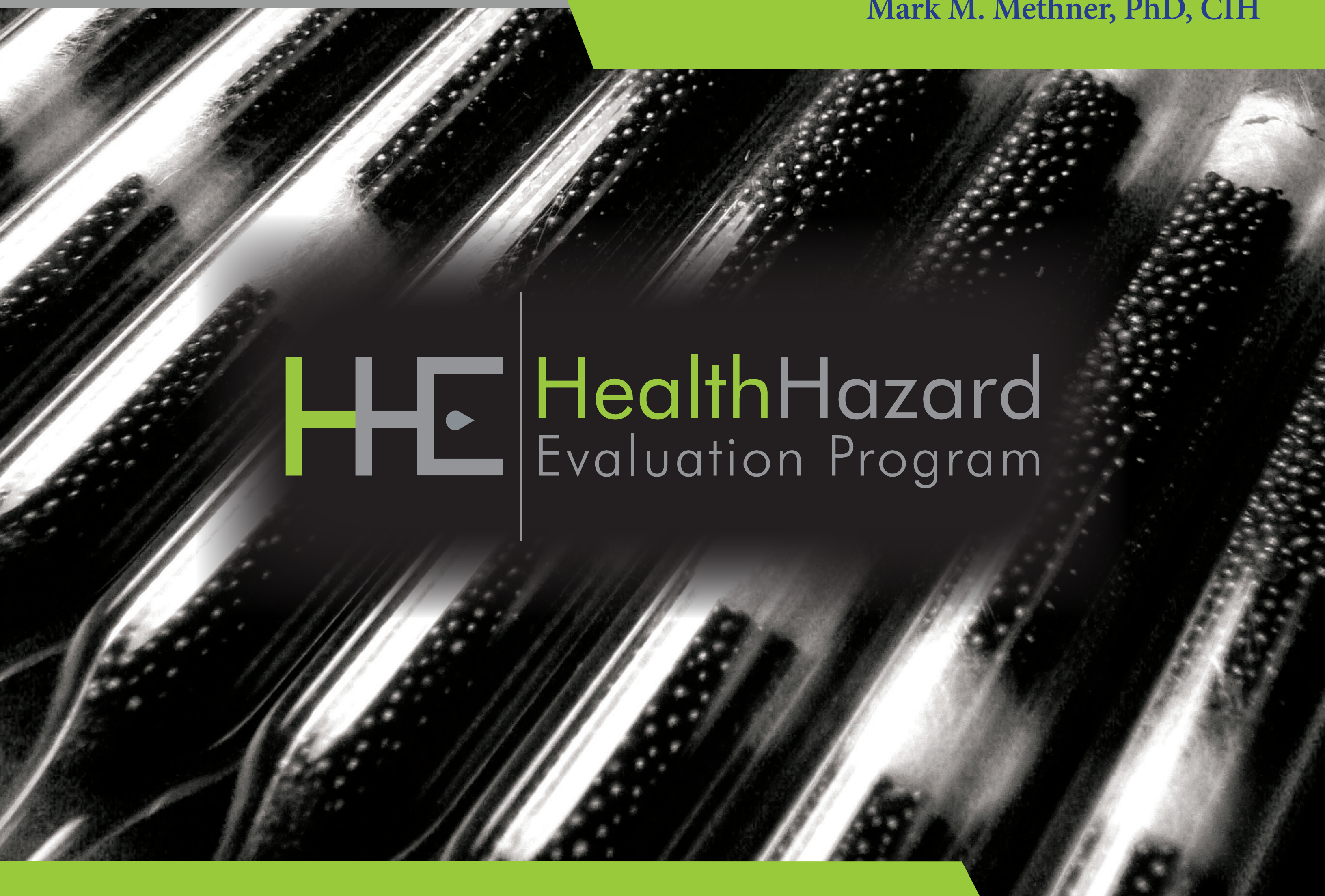
Evaluation of Occupational Exposures to Noise and Chemicals at an Automobile Parts Manufacturing Plant

Jessica F. Li, MSPH
Mark M. Methner, PhD, CIH



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Contents

The employer is required to post a copy of this report for 30 days at or near the workplace(s) of affected employees. The employer must take steps to ensure that the posted report is not altered, defaced, or covered by other material.

