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Current Intelligence Bulletin XX

**Promoting Health and Preventing Disease and Injury through
Workplace Tobacco Policies**

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1 **Foreword**
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3 Current Intelligence Bulletins (CIBs) are issued by the National Institute for Occupational Safety and
4 Health (NIOSH) to disseminate new scientific information about occupational hazards. A CIB may draw
5 attention to a formerly unrecognized hazard, report new data on a known hazard, or disseminate
6 information about hazard control.
7

8 Public health efforts to prevent disease caused by tobacco use have been underway for the past half
9 century, but more remains to be done to achieve a society free of tobacco-related death and disease.
10 The Centers for Disease Control and Prevention (CDC), of which NIOSH is a component, has recently
11 proclaimed a “Winnable Battle” against tobacco use. NIOSH marks this 50th anniversary year of the first
12 Surgeon General’s Report on the health consequences of smoking by disseminating this CIB **XX**,
13 *Promoting Health and Preventing Disease and Injury through Workplace Tobacco Policies*.
14

15 Workers who use tobacco products or who are employed in workplaces where smoking is allowed are
16 exposed to carcinogenic and other toxic components of tobacco and tobacco smoke. Tobacco smoking is
17 becoming less frequent and smoke-free and tobacco-free workplace policies are reducing exposure to
18 secondhand smoke (SHS) and motivating smokers to quit, but millions of workers still smoke and
19 smoking is still permitted in many workplaces. Other forms of tobacco also represent a health hazard to
20 workers who use them. In addition to direct adverse effects of tobacco on the health of workers who
21 use tobacco products or are exposed to SHS, tobacco products used in the workplace and away from
22 work can worsen the hazardous effects of other workplace exposures.
23

24 The content of this CIB addresses tobacco use among workers; exposure to secondhand smoke in
25 workplaces; occupational health and safety concerns relating to tobacco use by workers; existing
26 occupational safety and health regulations and recommendations prohibiting or limiting tobacco use in
27 the workplace; hazards of worker exposure to SHS in the workplace; and interventions aimed at
28 eliminating or reducing these hazards. The CIB concludes with NIOSH recommendations relating to
29 tobacco use in places of work and tobacco use by workers.
30

31 NIOSH urges all employers to assure that all their workplaces are made and maintained tobacco-free
32 and that all their employees who continue to use tobacco products are encouraged to quit and provided
33 with cessation support. Doing so will help fulfill employers’ fundamental obligation to provide safe
34 workplaces and can improve the health and well-being of their workers.
35
36
37

38 John Howard, M.D.
39 Director
40 National Institute for Occupational Safety and Health
41 Centers for Disease Control and Prevention -

1 **Executive Summary**

2 Introduction

3

4 Various NIOSH criteria documents on individual hazardous industrial agents, from asbestos [NIOSH
5 1972] through hexavalent chromium [NIOSH 2013a], have included specific recommendations relating
6 to tobacco use along with other recommendations to eliminate or reduce occupational safety and
7 health risks. In addition, NIOSH has published two Current Intelligence Bulletins focused entirely on the
8 hazards of tobacco use. CIB 31, *Adverse Health Effects of Smoking and the Occupational Environment*,
9 outlined how smoking interacts with other workplace exposures to increase risk of disease and injury
10 among workers [NIOSH 1979]. In that CIB, NIOSH recommended that smoking be curtailed in workplaces
11 where those other hazards are present and that worker exposure to those other occupational hazards
12 be controlled. CIB 54, *Environmental Tobacco Smoke in the Workplace: Lung Cancer and Other Health*
13 *Effects*, presented a determination by NIOSH that secondhand smoke (SHS) causes cancer and
14 cardiovascular disease [NIOSH 1991]. In that CIB, NIOSH recommended that workplace exposures to SHS
15 be reduced to the lowest feasible concentration, and emphasized that elimination of tobacco smoking
16 from the workplace is the best way to achieve that. This current CIB XX, *Promoting Health and*
17 *Preventing Disease and Injury through Workplace Tobacco Policies*, augments those two earlier NIOSH
18 CIBs. Consistent with the philosophy embodied in its recently launched Total Worker Health™ Program
19 [NIOSH 2013b], this CIB is aimed not just at preventing occupational injury and illness related to tobacco
20 use, but also at improving the general health and well-being of workers.

21

22 Smoking and Other Tobacco Use by Workers; Exposure to Secondhand Smoke (SHS) at Work

23

24 Millions of workers use tobacco products. Cigarette smoking prevalence in the United States has been
25 reduced by more than 50% among all U.S. adults since publication of the first Surgeon General’s report
26 on the health consequences of smoking—from about 42% in 1965 to about 18% in 2012 [CDC 2014a;
27 DHHS 2014]. Overall, smoking among workers has similarly declined, but smoking rates among blue-
28 collar workers have been shown to be consistently higher than among white-collar workers. Among
29 blue-collar workers, those exposed to higher levels of workplace dust and chemical hazards are more
30 likely to be smokers [Chin et al. 2012]. Also, on average, blue-collar smokers smoke more heavily than
31 white-collar smokers [Fujishiro et al. 2012].

32

33 For the 2004–2011 period, smoking prevalence varied widely by industry, ranging from about 10% in
34 *education services* to more than 30% in *construction, mining, and accommodation and food services*.
35 Smoking prevalence varies even more by occupation, ranging from 2% among *religious workers* to 50%
36 among *construction trades helpers* [NIOSH 2014]. Overall, only about 3% of all workers use smokeless
37 tobacco in the form of chewing tobacco and snuff, but smokeless tobacco use exceeds 10% among
38 workers in *construction and extraction jobs* and stands at nearly 20% among workers in the *mining*
39 *industry* [NIOSH 2014]. The use of smokeless tobacco by individuals who also smoke tobacco products,
40 or “dual use,” is one way some workers maintain their nicotine habit in settings where smoking is
41 prohibited (e.g., in an office where indoor smoking is prohibited or in coal mines where smoking can
42 cause explosions). Over 4% of U.S. workers who smoke cigarettes also use smokeless tobacco [CDC
43 2014b; NIOSH 2014].

1
2 Mandatory and voluntary efforts over recent decades have either eliminated or substantially decreased
3 exposure to SHS in many U.S. workplaces. But millions of non-smoking workers not covered by these
4 policies are still exposed to SHS in their workplace. A recent survey found that 20.4% of nonsmoking U.S.
5 workers experienced exposure to SHS at work on at least one day during the preceding week [King et
6 al. 2014]. Another survey conducted at about the same time estimated that 10.4% of nonsmoking adult
7 U.S. workers experienced exposure to SHS at work on at least two days per week during the past year)
8 [Calvert et al. 2013]. Such exposure varied by industry, ranging from 4% for *finance and insurance* to
9 nearly 28% for *mining*, and by occupation, ranging from 2% for *education, training, and library*
10 occupations to nearly 29% for *construction and extraction* occupations.

11 12 Health and Safety Consequences of Tobacco Use

13
14 Beginning with the first Surgeon General’s report on smoking and health, numerous reports from the
15 Surgeon General and other health authorities have documented serious health consequences of
16 smoking tobacco, exposure to secondhand smoke (SHS), and use of smokeless tobacco. Smokeless
17 tobacco is known to cause several types of cancer, primarily in the mouth and throat. Smoking is a
18 known cause of the top five health conditions impacting the U.S. population—heart disease, cancers,
19 cerebrovascular disease, chronic lower respiratory disease, and unintentional injuries [DHHS 2004,
20 2014]. Smoking also causes a variety of other diseases, as well as adverse reproductive effects [DHHS
21 2004, 2014]. Not including premature deaths due to SHS exposure (see next paragraph), smoking is
22 responsible for over 439,000 premature deaths among U.S. smokers and former smokers [DHHS 2014].
23 The risk of most adverse health outcomes caused by smoking is related to the intensity and duration of
24 tobacco smoking, but no level of tobacco smoking is risk free [DHHS 2010b, 2014].

