CDC Workplace Safety and Health

Evaluation of Magnetic Field Exposure to Office Employees from an Electrical Transformer

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The employer shall post a copy of this report for a period of 30 calendar days at or near the workplace(s) of affected employees. The employer shall take steps to insure that the posted determinations are not altered, defaced, or covered by other material during such period. [37 FR 23640, November 7, 1972, as amended at 45 FR 2653, January 14, 1980].

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Acknowledgments

Abbreviations

ACGIH®	American Conference of Governmental Industrial Hygienists
BEI®	Biological exposure index
CFR	Code of Federal Regulations
GM	Geometric mean
GSD	Geometric standard deviation
HCMA	Human Capital Management Analyst
HHE	Health hazard evaluation
Hz	Hertz
IARC	International Agency for Research on Cancer
mG	milliGauss
NAICS	North American Industry Classification System
NIEHS	National Institute of Environmental Health Science
NIOSH	National Institute for Occupational Safety and Health
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
REL	Recommended exposure limit
SD	Standard deviation
STEL	Short term exposure limit
TLV®	Threshold limit value
TWA	Time weighted average
WEEL	Workplace environmental exposure level
WHO	World Health Organization

Highlights of the NIOSH Health Hazard Evaluation

The National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at the Lebanon Correctional Institution in Lebanon, Ohio. Management made the request due to concerns about exposure to electromagnetic fields after a transformer was installed near the timekeeping office.

What NIOSH Did

- We evaluated employees' electromagnetic field exposures in June 2009.
- We measured the magnetic fields at and around the transformer.
- We measured five employee's exposure to magnetic fields.
- We measured magnetic fields around electrical devices and near electrical lines in the timekeeping office and the front lobby.

What NIOSH Found

- We measured a maximum of 100 milliGauss (mG) directly at the transformer.
- We measured a maximum of 300 mG near an electric fan in the timekeeping office.
- Magnetic field strength dropped quickly when you moved away from the transformer.
- All exposure measurements were well below the American Conference of Governmental Industrial Hygienists threshold limit value of 10,000 mG.

What Managers Can Do

- Encourage employees to learn about magnetic field sources and ways to reduce their exposure.
- Design office spaces to maximize the distance between work stations and magnetic field sources.

What Employees Can Do

- Learn about magnetic fields and how you can reduce your exposure.
- Talk to your supervisor about any work-related health concerns you may have.

Summary

On June 24, 2009, NIOSH investigators conducted an HHE in the timekeeping office at the Lebanon Correctional Institution, Lebanon, Ohio, in response to a request received from management. Management was concerned about magnetic field exposures from a transformer installed outside the timekeeping office.

NIOSH investigators evaluated exposures to magnetic fields in the timekeeping office of a correctional institution. All personal and area magnetic field measurements were well below applicable OELs. Exposures can be further lowered by reducing the time spent near magnetic field sources and increasing the distance between these sources and employees.

Personal magnetic field monitoring was conducted on five employees (four in the timekeeping office and one in an office across the hall). Area magnetic field measurements were taken at an electrical transformer outside the building, along the exterior and interior walls of the timekeeping office, near electrical devices in the office, and in the front lobby.

The geometric means of personal magnetic field dosimeter measurements ranged from 0.47 mG to 3.3 mG. An area measurement of 100 mG at the transformer was recorded while another area measurement of 300 mG was recorded inside the office near a fan. All personal and area measurements were well below the ACGIH TLV of 10,000 mG and the ACGIH ceiling value of 1,000 mG for individuals with cardiac pacemakers or similar medical devices.

All magnetic field exposures measured in this evaluation were well below applicable OELs. Magnetic field exposures can be further reduced by limiting the amount of time spent working near magnetic field sources and by increasing working distance from magnetic field sources.

Keywords: NAICS 922140 (Correctional Institutions), correctional institution, prison, magnetic fields, executive office

Introduction

On May 19, 2009, NIOSH received a management request for an HHE at the Lebanon Correctional Institution, Lebanon, Ohio. The HHE request was submitted because a transformer had been installed near the timekeeping office and employees were concerned about magnetic field exposures.