The cover photo is a close-up image of sorbent tubes, which are used by the HHE Program to measure airborne exposures. This photo is an artistic representation that may not be related to this Health Hazard Evaluation. Photo by NIOSH.

Highlights of this Evaluation

The Health Hazard Evaluation Program received a request from an automobile parts manufacturing plant. The employer was concerned about employees' exposures to noise in the cutting area and injection molding areas and to chemicals in the injection molding and epoxy injection areas. We visited the plant in January 2016.

What We Did

- We collected personal and area air samples for volatile organic compounds. We sampled while employees operated an injection molding machine and an epoxy injection machine.
- We measured carbon monoxide in the injection molding area.
- We measured employees' noise exposures in the injection molding area and the cutting area.

We evaluated employee exposures in the injection molding area, epoxy injection area, and cutting area. An injection molding operator was overexposed to noise but a tube cutter and wire harness crimpers were not. An injection molding operator and an epoxy injection operator were exposed to low levels of volatile organic compounds well below occupational exposure limits. We recommended implementing a hearing conservation program and increasing communication between the employer and employees through the existing health and safety committee.

What We Found

- An injection molding employee was overexposed to noise.
- The cutting area employees were not overexposed to noise.
- An injection molding employee was exposed to low levels of volatile organic compounds such as 2-butoxyethanol, isopropyl alcohol, pentane, and toluene. All exposures were below occupational exposure limits.
- The epoxy injection employee was exposed to low levels of volatile organic compounds such as n-butyl glycidyl ether, 2-butoxyethanol, isopropyl alcohol, pentane, and toluene. All exposures were below occupational exposure limits.
- There was no local exhaust ventilation to control smoke released during purges in the injection molding area.
- There was no local exhaust ventilation to control odors produced while mixing and curing epoxy-coated parts in the epoxy injection area.
- Carbon monoxide levels were well below the lowest occupational exposure limit.

What the Employer Can Do

- Consider installing local exhaust ventilation at the exhaust port of the injection molding machine to control smoke produced during purges.
- Consider installing local exhaust ventilation in the epoxy injection area at the location where epoxy is mixed and also on the enclosure cabinet used to cure parts.
- Start a hearing conservation program for injection molding employees.
- Encourage employees to join the health and safety committee.
- Ask employees to report health symptoms they consider to be work-related to their supervisor and health care provider.
- Fit-test employees for the hearing protection they use.
- Require wearing gloves when mixing and handling epoxies.

What Employees Can Do

- Wear hearing protection when operating the injection molding machine.
- Participate in the health and safety committee.
- Report symptoms you believe to be work-related to your supervisor and personal physician.

Abbreviations

2-BE	2-butoxyethanol
ACGIH®	American Conference of Governmental Industrial Hygienists
AL	Action level
CFR	Code of Federal Regulations
dBA	Decibels, A-weighted
Hz	Hertz
IPA	Isopropyl alcohol
n-BGE	n-butyl glycidyl ether
NIHL	Noise-induced hearing loss
NIOSH	National Institute for Occupational Safety and Health
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
ppm	Parts per million
REL	Recommended exposure limit
TLV®	Threshold limit value
TWA	Time-weighted average
VOC	Volatile organic compound
WEEL	Workplace environmental exposure level

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Introduction

The Health Hazard Evaluation Program received a request from the safety administrator at a manufacturer of automobile parts. Employees were concerned about odors in the injection molding and epoxy injection areas, but had not reported any health concerns associated with these odors. Additionally, the employer was concerned about high noise levels in the cutting area and in the injection molding area. We visited the plant in January 2016. After the visit, we sent letters summarizing our activities to management and employee representatives, and sent notifications to employees who requested their personal sampling results.

The production area consisted of two separate rooms. One room contained the plastic injection molding area, epoxy injection area, and storage. The other room housed tube cutting, wire harness crimping, and small parts assembly areas.