25
26 Likewise, there is no risk-free level of exposure to SHS [DHHS 2006, 2014]. SHS exposure causes over
27 41,000 deaths each year among U.S. non-smokers [DHHS 2014]. Among exposed adults, there is strong
28 evidence of a causal relationship between exposure to SHS and a number of adverse health effects,
29 including lung cancer, heart disease (including heart attacks), stroke, exacerbation of asthma, and
30 reduced birth weight of offspring (due to SHS exposure of nonsmoking pregnant women) [DHHS 2006,
31 2014; IARC 2009; IOM 2010; Henneberger et al. 2011]. In addition, there is suggestive evidence that
32 exposure to SHS causes a range of other health effects among adults, including other cancers (breast
33 cancer, nasal cancer), asthma, chronic obstructive pulmonary disease (COPD), and premature delivery of
34 babies born to women exposed to SHS [DHHS 2006, 2014; IARC 2009].

35 36 Interaction of Tobacco Use with Other Occupational Hazards

37
38 Tobacco use (most commonly, smoking) can interact in several ways with other hazards present in some
39 workplaces to worsen their impact on workers’ health [NIOSH 1979; DHEW 1979b; DHHS 1985]. Specific
40 toxic chemicals associated with work processes in some workplaces are also present in tobacco products
41 and/or tobacco smoke, thus increasing exposure to those specific agents among tobacco-using workers
42 and workers exposed to SHS. Tobacco products can also become contaminated by toxic industrial agents
43 in the user’s workplace, through contact of the tobacco products with unwashed hands or contaminated
44 surfaces and through deposition of airborne contaminants onto the tobacco products. Subsequent use

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1 of the contaminated tobacco products, whether at or away from the workplace, can facilitate entry of
2 these toxic agents into the body. Another type of interaction involves the transformation of industrial
3 chemicals into more harmful agents by the heat of burning tobacco when tobacco is smoked. Smoking
4 and exposure to a toxic agent found in the workplace can each have independent but similar adverse
5 effects on a worker's body. The overall effect of these combined exposures can be additive (i.e.,
6 amounting to the sum of each independent effect) or, in some cases, synergistic (i.e., amounting to an
7 effect greater than the sum of each independent effect). One of the best known examples of such an
8 effect is the synergistic effects of smoking and asbestos exposure on lung cancer [Markowitz et al.
9 2013]. Occupational injuries and traumatic fatalities can result from interaction of flammable or
10 explosive hazards present in many workplaces with tobacco smoking as an ignition source. Even without
11 causing explosion or fire, any form of tobacco use may result in traumatic injury if the worker operating
12 a vehicle or industrial machinery is distracted by tobacco use (e.g., opening, lighting, extinguishing, or
13 disposing of a tobacco product).

14 15 Prevention

16
17 Both health and economic considerations can motivate individuals to quit tobacco use. Workers who
18 smoke can protect their own health by quitting tobacco use and can protect their co-workers' health by
19 not smoking in the workplace. Smokers who quit stand to benefit financially. Substantial savings can be
20 realized by those who quit. Among other savings, they no longer incur direct costs associated with
21 consumer purchases of tobacco products and related materials, and generally pay lower life and health
22 and insurance premiums and less out-of-pocket costs for health care.

23
24 Legally determined employer responsibilities set out in federal, state, and local laws and regulations, as
25 well as health and economic considerations, can motivate employers to establish workplace policies that
26 prohibit or restrict tobacco use. For example, the general duty of employers to provide safe work
27 environments for their employees can motivate employers to prohibit smoking in their workplaces,
28 thereby avoiding liability for exposing nonsmoking employees to SHS [Zellers et al. 2007]. Also, not only
29 are nonsmoking workers generally healthier, but they are more productive and less costly for
30 employers. Considering aggregate cost and productivity impacts, one recent study estimated that the
31 annual cost to employ a smoker was, on average, nearly \$6,000 greater than the cost to employ a
32 nonsmoker [Berman et al. 2013]. It follows that interventions that help smoking workers quit can
33 benefit the bottom line of a business.

34
35 Several studies have shown that smoke-free workplace policies decrease exposure of nonsmoking
36 employees to SHS at work, increase smoking cessation, and decrease smoking rates among employees
37 [Fichtenberg and Glantz 2002; Bauer et al. 2005; DHHS 2006; IARC 2009; Hopkins et al. 2010]. Less
38 restrictive workplace smoking policies are associated with higher levels of sustained tobacco use among
39 workers [IARC 2009]. In workplaces without a workplace rule limiting smoking, workers are significantly
40 more likely to be smokers [Ham et al. 2011]. Policies that make indoor workplaces smoke-free result in
41 improved worker health [IARC 2009; Callinan et al. 2010]. For example, smoke-free policies in the
42 hospitality industry have been shown to improve health among bar workers, who are often heavily
43 exposed to SHS in the absence of such policies [Eisner et al. 1998; DHHS 2006; IARC 2009]. Smoke-free
44 policies also reduce hospitalizations for heart attacks in the general population [IARC 2009; IOM 2010;

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1 Tan and Glantz 2010; DHHS 2014] and several recent studies suggest that these policies may also reduce
2 hospitalizations and emergency department visits for asthma in the general population [Hahn 2010;
3 Mackay et al. 2010; Tan and Glantz 2010; Herman and Walsh 2011; Millet et al. 2013]. The Task Force on
4 Community Preventive Services recommends smoke-free workplace policies, not only to reduce
5 exposure to SHS, but also to increase tobacco cessation, reduce tobacco use prevalence, and reduce
6 tobacco-related morbidity and mortality [Hopkins et al. 2010; Task Force on Community Preventive
7 Services 2010; GCPS 2012a].
8

9 Some employers have taken action to extend restrictions on tobacco use by their employees beyond the
10 workplace, for example prohibiting smoking by workers during their workday breaks, when away from
11 the workplace, including during lunchtime. Several large employers have gone further by barring the
12 hiring of smokers. Such wide-ranging policies generate substantial controversy and are illegal in some
13 jurisdictions [Asch et al. 2013; Schmidt et al. 2013].
14

15 Workplace Tobacco Use Cessation Programs 16

17 Smoking employees who want to quit can benefit from employer-provided resources and assistance.
18 Various levels and types of cessation support can be provided to workers though more intensive
19 intervention has a greater effect [O’Hara et al. 1993; Clinical Practice Guideline 2008]. Occupational
20 health providers and worksite health promotion staff can increase quit rates simply by asking about a
21 worker’s tobacco use and offering brief counseling. Workers who smoke can be referred to publically
22 funded state quitlines, which have been shown to increase tobacco cessation success [GCPS 2012b;
23 Clinical Practice Guideline 2008]. Widespread availability, ease of accessibility, affordability, and
24 potential reach to populations with higher levels of tobacco use make quitlines an important component
25 of any cessation effort [Clinical Practice Guideline 2008]. But many employers do not make their
26 employees aware of them [Hughes et al. 2011]. The most comprehensive workplace cessation programs
27 incorporate tobacco cessation support into programs that address the overall safety, health, and well-
28 being of workers. A growing evidence base supports the enhanced effectiveness of workplace programs
29 that integrate health promotion efforts such as smoking cessation with more specific occupational
30 health protection programs [Hymel et al. 2011; NIOSH 2013c].
31

32 Health Insurance and Smoking; Using Incentives and Disincentives to Modify Tobacco Use Behavior 33

34 Many workers are covered by employer-provided health insurance, which is increasingly being designed
35 to encourage employees to adopt positive personal health-related behaviors, including smoking
36 cessation for smokers. Quit rates are higher when health insurance covers the costs of evidence-based
37 smoking cessation treatments [Clinical Practice Guideline 2008]. Ideally, such coverage should provide
38 access to all evidence-based cessation treatments, including individual, group, and telephone counseling
39 and all seven FDA-approved cessation medications, while eliminating or minimizing barriers such as
40 cost-sharing and prior authorization [Clinical Practice Guideline 2008; CDC 2014c].
41

42 The Affordable Care Act (ACA) includes provisions pertinent to tobacco use and cessation. For example,
43 the ACA will allow employer-sponsored health insurance programs to charge tobacco users premiums
that are up to 50% higher than premiums charged to non-tobacco users [Kofman et al. 2012; Madison et

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1 al. 2013]. However, tobacco users in the group market can avoid these surcharges if they choose to
2 participate in a cessation program. States can ban this practice or restrict the size of the surcharge, and
3 several states have done so.