On June 24, 2009, NIOSH investigators made a site visit to the Lebanon Correctional Institution. We met with management and employee representatives and observed work processes/practices, and workplace conditions. During the opening meeting we discussed the nature of the HHE and the types of sampling for evaluating magnetic field exposures. Members of the Health and Safety Committee for the Lebanon Correctional Institution were present during the meeting and provided input into other areas of concern within the prison. We measured magnetic fields at the transformer, along the exterior and interior walls of the timekeeping office, and near electrical equipment used in the office such as personal cooling fans, computers, and paper shredders. We asked five employees to wear personal monitoring devices which measured their magnetic field exposures throughout the day. Based upon recommendations from the Health and Safety Committee for the Lebanon Correctional Institution we also evaluated magnetic field exposures in the front lobby. A closing meeting was held on June 24, 2009, with management, the Health and Safety Committee, and employee representatives to summarize site visit activities and provide preliminary findings. This was followed by a letter dated July 7, 2009, that provided a summary of our findings and preliminary recommendations.

Workplace Description

The Lebanon Correctional Institution opened in 1960 and encompasses 1,900 acres. In 2006, an electrical transformer (Areva OA-KNAN 60 Hertz, 12,470 volt, 208Y/120 rated at 416.4 amps) was installed outside the timekeeping office (Figure 1). A replacement transformer was installed in 2008. The electrical lines from the transformer enter the building directly underneath the timekeeping office.

Figure 1. Transformer located within 7 feet of the exterior wall of the timekeeping office.

The 530 square foot timekeeping office has four employees working at individual work stations. Figure 2 illustrates the timekeeping office design. The timekeeping office has a copier/printer, paper shredder, and computer workstations as well as a microwave, refrigerator, and personal cooling fans. Employees spend most of their time in the office although some tasks require them to leave the office for short periods of time.

Introduction (continued)