One employee per shift operated the plastic injection molding machine. The first shift was from 6 a.m. to 6 p.m., and the second shift was from 6 p.m. to 6 a.m. At the beginning of each shift, and sometimes two to three times per shift, the plastic injection molding machine was purged to remove excess or overheated plastic. This purging operation released smoke from an exhaust port on top of the machine. Local exhaust ventilation was not present in the injection molding area. The company provides hearing protection on a voluntary use basis.

For all other positions and departments, employees worked a 10-hour shift from 7:00 a.m. to 5:30 p.m. During epoxy injection, one employee manually mixed a batch of epoxy and catalyst for 4 minutes, then pneumatically injected the mixture into trays containing molds of automobile parts. The employee placed the trays of injected epoxy parts into an unventilated cabinet to cure. Once cured, the employee removed all the trays from the cabinet. This process was repeated for approximately 2–3 hours per day, but was not done every day. Local exhaust ventilation was not present in the epoxy injection area. The company provides nitrile gloves on a voluntary use basis for employees in this area.

During tube-cutting, an employee programmed a lathe to cut tubes made of Kevlar® and silicone to lengths ranging from 65 millimeters to over 500 millimeters. In wire harness crimping, two employees operated a machine that assembled, cut, and crimped wire harnesses on an assembly line. The cutting area is an open area adjacent to other assembly tasks.

Methods

The objectives of this evaluation were to (1) measure concentrations of n-butyl glycidyl ether and other volatile organic compounds (VOCs) potentially released during epoxy injection and injection molding; (2) measure carbon monoxide levels in the area of the injection molding machine; and (3) determine if employees were overexposed to noise during injection molding and cutting activities.

During the site visit, we observed manufacturing processes, work practices, workplace conditions, and personal protective equipment use. We reviewed the safety data sheets for the materials used in injection molding and epoxy injection. We also reviewed Occupational

Safety and Health Administration (OSHA) 300 injury and illness records from 2012 to 2015.

Air Sampling

We used thermal desorption tubes to collect and analyze two area air samples according to National Institute for Occupational Safety and Health (NIOSH) Method 2549 [NIOSH 2016]. This method was used to identify VOCs produced during injection molding and epoxy injection processes. We used the thermal desorption results to identify the predominant VOCs for quantitative analysis. We also collected full-shift personal and area air samples during these processes using charcoal sorbent tubes according to NIOSH Method 1501 [NIOSH 2016]. These air samples were collected during the second shift for injection molding. This method was modified to include 2-butoxyethanol, isopropyl alcohol, and pentane. We also collected one short-term, 15-minute air sample on an epoxy injection employee using a charcoal tube and analyzed it for n-butyl glycidyl ether using NIOSH Method 1616 [NIOSH 2016]. We measured carbon monoxide concentrations for the entire shift in the injection molding area using a direct-reading BW Technologies GasAlert® Extreme meter.

Noise Sampling

We used Larson Davis Spark™ 706RC integrating noise dosimeters to measure time-weighted average (TWA) personal noise exposure on three employees during the first shift. The dosimeters simultaneously collected data on three different settings to compare noise measurements with the OSHA permissible exposure limit (PEL), the OSHA action level (AL), and the NIOSH recommended exposure limit (REL). We also took periodic spot area measurements in the cutting and injection molding areas using a Quest Technologies® Model 2400 Type II Sound Level Meter. This instrument was set to respond to noise levels between 70 and 140 decibels, A-weighted (dBA) on a slow response scale.

Results and Discussion

Air Sampling

Results from the thermal desorption tube analyses identified several VOCs, including 2-butoxyethanol, isopropyl alcohol, pentane, and toluene. On the basis of these results, we analyzed the charcoal sorbent tubes collected in the injection molding and epoxy injection areas for these substances. We also analyzed for n-butyl glycidyl ether in the epoxy injection area because it was a component of the epoxy adhesive.

All personal air sampling results were well below their most protective occupational exposure limits (OELs) (Table 1). Because work shifts exceeded 8 hours, the American Conference of Governmental Industrial Hygienists® (ACGIH) threshold limit value® (TLV) was adjusted for the extended work shifts [Brief and Scala 1975] when the TLV was the lowest OEL. For an 8-hour work shift, the ACGIH TLV for n-butyl glycidyl ether is 3 parts per million (ppm), for isopropyl alcohol it is 200 ppm, and for toluene it is 20 ppm. The NIOSH REL and the OSHA PEL are not adjusted for extended work shifts. After adjusting exposure concentrations for an extended work shift, personal air sampling results were still well below their most protective OELs.