4
5 In addition to employer-sponsored health insurance plan provisions discouraging tobacco use by
6 covered workers, governmental actions and employer policies are increasingly removing disincentives
7 and offering incentives for employee attempts to quit and for success in quitting tobacco use.
8 Regulations promulgated under authority of the ACA increased the maximum permissible reward under
9 a health-contingent wellness program offered in connection with a group health plan to 50% of the cost
10 of coverage for wellness programs designed to prevent or reduce tobacco use [78 Fed. Reg. 33158]. The
11 appropriate intent of incentives is not to shift health care costs to high-risk individuals but to help
12 employees who use tobacco quit, thus improving health and reducing health care costs overall. The
13 evidence for the effectiveness of imposing surcharges on tobacco users is limited, and care is needed to
14 ensure that incentive programs are designed to work as intended and to minimize the potential use of
15 incentives in an unduly coercive or discriminatory manner, and to avoid unintended consequences such
16 as smokers concealing their smoking and avoiding seeking cessation assistance [Madison et al. 2011,
17 2013]. The Task Force on Community Preventive Services has recommended worksite-based incentives
18 and even competitions when they are combined with other evidence-based interventions (e.g.,
19 education, group support, telephonic counseling, self-help materials, smoke-free workplace policies,
20 etc.) as part of a comprehensive cessation program [GCPS 2005].

21 Conclusions

- 23 • Tobacco smoking by workers and SHS exposure in the workplace have both declined
24 substantially over recent decades, but about 20% of all U.S. workers still smoke and about 20%
25 of nonsmoking workers are still exposed to SHS at work.
- 26 • Smoking prevalence among workers varies widely by industry and occupation, approaching or
27 exceeding 30% in construction, mining, and accommodation and food services workers.
- 28 • Smokeless tobacco is used by about 3% of U.S. workers overall, but smokeless tobacco is used
29 by more than 10% workers in construction and extraction jobs and by nearly 20% of workers in
30 the mining industry.
- 31 • Tobacco use causes serious diseases, including cancer, respiratory diseases, and cardiovascular
32 diseases, mainly among users but also among those exposed to SHS. More than 20 million U.S.
33 adults live with a disease caused by tobacco and each year nearly a half million die prematurely
34 from smoking or exposure to SHS. Tobacco use is associated with increased risk of injury and
35 property loss due to fire, explosion, and vehicular collisions.
- 36 • Tobacco use by workers can interact with hazardous occupational exposures, worsening the risk
37 of disease and injury from these exposures for smoking workers and workers who are exposed
38 to SHS.
- 39 • Restrictions on smoking and tobacco use in specific work areas where particular high-risk
40 occupational hazards (e.g., explosives, highly flammable materials, or highly toxic materials that
41 could be ingested via tobacco use) are present have long been used to protect workers.
- 42 • There is no risk-free level of exposure to SHS, and ventilation is insufficient to eliminate indoor
43 exposure to SHS.

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- 1 • Policies that prohibit tobacco smoking throughout the workplace (i.e., smoke-free workplace
2 policies) are now widely implemented, but have not yet been universally adopted. These
3 policies improve workplace air quality, reduce SHS exposure and related health effects, increase
4 the likelihood that workers who smoke will quit, decrease the amount of smoking during the
5 working day by employees who continue to smoke, and have an overall impact of improving the
6 health of workers (i.e., among both nonsmokers who are no longer exposed to secondhand
7 smoke on the job and smokers who quit).
- 8 • Workplace-based efforts to help workers quit tobacco use can be easily integrated into existing
9 occupational health and wellness programs. Even minimal counseling and/or simple referral to
10 state quitlines can be effective, and more comprehensive programs are even more effective at
11 increasing quitting among workers.
- 12 • The integration of both occupational safety and health protection components into workplace
13 health promotion (e.g., smoking cessation) programs can increase participation in tobacco
14 cessation programs and successful cessation among blue-collar workers.
- 15 • On average, it is substantially more costly to employ a smoker than a nonsmoker.
- 16 • Some employers have policies prohibiting employees from using tobacco when away from work
17 or barring the hiring of smokers or tobacco users, but the ethics of these policies remain under
18 debate and they may be legally prohibited in some jurisdictions.

19
20 Recommendations

- 21 NIOSH recommends that employers:
- 22 ○ Establish and maintain tobacco-free workplaces for all employees, allowing no use of any
23 tobacco products, including but not limited to cigarettes, cigars, pipes, and smokeless tobacco
24 products by anyone at any time in the workplace. Ideally, this should be done in concert with an
25 existing tobacco cessation support program. At a minimum, the tobacco-free zone should
26 encompass all indoor areas with no exceptions and no indoor smoking areas of any kind
27 (including separately enclosed and/or ventilated areas), as well as areas immediately outside
28 building entrances and air intakes, and all work vehicles. Optimally and whenever feasible, the
29 entire workplace campus, including all outdoor areas, should be established as tobacco-free. All
30 tobacco-related restrictions and prohibitions should be equitably enforced.
 - 31 ○ Assure compliance with current OSHA and MSHA regulations prohibiting or limiting smoking,
32 smoking materials, and/or use of other tobacco products in work areas characterized by the
33 presence of explosive or highly flammable materials or potential exposure to toxic materials
34 (see Table A-3 in the Appendix). To the extent feasible, follow all similar NIOSH
35 recommendations (see Table A-2 in the Appendix).
 - 36 ○ Provide information on tobacco-related health risks and on benefits of quitting to all employees
37 and other (e.g., contracted or voluntary) workers on a regular basis.
 - 38 ○ Inform all workers about health risks of tobacco use.
 - 39 ○ Inform all workers about health risks of exposure to SHS.
 - 40 ○ Train workers who are exposed or potentially exposed to occupational hazards at work
41 about health and/or injury risks of tobacco use combined with exposure to workplace
42 hazards, about what the employer is doing to limit the risks, and about what the worker
43 can do to limit his/her risks.
 - 44