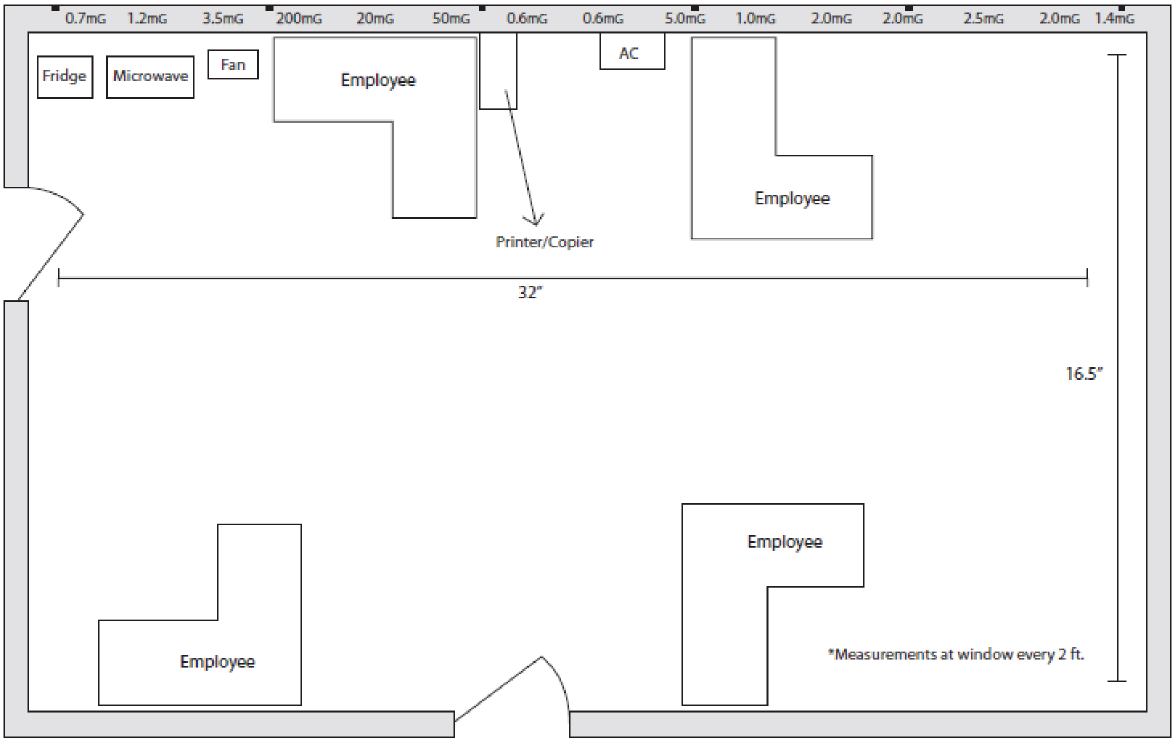

Figure 2. Scale layout of the timekeeping office showing magnetic field measures along the interior wall nearest the transformer.

Assessment

We monitored magnetic fields from 5 Hz to 2,000 Hz, a frequency range that encompasses the electrical power frequency of 60 Hz. For this evaluation, magnetic fields were measured in mG. Another common unit of measurement is microTesla (1 microTesla equals 10 mG). The methods used to collect area and personal magnetic field measurements are described in Appendix A. Monitored employees were asked to complete a log sheet on which they recorded any tasks involving trips to the other administrative offices or the use of electrical equipment other than typical office equipment. Appendix B discusses the OELs and potential health effects from magnetic field exposures.

Personal dosimeters were worn by all four employees in the timekeeping office and one employee in an office located across the hall from the timekeeping office. Area magnetic field readings were taken in the timekeeping office, at the electrical transformer, and in surrounding office areas such as the front lobby. Area magnetic field measurements were recorded near various electrical equipment, appliances, and personal fans in the timekeeping office. When possible the measurements were taken with the electrical equipment turned off and then recorded again when the electrical equipment was operating. All area measurements were taken as close to the electrical equipment as possible unless otherwise noted.

RESULTS

Magnetic Field Personal Measurements

All personal TWA measurements were well below the ACGIH TLV of 10,000 mG (Table 1) [ACGIH 2009]. Geometric mean exposures ranged from 0.47 mG to 3.32 mG. The maximum measurements ranged from 12.61 mG to 950.40 mG.

Table 1. Magnetic field personal monitoring results

Job Title	Sampling Time (minutes)	Magnetic Field Levels (mG)				
		Minimum	Maximum	Median	GM	GSD
Account Clerk II	339.5	0.14	40.10	2.06	1.39	2.34
HCMA 1*	373.1	0.14	12.68	3.08	2.26	2.32
HCMA 2	372.3	0.26	12.61	4.21	3.32	1.99
Payroll Assistant	380.8	0.01	950.40	2.82	2.32	3.45
Personnel Director †	376.3	0.01	20.50	0.38	0.47	2.27

* HCMA - Human Capital Management Analyst
† Primary location in office across hallway from the timekeeping office

Magnetic Field Area Measurements

Measurements were taken at 2 feet intervals approximately 1 foot from the transformer and were taken as near to the exterior wall of the timekeeping office as possible (Figure 3). Measurements at the transformer (located approximately 7 feet from the exterior wall of the timekeeping office) ranged from 2 mG to 100 mG due to the proximity of the measurement locations to electrical lines and the orientation of the transformer. Measurements taken along the outside of the exterior wall of the timekeeping office ranged from 0.8 mG to 15 mG. The maximum level of 15 mG was measured near an operating air conditioning wall unit. Figure 3 shows the consistent measurements at the wall directly across from the transformer and steady decline as the distance increased from the transformer. Figure 2 shows the measurements taken at the interior wall of the timekeeping office.