Table 1. Personal air sampling results, January 26–27, 2016

Job title	Sample time (minutes)	2-BE (ppm)	n-BGE (ppm)	IPA (ppm)	Pentane (ppm)	Toluene (ppm)
Injection molding operator	651	0.013	Not sampled	4.1	0.062	0.046
Epoxy injector	549	0.023	[0.007]*	5	0.067	0.038
Epoxy injector	15	None	0.077	None	None	None
NIOSH REL		5	5.6†	400	120	100
ACGIH TLV		20	2.1‡	140‡	1000	14‡
OSHA PEL		50	50	400	1000	200

2-BE = 2-butoxyethanol
n-BGE = n-butyl glycidyl ether
IPA = isopropyl alcohol
*The estimated concentration shown in brackets was above the minimum detectable concentration but below the minimum quantifiable concentration; there is more uncertainty associated with this value.
†A 15-minute TWA ceiling limit that should not be exceeded.
‡The TLV was adjusted for a 10-hour work shift (Brief and Scala 1975). The injection molding operator worked a 12-hour work shift with an adjusted TLV of 100 ppm for isopropyl alcohol and 10 ppm for toluene.

We did not have an opportunity to sample during two injection molding machine purges that occurred at the beginning of the shift before employees were wearing the personal air sampling devices. Therefore, our air sampling results likely underestimate the employee's actual VOC exposure. However, our sampling did include one purge that occurred during the shift.

Although levels of n-butyl glycidyl ether were well below the lowest OEL, this compound can have an irritating odor. The odor threshold of n-butyl glycidyl ether is unknown, but is likely to be at a low concentration, meaning that n-butyl glycidyl ether may be detected by humans at concentrations well below the lowest OEL.

Area air sampling results for VOCs are shown in Table 2. Similar to the personal air samples, area VOC concentrations were found to be low.

Table 2. Area air sampling results*, January 26–27, 2016

Area	Sample time (minutes)	2-BE (ppm)	IPA (ppm)	Pentane (ppm)	Toluene (ppm)
Injection molding	648	ND†	13	0.2	0.19
Epoxy injection	588	0.016	4.7	0.056	0.037

*Results for n-butyl glycidyl ether are not shown because it was not sampled for in the injection molding area and sampled for but not detected in the epoxy injection area. The minimum detectable concentration was 0.002 ppm, and the minimum quantifiable concentration was 0.009 ppm.
†Not detected, below the minimum detectable concentration of 0.002 ppm.

During the purge process, we noticed an odorous smoke released from the exhaust port. There was no local exhaust ventilation at the port to capture this emission. Also, the melted plastic expelled from the machine was placed on a metal tray and allowed to cool near the operator's work station. Such a practice may allow off-gassing of VOCs during cooling and result in unnecessary employee exposure.

We did not detect carbon monoxide during most of the shift in the injection molding area; the limit of detection was 1 ppm. However, we did measure carbon monoxide concentrations up to 6 ppm for a few seconds toward the end of the shift, well below the NIOSH REL of 35 ppm as a full-shift TWA and well below the NIOSH REL of 200 ppm as a ceiling value that should not be exceeded at any time.

Noise Exposure

Full-shift TWA personal noise measurements are shown in Table 3. The NIOSH REL was adjusted because the work shift was 10 hours for cutting area employees. The injection molding operator's noise exposure was 84.5 dBA, which exceeded the adjusted NIOSH REL of 83.2 dBA for a 12-hour work shift (Table 3). The personal noise measurements taken on employees in the cutting area did not exceed any OELs. Of the periodic spot measurements, we measured a maximum noise level of 83 dBA in the injection molding area. Noise levels in the injection molding area were generally constant compared to the intermittent nature of the noise produced during tube cutting.

Hearing protection (earmuffs and foam ear plugs) were available to employees for voluntary use. The injection molding operator wore ear plugs on the day of sampling. During our evaluation, the employee operating the tube-cutting machine did not wear hearing protection. The employee stated the ear plugs provided by the company did not fit well, and earmuffs were uncomfortable. None of the employees at the crimping station wore hearing protection.