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- 1 ○ Provide information on employer-provided and publically available tobacco cessation services to
2 all employees and other (e.g., contracted or voluntary) workers on a regular basis.
 - 3 ○ At a minimum, include information on available quitlines and self-help materials, and
4 information on employer-provided cessation programs and tobacco-related health
5 insurance benefits available to the worker.
 - 6 ○ Ask about personal tobacco use as part of all occupational health and wellness program
7 interactions with individual workers and promptly provide encouragement to quit and
8 guidance on tobacco cessation to each worker identified as a tobacco user and to any
9 other worker who requests tobacco cessation guidance.
 - 10 ○ Offer and promote more comprehensive tobacco cessation support to all tobacco-using workers
11 and, where feasible, to their dependents.
 - 12 ○ Provide employer-sponsored cessation programs at no-cost or subsidize cessation
13 programs for lower wage workers to enhance the likelihood of their participation. If
14 health insurance is provided for employees, the health plan can be designed to provide
15 employees with comprehensive cessation coverage, including evidence-based cessation
16 treatments, unimpeded by co-pays and other financial or administrative barriers.
 - 17 ○ Assure inclusion of occupational health protection content specific to the individual
18 workplace in employer-sponsored tobacco cessation programs offered to workers with
19 jobs involving (potential) exposure to other occupational hazards.
 - 20 ○ Become familiar with available guidance (e.g., CDC’s ‘Implementing a Tobacco-Free Campus
21 Initiative in Your Workplace’) (see Box 6-1) before developing, implementing, or modifying
22 tobacco-related policies, interventions, or controls.
 - 23 ○ Develop, implement, and modify tobacco-related policies, interventions, and controls in a
24 stepwise and participatory manner—with input from employees, labor representatives, line
25 management, occupational safety/health and wellness staff, and human resources
26 professionals. Those providing input should include current and former tobacco users, as well as
27 those who have never used tobacco. Seek voluntary input from employees with health
28 conditions exacerbated by exposure to SHS, such as heart disease and asthma.
 - 29 ○ Make sure that any differential employment benefits policies that are based on tobacco-use or
30 participation in tobacco cessation programs are designed with a primary intent to improve
31 worker health and comply with all applicable federal, state, and local laws and regulations. Even
32 when permissible by law, these differential employment benefit policies, as well as differential
33 hiring policies based on tobacco use, should be implemented only after serious consideration is
34 given to ethical concerns and possible unintended consequences, including the potential for
35 adverse impacts on individual employees (e.g., coercion, discrimination, and breach of privacy)
36 and the workforce as a whole.
- 37
- 38 NIOSH recommends that workers who smoke cigarettes or use other tobacco products:
- 39 ○ Comply with all workplace tobacco policies.
 - 40 ○ Ask about available employer-provided tobacco cessation programs and cessation-related
41 health insurance benefits.
 - 42 ○ Quit using tobacco products, with the understanding that
 - 43 ○ Quitting tobacco use is beneficial at any age, but the earlier one quits, the greater the
44 benefits.

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- 1 ○ Many people find various types of assistance to be very helpful in quitting, and
- 2 evidence-based cessation treatments have been found to increase smokers' chances of
- 3 quitting successfully. Assistance may be obtained from some or all of the following:
- 4 ▪ tobacco cessation programs
- 5 ▪ your state quitline (phone: 1-800-QUIT-NOW [1-800-784-8669])
- 6 ▪ your health care provider.

7 In addition, individual workers who want to quit tobacco may find several of the

8 websites listed in Box 6-1 helpful.

9

10 NIOSH recommends that all workers, including workers interested in quitting tobacco use and

11 nonsmokers exposed to SHS at their workplace:

- 12 ○ Know the occupational safety and health risks associated with their work, including those that
 - 13 can be made worse by personal tobacco use, and how to limit those risks.
 - 14 ○ Consider sharing a copy of this CIB with their employer.
- 15
- 16

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29	States, 2004–2010

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- 1 Figure A-2a. Smokeless tobacco use among working adults aged, by industry—United States,
2 2010
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- 17
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1 List of Abbreviations

2	ACA	Affordable Care Act
3	CDC	Centers for Disease Control and Prevention
4	CIB	Current Intelligence Bulletin
5	COPD	chronic obstructive pulmonary disease
6	DHHS	Department of Health and Human Services
7	ENDS	electronic nicotine delivery system
8	FDA	Food and Drug Administration
9	MSHA	Mine Safety and Health Administration
10	NHIS	National Health Interview Survey
11	NIOSH	National Institute for Occupational Safety and Health
12	OSHA	Occupational Safety and Health Administration
13	SHS	secondhand smoke
14	SIDS	sudden infant death syndrome
15		

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Promoting Health and Preventing Disease and Injury through Workplace Tobacco Policies

Part 1: BACKGROUND

The widespread recognition that tobacco use is a leading preventable cause of injury, disease, disability, and premature death in the United States is based on an extraordinarily strong scientific foundation. The first Surgeon General’s report on smoking and health, issued 50 years ago, concluded that cigarette smoke causes lung cancer and chronic bronchitis [DHEW 1964]. Subsequent reports of the Surgeon General have determined that both active tobacco smoking and secondhand smoke (SHS) exposure are important risk factors for cancer, heart disease, and respiratory disease, and that smokeless tobacco use also causes serious disease, including oral, esophageal, and pancreatic cancer [e.g., DHHS 1982, 1983, 1984, 1986a,b, 2004, 2006, 2014]. One Surgeon General’s report focused entirely on smoking-enhanced risks of cancer and chronic lung disease for workers exposed to hazardous industrial agents in the workplace [DHHS 1985]. Several reports of the Surgeon General have addressed benefits of effective smoking cessation programs and other means of reducing tobacco use [DHHS 1990, 2000, 2012, 2014].

A Surgeon General’s report also established the ongoing *Healthy People* strategy, aimed broadly at improving the nation’s health [DHEW 1979a]. Currently, *Healthy People 2020* includes a major goal of reducing “illness, disability, and death related to tobacco use and secondhand smoke exposure” along with several specific objectives targeting elimination of tobacco smoking in workplaces [DHHS 2013]. The Centers for Disease Control and Prevention has declared reducing tobacco use a “Winnable Battle”, noting that tobacco use is one of several “public health priorities with large-scale impact on health and with known, effective strategies to address them” [CDC 2013a], and the U.S. Department of Health and Human Services has published a strategic plan for tobacco control that envisions “a society free of tobacco-related death and disease” [DHHS 2010a].

Over time, National Institute for Occupational Safety and Health (NIOSH) publications have evolved in how they have acknowledged and made recommendations about hazards associated with tobacco use by workers. The first criteria document published by NIOSH—on asbestos—only briefly mentioned smoking, once in the context of a discussion of research findings that concluded that smoking alone could not explain the extremely high risk of lung cancer observed in asbestos-exposed workers, and once in a suggestion that the medical monitoring recommended by NIOSH for asbestos-exposed workers would offer opportunity for various forms of individualized medical management, including smoking cessation [NIOSH 1972] (see Appendix Table A-2). Nearly a decade later, after substantially more research on asbestos had been published, NIOSH disseminated a document affirming synergistic (i.e., more than additive) effects on lung cancer risk of combined exposure to asbestos and smoking [NIOSH 1980].

In the late 1970s, NIOSH scientists authored a chapter on “The Interaction between Smoking and Occupational Exposure” in the 1979 Surgeon General’s Report on Smoking and Health [DHEW 1979b]. That work led directly to the first NIOSH publication focused solely on tobacco smoke, a Current Intelligence Bulletin (CIB) that outlined several ways in which smoking interacts with other workplace exposures to increase risk of disease and injury among workers [NIOSH 1979]. In that CIB, NIOSH

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1 recommended that smoking be curtailed in workplaces where those other hazards are present and that
2 worker exposure to those other occupational hazards be controlled (see Appendix Table A-1).

3
4 Later, when scientific evidence became clear that the health risk from inhaling tobacco smoke is not
5 limited to direct smokers but also affects bystanders, NIOSH published another CIB focused solely on
6 tobacco smoke—this one on SHS in the workplace [NIOSH 1991]. In that CIB, NIOSH presented its
7 determination that SHS (referred to in that document as “environmental tobacco smoke”) causes cancer
8 and cardiovascular disease. In recommending that workplace exposures to SHS be reduced to the lowest
9 feasible concentration using all available preventive measures, NIOSH emphasized that the best
10 approach is to eliminate tobacco smoking in the workplace and endorsed employer-provided smoking
11 cessation programs for employees who smoke [NIOSH 1991] (see Appendix Table A-1).