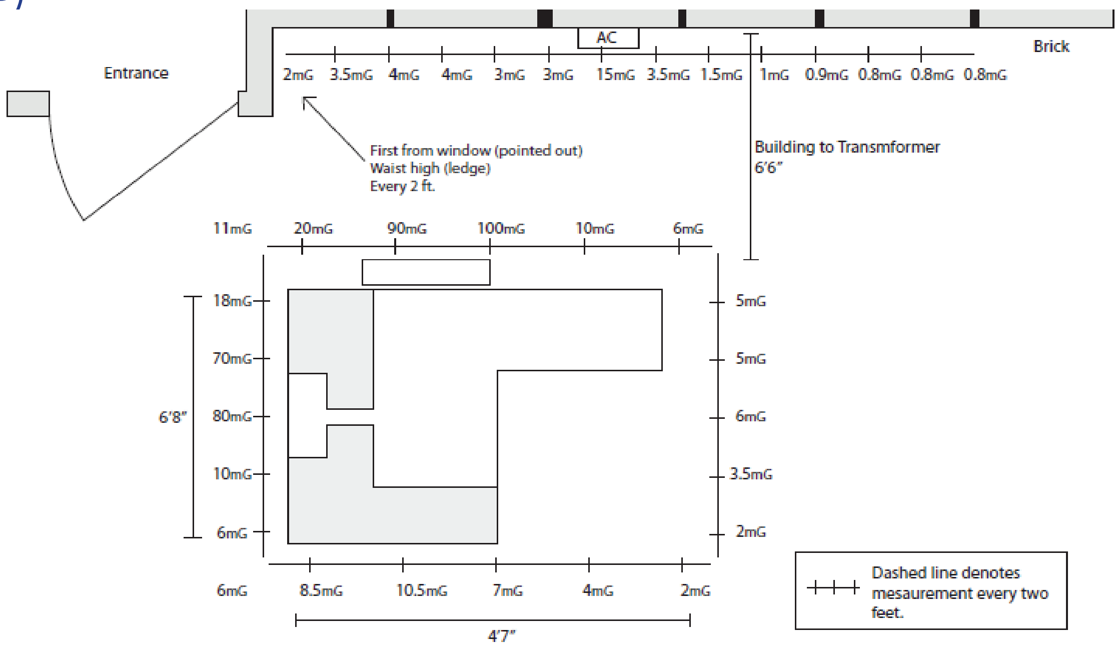

Figure 3. Magnetic field area measurements near transformer and exterior wall of the timekeeping office.

Table 2 shows the influence on magnetic fields when electrical equipment is operating and not operating and with increasing distance from a magnetic field source. For example, a level of 300 mG was measured at a personal fan operating near the Payroll Assistant's desk (0.7 mG when not operating). Additional measurements taken at 1 foot (50 mG), 2 feet (9 mG), and 4 feet (1 mG) from the fan demonstrated the rapid decline in magnetic field strength due to increasing distance from the source.

Table 2. Magnetic field area monitoring results in timekeeping office

Equipment	Magnetic Field Levels (mG)	
	Operating	Not operating
Microwave	150	2.0
Paper shredder	95	0.7
Personal cooling fan (1)	300	0.7
1 foot from fan (1)	50	N/A*
2 feet from fan (1)	9	N/A*
4 feet from fan (1)	1	N/A*
Personal cooling fan (2)	12	0.7
Personal cooling fan (3)	11	1.0
Electrical power strip	90	N/A*

* Measurements were not taken while not operating

The underground electrical lines from the transformer entered the building directly below the timekeeping office. Magnetic field levels measured at the floor surface near the employee desk for HCMA 2 ranged from 5 mG to 7 mG. These magnetic field levels declined to 2 mG to 3 mG when measured 3 feet above the floor (Table 3).

Table 3. Magnetic field area monitoring results above electrical lines in timekeeping office

Distance from exterior wall nearest the transformer	Magnetic Field Levels (mG)	
	Floor level	3 feet above floor
2 feet	7	2
4 feet	7	3
6 feet	6	3
8 feet	5	3

Area measurements taken in the front lobby are shown in Figure 4. The two guards spend most of their time near a metal detector used to process visitors. When the metal detector was operating, the magnetic field measurements ranged from 8 mG to 15 mG. A cabinet x-ray system was also available for use by the security guards but was not operational at the time of the site visit. The maximum magnetic field level measured near the operating automatic doors in the lobby were 4 mG.