Table 3. Full-shift noise levels, January 27, 2016

Job title	Using NIOSH REL criteria (dBA)*	Using OSHA AL criteria (dBA)*	Using OSHA PEL criteria (dBA)†
Injection molding operator	**84.5**	74.4	68.9
Wire harness crimper	81.3	76.7	67.4
Tube cutter	77.9	72.4	53.2
OELs, as 8-hour TWAs unless otherwise noted	84.0‡	83.4‡	90

*The criteria for calculating the NIOSH REL and OSHA AL include all noise exposures greater than or equal to 80 dBA.
†The criteria for calculating the OSHA PEL include all noise exposures greater than or equal to 90 dBA.

‡The NIOSH REL and OSHA AL of 85 dBA for an 8-hour TWA exposure were adjusted for a 10-hour extended work shift. The OSHA PEL is not adjusted for extended work shifts. The injection molding operator worked a longer 12-hour work shift with an adjusted REL of 83.2 dBA and an adjusted AL of 82.1.

The cutting area employees were not overexposed to noise (Table 3). In the cutting area, noise levels varied depending on the length and type of tube cut. Shorter lengths resulted in higher noise exposure because the tube was cut more frequently. Some examples of the maximum noise levels measured in the cutting area are shown below in Table 4.

Table 4. Area noise levels during tube cutting, January 27, 2016

Tube type	Tube length (millimeters)	Maximum noise level (dBA)
Wintown tube	580	82.2
Wintown tube	70	93
Kevlar tube	65	93

The maximum noise level measured in the crimping area was 84.3 dBA, and the maximum noise level measured in the walkway between the tube-cutting machine and the crimping area was 82 dBA.

At the time of the site visit, the company had no written hearing conservation program, but did provide three types of foam ear plugs (noise reduction rating range: 27 dBA–33 dBA) to all employees along with earmuffs in the cutting area for voluntary use. Hearing protection must attenuate noise levels to less than 85 dBA to provide adequate protection. Proper insertion of the hearing protection is critically important to ensure adequate noise attenuation. Noise attenuation of insert-type hearing protection by individual users depends on the type of hearing protector, shape of the user's ear canal, how well the hearing protector fits, and proper insertion of the hearing protector. Several hearing protection manufacturers have developed methods for fit-testing individual employees to determine the attenuation they actually receive from the hearing protectors they use.

The company had a health and safety committee with employer and employee representatives, but the employer stated that the committee did not meet on a regular schedule. Our review of injury and illness records did not find anything of significance that might be relevant to this evaluation.

Conclusions

Our sampling results showed that an injection molding employee was overexposed to noise based on the NIOSH REL, which is more protective than the OSHA PEL. Employees were exposed to low concentrations well below OELs of substances including 2-butoxyethanol, isopropyl alcohol, pentane, toluene, n-butyl glycidyl ether, and carbon monoxide. Although airborne exposure to n-butyl glycidyl ether was well below the most protective OEL, this substance has an irritating odor at low concentrations. Additionally, chronic dermal exposure to n-butyl glycidyl ether could result in skin sensitization and allergy. These health effects were not reported by employees. The epoxy injection employee wore nitrile gloves and a long sleeve shirt when mixing the epoxy, which reduced the potential for skin exposure to n-butyl glycidyl ether.

Recommendations

On the basis of our findings, we recommend the actions listed below. We encourage the automobile parts manufacturing plant to use the existing health and safety committee to discuss our recommendations and develop an action plan. Those involved in the work can best set priorities and assess the feasibility of our recommendations.

Our recommendations are based on an approach known as the hierarchy of controls. This approach groups actions by their likely effectiveness in reducing or removing hazards. In most cases, the preferred approach is to eliminate hazardous materials or processes and install engineering controls to reduce exposure or shield employees. Until such controls are in place, or if they are not effective or feasible, administrative measures and personal protective equipment may be needed. We recommend the following:

Engineering Controls

Engineering controls reduce employees' exposures by removing the hazard from the process or by placing a barrier between the hazard and the employee. Engineering controls protect employees effectively without placing primary responsibility of implementation on the employee.