12
13 In retrospect, the CIB on SHS in the workplace marked a watershed in the Institute’s approach to
14 occupational safety and health. Over time, NIOSH recommendations concerning specific industrial
15 hazards—which earlier might have been relatively silent about what were then narrowly understood to
16 be strictly personal health-related behaviors like smoking—have come to embrace a more
17 comprehensive preventive approach. This evolution has been motivated by a better understanding of
18 the interactive adverse effects of smoking and occupational exposures and, perhaps just as importantly,
19 by a changing societal view of the health and economic consequences of tobacco use. By way of
20 example, criteria documents produced in the past decade on two lung hazards—refractory ceramic
21 fibers [NIOSH 2006] and hexavalent chromium [NIOSH 2013a]—have included entire sections on
22 smoking cessation, something not seen in earlier criteria documents (see Appendix Table A-2). In a
23 paper published in a medical journal in 2004, the Director of NIOSH concluded that “Smoking is an
24 occupational hazard, both for the worker who smokes and for the non-smoker who is exposed to ETS in
25 his or her workplace” and recommended that “Smoking as an occupational hazard should be completely
26 eliminated for the sake of the health and safety of American workforce” [Howard 2004]. And a 2010
27 post on the NIOSH Blog site pointed out that “Tobacco-free workplaces, on-site tobacco cessation
28 services, and comprehensive, employer-sponsored healthcare benefits that provide multiple quit
29 attempts, have all been shown to increase tobacco treatment success” [Howard et al. 2010].

30
31 Thus, instead of staying focused nearly exclusively on protecting workers from specific occupational
32 hazards, NIOSH has progressively adopted a “strategy integrating occupational safety and health
33 protection with health promotion to prevent worker injury and illness and to advance health and well-
34 being” [NIOSH 2013b]. This integrated approach, embodied by NIOSH in its Total Worker Health™
35 Program [Schill and Chosewood 2013], has motivated NIOSH to produce this CIB on *Promoting Health
36 and Preventing Disease and Injury through Workplace Tobacco Policies*.

37
38
39 **Part 2: TOBACCO USE BY WORKERS AND SECONDHAND SMOKE EXPOSURES AT**
40 **WORK**

41
42 **Use of Conventional Tobacco Products by Workers**
43

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1 **Tobacco Smoking**
2

3 Since publication of the first Surgeon General’s report on the health consequences of smoking, cigarette
4 smoking prevalence has decreased substantially among U.S. adults, from 42.4% in 1965 to 18.1% in 2012
5 [CDC2014a]. Nationally representative studies on the smoking status of workers in the United States,
6 most often based on one or more iterations of the National Health Interview Survey (NHIS), have
7 demonstrated substantial declines in overall smoking similar to smoking among all U.S. adults [Sterling
8 and Weinkam 1976; Nelson et al. 1994; Lee et al. 2004, 2007; Barbeau et al. 2004]. The overall
9 prevalence of current cigarette smoking among workers during the 2004–2010 period was 19.6%, very
10 closely approximating the prevalence among all U.S. adults, which annually ranged from a high of 20.9%
11 to a low of 19.3% during the 2004–2010 period [CDC 2011a, 2013b].
12

13 Over the past several decades, a number of studies have assessed smoking habits among U.S. workers.
14 Consistently, these studies have shown substantially higher smoking prevalence among blue-collar
15 workers compared with white-collar workers, particularly among males [Sterling and Weinkam 1976;
16 DHHS 1985; Stellman et al. 1988; Brackbill et al. 1988; Covey et al. 1992; Nelson et al. 1994; Bang and
17 Kim 2001; Barbeau et al. 2004; Lee et al. 2004, 2007; CDC 2011a; Calvert et al. 2013]. In addition, these
18 studies provide evidence of higher intensity of smoking among blue-collar workers who smoke than
19 white-collar workers who smoke [Fujishiro et al. 2012]. Among blue-collar workers, those with higher
20 levels of exposure to dust and chemical hazards are more likely to be smokers [Chin et al. 2012].
21

22 NIOSH publishes recent data on smoking status by industry and occupation groupings in the *Work-*
23 *Related Lung Disease (WoRLD) Surveillance Report* and corresponding online updates [NIOSH 2008a,
24 2014]. The most recent tables, covering the period 2004–2011, show that smoking prevalence varies
25 widely—nearly four-fold—by industry. Smoking prevalence at or below 10% was found among major
26 industry sectors in *education services* (9.8%) and among minor industry sectors in *religious,*
27 *grantmaking, civic, labor, professional, and similar organizations* (10.0%). Smoking prevalence exceeding
28 30% was found among three major industry sectors—*construction* (32.1%), *accommodation and food*
29 *services* (32.1%), and *mining* (30.2%)—and several minor sectors in other major industries—*gasoline*
30 *stations* (37.6%), *fishing, trapping, and hunting* (34.3%), *forestry and logging* (32.9%), *warehousing and*
31 *storage* (32.0%), *rental and leasing services* (31.3%), *wood product manufacturing* (30.7%), and
32 *nonmetallic mineral product manufacturing* (30.4%). Additional tables posted on that same NIOSH site
33 show that smoking prevalence varies even more extremely—25-fold—by specific occupational group,
34 from 2.0% for *religious workers* to 49.5% for *construction trades helpers* [NIOSH 2014] (see Appendix
35 Figures A-1a and A-1b).
36

37 **Smokeless Tobacco**
38

39 Smokeless tobacco is tobacco that is not burned when used. There are many different types of
40 smokeless tobacco, including chewing tobacco, snuff, dip, snus, and dissolvable tobacco products. As
41 with smoking, NHIS data have been used to estimate smokeless tobacco use by workers [Dietz et al.
42 2011; NIOSH 2014]. During 2010, an estimated 3% of currently working adults used smokeless tobacco
43 in the form of chewing tobacco or snuff; smokeless tobacco use ranged up to 11% for those working in
44 *construction and extraction* jobs and over 18% for those working in the *mining* industry [CDC 2014b;

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1 NIOSH 2014]. (Appendix Figures A-2a and A-2b display prevalence of smokeless tobacco use for major
2 industry and occupation categories.)

3 4 **Dual Use**

5 So-called “dual use” of tobacco (e.g., use of smokeless tobacco by individuals who also smoke tobacco
6 products) is one way smokers can try to maintain their nicotine habit when and where smoking is
7 prohibited. Based on 2010 NHIS data, over 4% of U.S. adult workers who smoke cigarettes also use
8 smokeless tobacco in the form of snuff or chewing tobacco) [CDC 2014b; NIOSH 2014]. Dual use has
9 traditionally been practiced by many workers, including coal miners and others, employed in mines or
10 factories where smoking poses risk for explosion and fire [Mejia and Ling 2010]. (Appendix Figures A-3a
11 and A-3b display prevalence of dual use among U.S. adult workers who are current smokers for major
12 industry and occupation categories, respectively.)