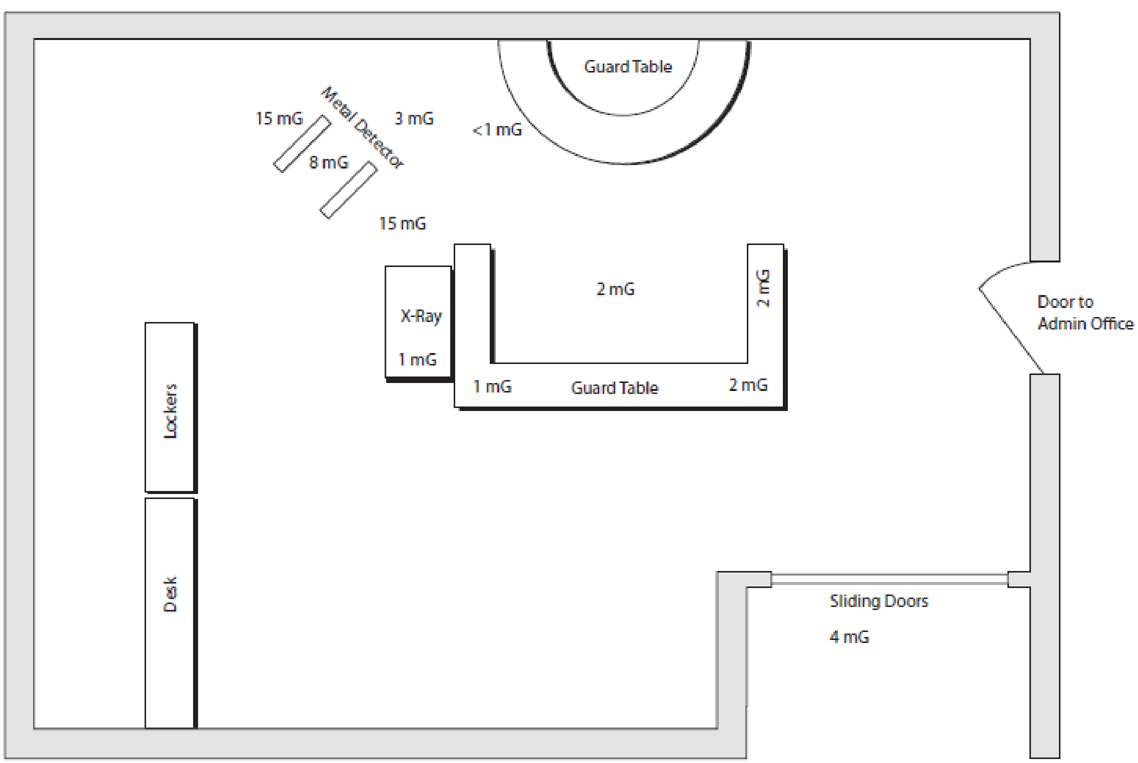

Figure 4. Magnetic field measurements in front lobby of the Lebanon Correctional Institution.

Electric and Magnetic Fields

The term radiation is commonly used to refer to ionizing radiation, which is energy that is able to ionize atoms or molecules of the substance in which the energy is absorbed. This causes chemical changes that damage tissues and structural materials in the body. Nonionizing radiation refers to the lower energy forms of the magnetic field spectrum such as radio waves, microwaves, infrared, and visible light, and does not carry enough energy to ionize atoms or molecules.

Magnetic field radiation is composed of both electric fields and magnetic fields. Electric fields are produced by voltage and increase in strength as the voltage increases. Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Electric fields were not monitored during this survey because they are shielded or weakened by materials that conduct electricity, even materials that conduct poorly, including building materials and human skin [NIEHS 2002]. In contrast, magnetic fields are not easily shielded and can pass through the human body, where they could potentially affect biological systems.