1. Install local exhaust ventilation on equipment exhaust ports if odors persist.

Administrative Controls

The term administrative controls refers to employer-dictated work practices and policies to reduce or prevent hazardous exposures. Their effectiveness depends on employer commitment and employee acceptance. Regular monitoring and reinforcement are necessary to ensure that policies and procedures are followed consistently.

1. Conduct full-shift personal exposure monitoring for 2-butoxyethanol, isopropyl alcohol, pentane, and toluene on an injection molding employee to capture all purge cycles that occur during the shift. This monitoring should be done periodically and whenever process changes occur that could affect personal exposures to process emissions.
2. Implement a hearing conservation program for all employees who work in the injection molding area. The program should include annual audiometric testing and training. More information on establishing a hearing conservation program can be found at http://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf, http://www.osha.gov/dts/osta/otm/noise/hcp/index.html, and http://www.osha.gov/Publications/osha3074.pdf.
3. Improve hazard communication training to ensure that all employees are knowledgeable about noise, how noise exposure affects their health, and what protective measures should be used to prevent exposure.

4. Increase communication related to health and safety issues between employees and the employer by having regular meetings of the health and safety committee.

Personal Protective Equipment

Personal protective equipment is the least effective means for controlling hazardous exposures. Proper use of personal protective equipment requires a comprehensive program and a high level of employee involvement and commitment. The right personal protective equipment must be chosen for each hazard. Supporting programs such as training, change-out schedules, and medical assessment may be needed. Personal protective equipment should not be the sole method for controlling hazardous exposures. Rather, personal protective equipment should be used until effective engineering and administrative controls are in place.

1. Require injection molding employees to wear hearing protection.
2. Conduct hearing protector fit-testing to ensure that employees' hearing protection provides sufficient noise attenuation.
3. Instruct supervisors to monitor and enforce the use of hearing protection among injection molding employees.

Appendix A: Occupational Exposure Limits and Health Effects

NIOSH investigators refer to mandatory (legally enforceable) and recommended OELs for chemical, physical, and biological agents when evaluating workplace hazards. OELs have been developed by federal agencies and safety and health organizations to prevent adverse health effects from workplace exposures. Generally, OELs suggest levels of exposure that most employees may be exposed to for up to 10 hours per day, 40 hours per week, for a working lifetime, without experiencing adverse health effects. However, not all employees will be protected if their exposures are maintained below these levels. Some may have adverse health effects because of individual susceptibility, a pre-existing medical condition, or a hypersensitivity (allergy). In addition, some hazardous substances act in combination with other exposures, with the general environment, or with medications or personal habits of the employee to produce adverse health effects. Most OELs address airborne exposures, but some substances can be absorbed directly through the skin and mucous membranes.

Most OELs are expressed as a TWA exposure. A TWA refers to the average exposure during a normal 8- to 10-hour workday. Some chemical substances and physical agents have recommended short-term exposure limit or ceiling values. Unless otherwise noted, the short-term exposure limit is a 15-minute TWA exposure. It should not be exceeded at any time during a workday. The ceiling limit should not be exceeded at any time.

In the United States, OELs have been established by federal agencies, professional organizations, state and local governments, and other entities. Some OELs are legally enforceable limits; others are recommendations.

- The U.S. Department of Labor OSHA PELs (29 CFR 1910 [general industry]; 29 CFR 1926 [construction industry]; and 29 CFR 1917 [maritime industry]) are legal limits. These limits are enforceable in workplaces covered under the Occupational Safety and Health Act of 1970.
- NIOSH RELs are recommendations based on a critical review of the scientific and technical information and the adequacy of methods to identify and control the hazard. NIOSH RELs are published in the *NIOSH Pocket Guide to Chemical Hazards* [NIOSH 2010]. NIOSH also recommends risk management practices (e.g., engineering controls, safe work practices, employee education/training, personal protective equipment, and exposure and medical monitoring) to minimize the risk of exposure and adverse health effects.
- Other OELs commonly used and cited in the United States include the TLVs, which are recommended by ACGIH, a professional organization, and the workplace environmental exposure levels (WEELs), which are recommended by the American Industrial Hygiene Association, another professional organization. The TLVs and WEELs are developed by committee members of these associations from a review of the published, peer-reviewed literature. These OELs are not consensus standards. TLVs are considered voluntary exposure guidelines for use by industrial hygienists and others trained in this discipline "to assist in the control of health hazards" [ACGIH 2016].