13 14 **Secondhand Smoke Exposures at Work**

15
16 SHS is a mixture of the ‘sidestream smoke’ emitted directly into the air by the burning tobacco product
17 and the ‘mainstream smoke’ exhaled by smokers while smoking. Workplace exposures to SHS have been
18 demonstrated by using air monitoring and through the use of biological markers, such as cotinine, a
19 metabolite of nicotine [Hammond et al. 1995; Hammond 1999; Achutan et al. 2011; Pacheco et al.
20 2012]. By the late 1990s, studies that objectively measured markers of SHS found levels that varied
21 substantially by workplace. Where smoking was allowed, offices and blue-collar workplaces had similar
22 concentrations of nicotine in the air; higher nicotine concentrations were present in restaurants, and
23 still higher concentrations (an order of magnitude higher than in offices) were measured in bars
24 [Hammond 1999]. More recently, objective evidence of absorption of a specific cancer-causing
25 component of SHS was documented by showing significant increases in urine levels of a metabolite of
26 that component over a work shift among nonsmoking card dealers at three casinos where smoking was
27 prevalent [Achutan et al. 2012].

28
29 Various mandatory and voluntary efforts have either eliminated or substantially decreased exposure to
30 SHS in many workplaces in the United States. In a 1986 survey of the civilian U.S. population, only 3% of
31 employed respondents reported working under a smoke-free workplace policy [CDC 1988]. Subsequent
32 surveys carried out in the 1990s tracked an increasing proportion of indoor workers reporting that they
33 worked under a smoke-free workplace policy—just over 45% in 1993, just over 64% in 1996, and nearly
34 70% by 1999 [Shopland et al. 2004]. That 1999 survey found wide disparities; while smoke-free
35 workplace policies covered 90% of teachers, they covered only 43% of food preparation and service
36 workers, and only 13% of bartenders [Shopland et al. 2004].

37 While establishment of smoke-free workplace policies continues to progress in the United States, these
38 policies are not always 100% effective. One recent nationwide survey found that, among employed
39 nonsmoking adults in the U.S. whose workplaces were covered by an indoor smoke-free policy, 16.4%
40 reported exposure to SHS at work one or more days during the past seven days [King et al. 2014]. Still
41 this compared favorably with the much greater 51.3% of those not covered by smoke-free policies who
42 reported similar SHS at work [King et al. 2014].

43

1 One recent nationwide survey found that 20.1% of nonsmoking employed adults reported SHS exposure
2 in their indoor workplace on one or more days during the past seven days [King et al. 2014]. An analysis
3 of recent NHIS data that used a more restrictive definition of SHS exposure—exposure to SHS at work on
4 two or more days per week during the past year—estimated that 10.0% of nonsmoking U.S. workers
5 reported *frequent* exposure to SHS at work [Calvert et al. 2013]. Prevalence of such frequent exposure
6 by major industry sector ranged from 4.1% for *finance and insurance* to 28.4% for *mining*, while
7 prevalence by major occupation ranged from 2.3% for *education, training, and library* occupations to
8 28.5% for ‘construction and extraction’ occupations (See Appendix Figures A-4a and A-4b).

9 Data from 14 state-based population surveys conducted in 2005 indicated that the majority of all indoor
10 workers reported a complete smoke-free workplace policy at their place of employment. State-specific
11 proportions ranged from 54.8% (Nevada) to 85.8% (West Virginia), with a median of 73.4% [CDC 2006].
12 Results from later surveys conducted by 13 states in 2008 found proportions of nonsmoking employed
13 adults who reported SHS exposure on two or more days during the past seven days in their indoor
14 workplace ranging from 6.0% (Tennessee) to 15.8% (Mississippi), with a state-specific median of 8.6%
15 [CDC 2009]. An even more recent survey involving all states, found proportions of nonsmoking
16 employed adults who reported SHS exposure on one or more days during the past seven days in their
17 indoor workplace ranging from 12.4% (Maine) to 30.8% (Nevada)[King et al. 2014].
18

19 Prevalences of SHS exposure at work on one or more days during the past seven days were significantly
20 higher among males (23.8%) than females (16.7%), among those without a high school diploma (31.9%)
21 than those with a graduate school degree (11.9%), and among those with an annual household income
22 less than \$20,000 (24.2%) than those with ≥\$100,000 income (14.8%). A recent study separated effects
23 on workplace SHS exposure associated with education and income from effects associated with
24 occupation [Fujishiro et al. 2012]. Even after statistically adjusting for the effects of education and
25 income, blue-collar workers were more likely to report workplace SHS exposure than managers and
26 professionals. That same study also found that blue-collar workers were also more likely to be smokers
27 and more likely to be heavy smokers, suggesting more intense SHS exposures at work for blue-collar
28 workers.
29

30 **Electronic Nicotine Delivery Systems (ENDS)**

31
32 First introduced into the U.S. market in 2007 [Regan et al. 2013], electronic nicotine delivery systems
33 (ENDS), which include electronic cigarettes, or e-cigarettes, are rapidly increasing in use [King et al.
34 2013]. The ENDS marketplace has diversified in recent years and now includes multiple products,
35 including electronic hookahs, vape pens, electronic cigars, and electronic pipes. Typically, an ENDS
36 product has a cartridge containing a liquid consisting of varying amounts of nicotine, a propylene glycol
37 or glycerine carrier, and flavorings. Inhalation draws the fluid to a heating element, creating vapor that
38 subsequently condenses into a misty aerosol [Ingebrethsen et al. 2012].
39

40 Available data suggests that e-cigarettes use has increased greatly in the United States over the past
41 several years. A recent mail survey of U.S. adults showed that the percentage who had ever used ENDS
42 more than quadrupled from 0.6% in 2009 to 2.7% in 2010 [Regan et al. 2013]. A subsequent survey of
43 U.S. adults found that approximately 1 in 5 current smokers reported ever having used e-cigarettes in
44 2011 [King et al. 2013]. To date, there have been no nationally representative surveys of ENDS use
45 specifically among workers.

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Part 3: HEALTH AND SAFETY CONSEQUENCES OF TOBACCO USE

Interactions Involving Tobacco Use and Occupational Hazards

Tobacco use causes many health problems, outlined later in this section. Tobacco use (most commonly, smoking) can also interact in several ways with other hazards present in some workplaces to worsen their impact on workers' health [NIOSH 1979; DHEW 1979b; DHHS 1985]. Because the types of interactions discussed in the following paragraphs are not mutually exclusive, several of these interactions may be relevant for any given agent.

In one general type of interaction, the specific toxic chemicals associated with work processes in some workplaces are also present in tobacco products and/or smoke, thus increasing exposure to those specific agents among tobacco-using workers and workers exposed to SHS. Chemicals found in tobacco smoke to which some workers are exposed at their jobs due to work processes include acetone, acrolein, aldehydes (e.g., formaldehyde), arsenic, cadmium, carbon monoxide, hydrogen cyanide, hydrogen sulfide, ketones, lead, methyl nitrite, nicotine, nitrogen dioxide, phenol, and polycyclic aromatic compounds.

In another type of interaction, tobacco products serve as a pathway to increase exposure of tobacco-using workers to toxic occupational agents. Tobacco products can readily become contaminated by toxic occupational agents in the workplace. Subsequent use of the contaminated tobacco products, whether at or away from the workplace, can facilitate entry of these toxic agents into the body by inhalation, ingestion, and/or skin absorption.

Yet another type of interaction involves transformation of chemicals found in the workplace into more harmful agents. Heat generated by burning tobacco can cause reactions with some workplace chemicals. Examples of occupational agents that have the potential for conversion to highly toxic chemicals in the act of smoking tobacco products include polytetrafluoroethylene (Teflon®) and other chlorinated hydrocarbons (see Box 3-1).

Box 3-1. Polymer Fume Fever in Smokers with Occupational Exposure to Tetrafluoroethylene [CDC 1987].