Personal exposures measured in this survey were well below the ACGIH TLV of 10,000 mG [ACGIH 2009]. This and other recommended OELs for magnetic field exposures are based on acute effects, such as induced currents in cells or nerve stimulation, which are known to occur at high exposures—more than 1,000 times higher than magnetic field levels typically found in occupational settings [NIEHS 2002]. More information on OELs and health effects related to magnetic field exposures is provided in Appendix B.

Extremely low frequency magnetic fields are ubiquitous because they are present wherever there is electricity. However, the amount of extremely low frequency magnetic fields in the environment has increased due to electricity demand, advancing technology, and changes in work practices [WHO 2002]. Extremely low frequency magnetic fields are in the range of 3 Hz to 3000 Hz with most exposure coming from the power-line frequency of 50 Hz to 60 Hz. Exposure to magnetic fields in homes is relatively consistent throughout the world, with GMs between 0.55 mG and 1.1 mG [WHO 2007]. Occupational exposures can be much higher, with exposures up to 100 mG near electrical conductors. Magnetic field exposures average 4 mG to 6 mG for electricians and electrical engineers, 10 mG for power-line employees and greater than 30 mG for welders, railway engine drivers, and sewing machine operators [WHO 2007].

Magnetic field levels decrease with increasing distance from the source. Although 300 mG was measured at a personal fan during operation, 1.0 mG was measured at the desk just 4 feet away. Magnetic field levels were 7 mG when measured at the floor surface directly above the electrical lines entering the building but decreased to 2 mG when measured 3 feet above the floor.

According to the job exposure matrix for power-line frequency magnetic fields [Bowman et al. 2008], GM exposures are 1.7 mG for computer operators and 1.0 mG for programmers. Exposures to the Account Clerk II (GM = 1.4) and Personnel Director (GM = 0.47) who perform similar, but not identical jobs, are consistent with the GMs reported by Bowman et al. The magnetic field exposure to the Payroll Assistant (GM = 2.32 mG) was slightly higher. While the exposures we measured are only slightly higher than those reported in the literature, the jobs are not identical and are within the range of exposures that would normally be expected in an office environment.

The HCMA 2 had a GM of 3.32 mG which was higher than the GM of 1.7 mG reported by Bowman et al. for a similar occupational group. The higher HCMA 2 GM maybe due to the position of the employee's desk above the electrical lines entering the building directly beneath the floor under the desk. Other measurements around the desk were not higher than what would normally be expected from standard office equipment. A geometric SD of 1.99 mG and a maximum measurement of 12.61 mG suggest that magnetic field exposures were consistent throughout the shift.

The HCMA 1 had a GM of 2.26 mG which is higher than the GM of 1.7 mG reported by Bowman et al. Although this employee was located on the same side of the timekeeping office that the electrical lines entered the building these lines did not run underneath the employee's desk. Area measurements did not indicate that magnetic field strength from the lines was higher than background at the floor level near the employee's desk. A power strip outlet was measured at 90 mG and was located near the employee's feet underneath the desk. The power strip appeared to be an older model and area measurements taken at the power strip were appreciably higher than any other power strip located in the timekeeping office.

Conclusions

All magnetic field exposures were well below the ACGIH TLV of 10,000 mG [ACGIH 2009]. Two job titles (Account Clerk II and Personnel Director) had GM exposures lower than similar job categories reported in the scientific literature [Bowman et al. 2008]. Three job titles (HCMA 1, HCMA 2, and Payroll Assistant) had GM exposures greater than similar job titles reported in the scientific literature [Bowman et al. 2008]. However, the job titles are not identical to the ones reported by Bowman et al. and overall are well within the range of exposures consistent with typical office workers.

These findings show that the magnetic field exposure levels are related to movement patterns and the length of time spent near magnetic field sources and for that reason are likely to vary from day to day. Because measurements were taken during a span of about 8 hours on one day, the annual range of typical exposures over time could not be determined.

Recommendations

The magnetic field exposures measured in this survey did not exceed the ACGIH TLV of 10,000 mG [ACGIH 2009]. The 10,000 mG TLV is based on potential acute health effects. No OELs are based on the potential health effects from chronic magnetic field exposures; however, exposures should be reduced whenever possible. Based on our findings, we recommend the actions listed below to create a more healthful workplace. We encourage the Lebanon Correctional Institution to use these recommendations to develop an action plan based, if possible, on the hierarchy of controls approach (refer to Appendix B: Occupational Exposure Limits and Health Effects). 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/or personal protective equipment may be needed.