WEELs have been established for some chemicals "when no other legal or authoritative limits exist" [AIHA 2016].

Outside the United States, OELs have been established by various agencies and organizations and include legal and recommended limits. The Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung (Institute for Occupational Safety and Health of the German Social Accident Insurance) maintains a database of international OELs from European Union member states, Canada (Québec), Japan, Switzerland, and the United States. The database, available at http://www.dguv.de/ifa/gestis/gestis-internationale-grenzwerte-fuer-chemische-substanzen-limit-values-for-chemical-agents/index-2.jsp, contains international limits for more than 2,000 hazardous substances and is updated periodically.

OSHA requires an employer to furnish employees a place of employment free from recognized hazards that cause or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970 (Public Law 91–596, sec. 5(a)(1))]. This is true in the absence of a specific OEL. It also is important to keep in mind that OELs may not reflect current health-based information.

When multiple OELs exist for a substance or agent, NIOSH investigators generally encourage employers to use the lowest OEL when making risk assessment and risk management decisions. NIOSH investigators also encourage use of the hierarchy of controls approach to eliminate or minimize workplace hazards. This includes, in order of preference, the use of (1) substitution or elimination of the hazardous agent, (2) engineering controls (e.g., local exhaust ventilation, process enclosure, dilution ventilation), (3) administrative controls (e.g., limiting time of exposure, employee training, work practice changes, medical surveillance), and (4) personal protective equipment (e.g., respiratory protection, gloves, eye protection, hearing protection). Control banding, a qualitative risk assessment and risk management tool, is a complementary approach to protecting employee health. Control banding focuses on how broad categories of risk should be managed. Information on control banding is available at http://www.cdc.gov/niosh/topics/ctrlbanding/. This approach can be applied in situations where OELs have not been established or can be used to supplement existing OELs.

Noise

Noise-induced hearing loss (NIHL) is an irreversible condition that progresses with noise exposure. It is caused by damage to the nerve cells of the inner ear and, unlike some other types of hearing disorders, cannot be treated medically [Berger et al. 2003]. More than 22 million U.S. workers are estimated to be exposed to workplace noise levels above 85 dBA [Tak et al. 2009]. NIOSH estimates that workers exposed to an average daily noise level of 85 dBA over a 40-year working lifetime have an 8% excess risk of material hearing impairment. This excess risk increases to 25% for an average daily noise exposure of 90 dBA [NIOSH 1998]. NIOSH defines material hearing impairment as an average of the hearing threshold levels for both ears that exceeds 25 dB at frequencies of 1000, 2000, 3000, and 4000 Hertz (Hz).

Although hearing ability commonly declines with age, exposure to excessive noise can increase the rate of hearing loss. In most cases, NIHL develops slowly from repeated exposure to noise over time, but the progression of hearing loss is typically the greatest during the first several years of noise exposure. NIHL can also result from short-duration exposures to high noise levels or even from a single exposure to an impulse noise or a continuous noise, depending on the intensity of the noise and the individual's susceptibility to NIHL [Berger et al. 2003]. Noise-exposed workers can develop substantial NIHL before it is clearly recognized. Even mild hearing losses can impair a person's ability to understand speech and hear many important sounds. In addition, some people with NIHL also develop tinnitus. Tinnitus is a condition in which a person perceives sound in one or both ears, but no external sound is present. Persons with tinnitus often describe hearing ringing, hissing, buzzing, whistling, clicking, or chirping like crickets. Tinnitus can be intermittent or continuous and the perceived volume can range from soft to loud. Currently, there is no cure for tinnitus.

The preferred unit for reporting of noise measurements is the decibel, A-weighted. A-weighting is used because it approximates the "equal loudness perception characteristics of human hearing for pure tones relative to a reference of 40 dB at a frequency of 1,000 Hz" and is considered to provide a better estimation of hearing loss risk than using unweighted or other weighting measurements [Earshen 2003].