Soon after use of a new spray product containing tetrafluoroethylene (a fluorocarbon monomer) was introduced at a small industrial facility, workers began experiencing severe episodic "flu-like" symptoms. The symptoms—lower backache accompanied by fever, chills, and malaise, and a dry, nonproductive cough—occurred only on work days and usually subsided by the next morning. The spray was used in a stamp-making process, and only the employees making the stamps were affected. All the affected workers ate and smoked in their work area. After smoking was prohibited, no further symptoms occurred. Investigators concluded that workers had experienced polymer-fume fever due to contamination of cigarettes with the fluorocarbon (via the workplace air or direct contact with workers' hands) and subsequent inhalation of decomposition products created by the intense heat of the cigarettes as they smoked.

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1
2 Perhaps most substantial in terms of documented widespread impact on worker health is the type of
3 interaction in which smoking and exposure to a toxic agent found in the workplace each have
4 independent but similar adverse effects on an organ system. If a worker’s lung function is already
5 reduced by smoking, that worker is more vulnerable to the effects of any further lowering of lung
6 function caused by occupational exposures to dusts, gases, or fumes. Looked at in another way, if a
7 worker’s lung function is already reduced by the effects of occupational exposure to dusts, gases, or
8 fumes, that worker is more susceptible to the effects of smoking on lung function. The combined impact
9 on affected workers can be either additive (i.e., amounting to the sum of each independent effect) or, in
10 some cases, synergistic (i.e., amounting to an effect greater than the sum of each independent effect).
11 One of the best known examples of such an effect is the synergistic effects of smoking and asbestos
12 exposure on lung cancer (see Box 3-2). In addition to asbestos, other workplace hazards that can cause
13 serious health problems, especially when combined with smoking, include coal mine dust, cotton dust,
14 grain dust, silica dust, welding fumes, petrochemicals, aromatic amines, pesticides, and ionizing
15 radiation [DHHS 1985]. Importantly, even if all smoking is eliminated from the workplace, workers who
16 smoke outside of work remain vulnerable to this type of interaction.

17
18 Finally, occupational traumatic injuries and fatalities can result from interaction of tobacco use with
19 existing occupational risks. Best recognized are explosion and fire risks when explosive or flammable
20 materials in the workplace are ignited by sources associated with tobacco smoking. But, even without
21 explosion or fire, any form of tobacco use may result in traumatic injury if a kinetic work process goes
22 awry due to operator distraction associated with tobacco use (e.g., opening up, lighting up,
23 extinguishing, or disposing of a tobacco product).

24
25 | **Health Problems Caused by Use of Tobacco Products**

26
27 ***Tobacco Smoking***

28
29 Smoking is a known cause of the top five health conditions impacting the U.S. population—heart
30 disease, cancers, cerebrovascular disease, chronic lower respiratory disease, and unintentional injuries
31 [DHHS 2004] (Table 3-1), and each of these is amenable to preventive intervention [Task Force on
32 Community Preventive Services 2010]. The risk and severity of most adverse health outcomes caused by
33 smoking are directly related to the intensity and duration of tobacco smoking, but no level tobacco
34 smoking is risk-free [DHHS 2010b, 2014]. In the United States, smoking is responsible for more than
35 439,000 deaths each year among current and former smokers [DHHS 2014]. It is estimated that more
36 than 20 million U.S. adults live with chronic obstructive pulmonary disease or other disease attributable
37 to tobacco [DHHS 2014].
38

Table 3-1. Some Health Conditions Caused by Tobacco Smoking

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Cancers	Lung Bladder Esophageal Laryngeal Oral and throat Cervical Kidney Pancreatic Liver Stomach Colorectal Acute myeloid leukemia
Cardiovascular disease	Atherosclerosis Coronary heart disease Cerebrovascular disease (stroke) Abdominal aortic aneurysm
Lung disease	Chronic obstructive pulmonary disease Acute respiratory infections, including pneumonia Asthma exacerbation Tuberculosis Asthmatic and other respiratory symptoms Accelerated lung function decline
Reproductive effects	Reduced fertility Placental abnormalities Ectopic pregnancy Impaired fetal development and congenital orofacial defects Premature delivery Low birth weight Sudden infant death syndrome (SIDS) Erectile dysfunction
Other diseases or conditions	Cataracts, macular degeneration, and blindness Low bone density and hip fractures Poor wound healing Peptic ulcer disease Periodontitis Diabetes Rheumatoid arthritis Impaired immune function General poor health

1 Source: DHHS [2004, 2014]

2

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1 Cancer

2

3 Smoking is estimated to cause nearly 164,000 cancer deaths among smokers each year in the United
4 States [DHHS 2014]. Cancers caused by smoking include lung, mouth, throat, bladder, and other cancers
5 (Table 3-1). Among the carcinogens present in cigarette smoke are polycyclic aromatic hydrocarbons, N-
6 nitrosamines, aromatic amines, 1,3-butadiene, benzene, aldehydes, and ethylene oxide. In addition to
7 directly causing cancer, smoking interacts with occupational exposures known to separately cause
8 cancer, leading to effects on cancer causation greater than the effects of the two factors separately
9 [Wraith and Mengersen 2007; Frost et al. 2011; Markowitz et al. 2013] (see Box 3-2).

10

Box 3-2. Lung Cancer Risk in Insulators—Effects of Smoking, Asbestos Exposure, and Asbestosis [Frost et al. 2011; Markowitz et al. 2013]

Cigarette smoking and exposure to asbestos are each well-known causes of lung cancer. Many studies have assessed lung cancer risk among persons who have both smoking and asbestos exposure as risk factors. One recent study confirmed the long-standing view that cigarette smoking raises the risk of death from lung cancer among asbestos-exposed workers in a manner that is greater than additive, if not multiplicative. Results of another recent study illustrate interactive effects of smoking combined not just with asbestos exposure, but also specifically with asbestosis (a fibrotic lung disease caused by asbestos). This was a long-term mortality study of 2,377 asbestos-exposed insulators identified in 1967 and 54,243 contemporaneous blue-collar workers with little, if any, asbestos exposure. The insulators were divided into two subgroups—one with and the other without radiographic evidence of asbestosis— with roughly equivalent asbestos exposure. Separate lung cancer risks were 10.3-fold for smoking (without asbestos exposure), 3.6-fold for asbestos exposure (without smoking), and 7.4-fold for asbestosis (without smoking). Combined lung cancer risks were 14.4-fold for smoking combined with asbestos exposure and 36.5-fold for smoking combined with asbestosis. The former is considered additive because the combined effect is about what would be expected by adding the separate risks for smoking and asbestos exposure; the latter is considered supra-additive (i.e., synergistic) because the combined effect is substantially greater than what would be expected by adding the separate risks for smoking and asbestosis.

11

12 Cardiovascular Disease

13

14 Smoking is estimated to cause nearly 125,000 heart disease deaths among smokers each year in the
15 United States [DHHS 2014]. The constituents of tobacco smoke believed to be responsible for causing
16 cardiovascular disease include oxidizing chemicals, nicotine, carbon monoxide, and particulate matter.
17 Coronary heart disease (ischemic heart disease) makes up the majority of those heart disease deaths.
18 Cerebrovascular disease (vascular disease in the brain), which can cause strokes, is also a major cause of
19 death from smoking. Smoking also causes aortic aneurysms and peripheral arterial disease. Smoking is
20 estimated to cause nearly 27,000 cerebrovascular and peripheral vascular deaths among smokers each
21 year in the United States [DHHS 2014]. Even low levels of exposure to tobacco smoke—such as a
22 smoking only a few cigarettes per day, occasional smoking, or exposure to SHS—are enough to greatly
23 increase risk of cardiovascular events [DHHS 2010b].