Elimination and Substitution

Elimination or substitution of a toxic/hazardous process material is a highly effective means for reducing hazards. Incorporating this strategy into the design or development phase of a project, commonly referred to as “prevention through design,” is most effective because it reduces the need for additional controls in the future.

1. Remove unnecessary magnetic field sources (personal fans) from the office.
2. Replace certain electrical devices with ones are rated to produce lower magnetic field emissions (i.e., the power strip outlet that measured 90 mG was much higher than other power strips in the office).

Engineering Controls

Engineering controls reduce exposures to employees by removing the hazard from the process or placing a barrier between the hazard and the employee. Engineering controls are very effective at protecting employees without placing primary responsibility of implementation on the employee.

1. Increase distance between magnetic field sources and employees. For example, potential magnetic field sources in the timekeeping office (microwave, paper shredder, refrigerator, photocopier, etc.) could be relocated to the area of the office where the electrical lines enter the building. Employee desks could then be arranged to provide the most distance between their workstations and the magnetic field sources.

Administrative Controls

Because magnetic fields cannot be easily shielded, administrative controls are the most feasible option to reduce employees’ exposures. Administrative controls are management-dictated work practices and policies to reduce or prevent exposures to workplace hazards. The effectiveness of administrative changes in work practices for controlling workplace hazards depends on management commitment and employee acceptance. Regular monitoring and reinforcement are necessary to ensure that control policies and procedures are not circumvented in the name of convenience or production. The following administrative controls

Recommendations (continued)

are recommended to reduce the employees' personal exposures to the magnetic fields.

1. Encourage employees to arrange their workstations so that magnetic field sources are located away from where they spend most of their time (normally their chair at the computer) but at a distance that is feasible for everyday usage.

Management and employees may want to learn more about magnetic fields and other forms of magnetic field radiation. The following websites provide more information on occupational and environmental exposures, scientific research, and health concerns related to magnetic field radiation:

- NIOSH: www.cdc.gov/niosh/topics/emagnetic field/
- OSHA: www.osha.gov/SLTC/elfradiation/index.html
- NIEHS: www.niehs.nih.gov/health/topics/agents/emagnetic field/
- WHO: www.who.int/peh-emagnetic field/en/

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Appendix A: Methods

Magnetic field measurements were collected using instruments that were calibrated within 1 month of the evaluation. Area measurements were collected using the HI-3627 ELF-Magnetic Field Meter (Holaday Industries Inc., Eden Prairie, Minnesota). This meter is designed to measure the flux density of magnetic fields in the frequency range of 5 Hz to 2000 Hz. It computes the root mean square value of the 3-axis magnetic flux density and directly displays it on an analog meter. It is capable of measuring magnetic field strength from 0.2 mG to 20,000 mG, independently of the 3-axis probe orientation. Measurements were taken at a variety of locations throughout the workplace at a height of 48 inches to characterize levels near the torso of an employee.

Personal magnetic field measurements were collected using the EMDEX II (Enertech Consultants, Campbell, California). This instrument is a programmable data-acquisition meter that measures the orthogonal-vector components of the magnetic field through its internal sensors in the frequency range of 40 Hz to 800 Hz. The instrument was set to record measurements every 1.5 seconds. Five employees wore the meters on their waists for 3 or more hours during the morning.

Appendix B: Occupational Exposure Limits & Health Effects

In evaluating the hazards posed by workplace exposures, NIOSH investigators use both mandatory (legally enforceable) and recommended OELs for chemical, physical, and biological agents as a guide for making recommendations. OELs have been developed by Federal agencies and safety and health organizations to prevent the occurrence of adverse health effects from workplace exposures. Generally, OELs suggest levels of exposure that most employees may be exposed 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 from adverse health effects even if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a preexisting medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the employee to produce health effects even if the occupational exposures are controlled at the level set by the exposure limit. Also, some substances can be absorbed by direct contact with the skin and mucous membranes in addition to being inhaled, which contributes to the individual's overall exposure.