Employees exposed to noise should have baseline and yearly hearing tests to evaluate their hearing thresholds and determine whether their hearing has changed over time. Hearing testing should be done in a quiet location, such as an audiometric test booth where background noise does not interfere with accurate measurement of hearing thresholds. In workplace hearing conservation programs, hearing thresholds must be measured at 500, 1000, 2000, 3000, 4000, and 6000 Hz. Additionally, NIOSH recommends testing at 8000 Hz [NIOSH 1998]. The OSHA hearing conservation standard requires analysis of changes from baseline hearing thresholds to determine if the changes are substantial enough to meet OSHA criteria for a standard threshold shift. OSHA defines a standard threshold shift as a change in hearing threshold (relative to the baseline hearing test) of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear [29 CFR 1910.95]. If a standard threshold shift occurs, the company must determine if the hearing loss also meets the requirements to be recorded on the OSHA Form 300 Log of Work-Related Injuries and Illnesses [29 CFR 1904.1]. In contrast to OSHA, NIOSH defines a significant threshold shift as a change in the hearing threshold level of 15 dB or more (relative to the baseline hearing test) at any test frequency in either ear measured twice in succession [NIOSH 1998].

NIOSH has a REL for noise of 85 dBA, as an 8-hour TWA. For calculating exposure limits, NIOSH uses a 3-dB time/intensity trading relationship, or exchange rate. Using the NIOSH criterion, an employee can be exposed to 88 dBA for no more than 4 hours, 91 dBA for 2 hours, 94 dBA for 1 hour, 97 dBA for 0.5 hours, etc. Exposure to impulsive noise should never exceed 140 dBA. For extended work shifts NIOSH adjusts the REL to 84.5 dBA for a 9-hour shift, 84.0 dBA for a 10-hour shift, 83.6 dBA for an 11-hour shift, and 83.2 dBA for a 12-hour work shift. NIOSH recommends the use of hearing protection and implementation of a hearing loss prevention program when noise exposures exceed the REL [NIOSH 1998].

The OSHA noise standard specifies a PEL of 90 dBA and an AL of 85 dBA, both as 8-hour TWAs. OSHA uses a less conservative 5-dB exchange rate for calculating the PEL and AL. Using the OSHA criterion, an employee may be exposed to noise levels of 95 dBA for no more than 4 hours, 100 dBA for 2 hours, 105 dBA for 1 hour, 110 dBA for 0.5 hours, etc. Exposure to impulsive or impact noise must not exceed 140 dB peak noise level. OSHA does not adjust the PEL for extended work shifts. However, the AL is adjusted to 84.1 dBA for a 9-hour shift, 83.4 dBA for a 10-hour shift, 82.7 dBA for an 11-hour shift, and 82.1 dBA for a 12-hour work shift. OSHA requires implementation of a hearing conservation program when noise exposures exceed the AL [29 CFR 1910.95].

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The Health Hazard Evaluation Program investigates possible health hazards in the workplace under the authority of the Occupational Safety and Health Act of 1970 (29 U.S.C. § 669(a)(6)). The Health Hazard Evaluation Program also provides, upon request, technical assistance to federal, state, and local agencies to investigate occupational health hazards and to prevent occupational disease or injury. Regulations guiding the Program can be found in Title 42, Code of Federal Regulations, Part 85; Requests for Health Hazard Evaluations (42 CFR Part 85).

Disclaimer

The recommendations in this report are made on the basis of the findings at the workplace evaluated and may not be applicable to other workplaces.

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Editor: Ellen Galloway
Logistics: Donnie Booher and Kevin Moore

Availability of Report

Copies of this report have been sent to the employer and employees at the facility. The state and local health department and the Occupational Safety and Health Administration Regional Office have also received a copy.

Recommended citation for this report:
NIOSH [2016]. Evaluation of occupational exposures to noise and chemicals at an automobile parts manufacturing plant. By Li JF, Methner MM. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Health Hazard Evaluation Report 2015-0158-3262, http://www.cdc.gov/niosh/hhe/reports/pdfs/2015-0158-3262.pdf.

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