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 STEL or ceiling values where health effects are caused by exposures over a short period. Unless otherwise noted, the STEL is a 15-minute TWA exposure that should not be exceeded at any time during a workday, and the ceiling limit is an exposure that 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, while 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 enforceable in workplaces covered under the Occupational Safety and Health Act. NIOSH RELs are recommendations based on a critical review of the scientific and technical information available on a given hazard and the adequacy of methods to identify and control the hazard. NIOSH RELs can be found in the *NIOSH Pocket Guide to Chemical Hazards* [NIOSH 2005]. NIOSH also recommends different types of 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 from these hazards. Other OELs that are commonly used and cited in the United States include the TLVs recommended by ACGIH, a professional organization, and the WEELs 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. They are not consensus standards. ACGIH 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 2009]. WEELs have been established for some chemicals "when no other legal or authoritative limits exist" [AIHA 2009].

Outside the United States, OELs have been established by various agencies and organizations and include both legal and recommended limits. Since 2006, the Berufsgenossenschaftliches Institut für Arbeitsschutz (German Institute for Occupational Safety and Health) has maintained a database of international OELs from European Union member states, Canada (Québec), Japan, Switzerland, and the United States available at www.dguv.de/bgia/en/gestis/limit_values/index.jsp. The database contains international limits for over 1250 hazardous substances and is updated annually.

Employers should understand that not all hazardous chemicals have specific OSHA PELs, and for some agents the legally enforceable and recommended limits may not reflect current health-based information. However, an employer is still required by OSHA to protect its employees from hazards even in the absence of a specific OSHA PEL. 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))]. Thus, NIOSH investigators encourage employers to make use of other OELs when making risk assessment and risk management decisions to best protect the health of their employees. NIOSH investigators also encourage the use of the traditional hierarchy of controls approach to eliminate or minimize identified 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 that focuses resources on exposure controls by describing how a risk needs to be managed. Information on control banding is available at 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 the OELs, when available.

Magnetic Fields

Although OSHA and NIOSH have not established OELs for magnetic fields in the extremely low frequency range (3 to 3000 Hz), several organizations have, including the American National Standards Institute, the Institute of Electrical and Electronics Engineers, and the ACGIH. Among these organizations, the ACGIH has published frequency-dependent TLVs. Because the magnetic fields at the Information Services Department come primarily from 60 Hz power lines, the whole-body TLV of 10,000 mG applies. The health and safety basis for this TLV is that magnetic fields greater than this level can induce currents in the body and cause magnetophosphenes in the visual system [ACGIH 2006]. The ACGIH also recommends a power frequency ceiling value of 1,000 mG for employees wearing cardiac pacemakers or similar medical electronic devices to protect against the interference with the function of these devices [ACGIH 2009]. Neither the TLV, nor any of the other OELs, address potential health effects from chronic magnetic field exposures.

Much research has been conducted during the past decade to determine if slightly elevated magnetic field exposures (greater than 2 mG) pose a health threat. The NIEHS evaluated many of these studies and, in 1999, concluded that "... the probability that magnetic field exposure is truly a health hazard is currently small. The weak epidemiological associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm." However, the report also states that magnetic field exposures "cannot be recognized as entirely safe" and that efforts should continue to reduce exposures [NIEHS 1999]. More recently, in 2002, the IARC classified extremely low frequency magnetic fields as possibly carcinogenic to humans based on epidemiology studies of childhood leukemia. This classification is used to denote an agent that has limited evidence of carcinogenicity in humans and less than sufficient evidence for carcinogenicity in experimental animals. Evidence for all other cancers in children and adults was inadequate to classify due to insufficient or inconsistent scientific information [IARC 2002]. A 2007 update of this evaluation did not change the classification based upon more recent studies [WHO 2007].

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Acknowledgments and Availability of Report

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found. HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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