24

25 Lung Disease

26

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1 Smoking is estimated to cause more than 113,000 deaths among smokers each year in the United States
2 from non-malignant lung diseases [DHHS 2014]. Some of the chemical pathways by which tobacco
3 smoke produces lung damage have been well characterized. It is likely that familial or genetic factors
4 influence susceptibility to the adverse effects of tobacco smoke. Chronic obstructive pulmonary disease
5 (COPD) is a broad designation for the bronchitis, emphysema, and airways obstruction that account for
6 most smoking-caused respiratory deaths. As noted above, the effects of occupational exposure to
7 agents that are toxic to the lung can combine with the adverse health effects of tobacco smoke to cause
8 lung disease of greater severity than that expected from either of the exposures alone (see Box 3-3).
9 While smoking is the single most common cause of COPD, occupational exposures—often combined
10 with smoking—play a role in causing about 10% to 20% of all COPD cases [Balmes et al. 2003]. In
11 addition, smoking causes exacerbation of asthma, greater susceptibility to infectious pneumonias, and
12 higher risk of tuberculosis [DHHS 2014].

13

14 Reproductive and Developmental Effects

15

16 Inhalation of tobacco smoke affects the reproductive system, with harmful effects related to fertility,
17 fetal and child development, and pregnancy outcome. Smoking is estimated to cause more than 1000
18 deaths from perinatal conditions each year in the United States [DHHS 2014]. Exposure to the complex
19 chemical mixture of combustion compounds in tobacco smoke, including carbon monoxide which binds
20 to hemoglobin and can deprive the fetus of oxygen, has been found to contribute to a wide range of
21 reproductive effects in women. These effects include altered menstrual cycle and reduced fertility;
22 placental abnormalities and preterm delivery; reduced birth weight, stillbirth, neonatal death, and
23 sudden infant death syndrome (SIDS) in their offspring; earlier and more symptomatic menopause; and
24 other effects [DHHS 2001, 2004, 2014; Soares and Melo 2008; Sadeu et al. 2010]. Smoking by men
25 causes erectile dysfunction [McVary et al. 2001; DHHS 2014], which can also impair reproduction.

26

27 Other Adverse Effects

28

29 Smoking is known to cause a variety of other health problems that contribute to the generally poorer
30 health status of smokers as a group. These include visual difficulties (due to cataracts and age-related
31 macular degeneration), hip fractures (due to low bone density), peptic ulcer disease, diabetes,
32 rheumatoid arthritis, and periodontitis [DHHS 2014] (Table 3-1). Smoking may also cause hearing loss in
33 adults [Cruickshanks et al. 1998].

34

35 Inflammatory effects of tobacco smoke have been associated with many other health effects. For
36 example, smoking has been found to delay wound healing after surgery and lead to wound
37 complications [Sorensen 2012]. Also, tobacco smoking may increase the risk of hearing loss caused by
38 occupational exposure to excessive noise [Tao et al. 2013]. Research on other health effects associated
39 with exposure to tobacco smoke will undoubtedly provide a more complete understanding of the
40 adverse health effects of smoking.

Box 3-3. Emphysema Risk in Coal Miners—Effects of Tobacco Smoking and Coal Mine Dust Exposure [Kuempel et al. 2009]

A recent study evaluated the effects of exposure to coal mine dust, cigarette smoking, and other factors on the severity of lung disease (emphysema) among more than 700 deceased individuals, including more than 600 deceased coal miners. The study found that combined occupational exposure to coal mine dust and cigarette smoking had an additive effect on the severity of emphysema among the coal miners. Among smokers and never-smokers alike, emphysema was generally more severe among those who had experienced higher levels of exposure to coal mine dust, but at any given level of dust exposure, miners who had smoked generally had worse emphysema than miners who had not smoked.

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Secondhand Smoke

In the United States, SHS exposure causes over 41,000 deaths among nonsmokers each year [DHHS 2014]. There is strong evidence of a causal relationship between SHS of adults and adverse health effects, including lung cancer, heart disease, stroke, exacerbation of asthma, nasal irritation, and (due to maternal exposure) reduced birth weight of offspring (Table 3-2) [DHHS 2006, 2014; IARC 2009; Henneberger et al. 2011]. The evidence that exposure to SHS causes health effects among exposed infants and children is also strong (Table 3-2)[DHHS 2006, 2014; IARC 2009].

In addition, there is suggestive evidence that exposure to SHS causes a range of other health effects. These include respiratory diseases (asthma, COPD), breast cancer, and nasal cancer among adults exposed to SHS, premature delivery of babies born to women exposed to SHS, and cancers (leukemia, lymphoma, brain cancer) among children exposed to SHS [DHHS 2006, 2014; IARC 2009]. SHS exposure may also be associated with hearing loss in adults [Fabry et al. 2011].

Table 3-2. Some Health Conditions Caused by Exposure to Secondhand Smoke	
Effects on nonsmoking adults	Premature death and disease Lung cancer Coronary artery disease Stroke Asthma exacerbation Nasal Irritation
Effects on infants/children	Premature death and disease Reduced birth weight (due to maternal SHS exposure) Sudden infant death syndrome (SIDS) Slow lung growth and reduced lung function Lower respiratory illnesses More severe asthma Wheeze illnesses Respiratory symptoms (cough, phlegm, wheeze, breathlessness) Middle ear disease

17 **Source: DHHS [2006, 2014]; IARC [2009]; Henneberger et al. [2011]**

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Among adults, health risks of SHS exposure extend to workplace exposures. A meta-analysis of 11 pertinent studies provided quantitative estimates of lung cancer risk attributable to workplace exposure to SHS; lung cancer risk was increased by 24% overall among workers exposed to SHS in the workplace, and there was a doubling of lung cancer risk among workers categorized as highly exposed to SHS in the workplace [Stayner et al. 2008]. A dramatic example of an adverse effect of exposure to SHS in the workplace resulted in an asthmatic worker’s death (see Box 3-4).

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Box 3-4. Asthma Death and Exposure to Secondhand Smoke—A Case Report [MIFACE 2006; Stansbury et al. 2008]

On May 1, 2004, a 19 year-old part-time waitress, who had a history of asthma since childhood, arrived at work. She spent 15-minutes chatting with a co-worker in an otherwise unoccupied room adjacent to the bar and was reported to have no apparent breathing difficulty at that time. She then entered the bar, which was occupied by dozens of patrons, many of them smokers. Less than 5 minutes later she reported to the manager that she wished she had her inhaler with her, needed fresh air, and needed to get to the hospital. As she walked towards the door, she collapsed. An emergency medical crew attempted resuscitation and transported her to a hospital emergency room where she was declared dead. “Status asthmaticus” and “asphyxia secondary to acute asthma attack” were the causes of death recorded on the death certificate and autopsy report, respectively. The workplace was described by an investigator from a NIOSH-funded state program as a “typical smoky bar.” Based on the nature and circumstances of the waitress’s death, it was concluded by the principal investigator of the state’s fatality investigation program and his colleagues that this waitress died from exposure to work-related SHS.

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Smokeless Tobacco

Smokeless tobacco is a known cause of oral cancer, esophageal cancer, and pancreatic cancer [IARC 2012]. The most harmful chemicals in smokeless tobacco are tobacco-specific nitrosamines, which are formed during the growing, curing, fermenting, and aging of tobacco. Other cancer-causing substances in smokeless tobacco include polonium-210 (a radioactive element found in tobacco fertilizer) and polynuclear aromatic hydrocarbons (also known as polycyclic aromatic hydrocarbons) [DHHS 1986a].

Electronic Nicotine Delivery Systems (ENDS)

Because ENDS are relatively new products, limited data are available on potential hazardous effects of active and passive exposures to their emissions. Most of the hazardous components identified in tobacco smoke are either absent from ENDS emissions or are present at much lower levels than in conventional tobacco smoke. However, ENDS are not emission-free and questions remain regarding the long-term impact of these products on individual and population level health. Contrary to some marketing messages, secondhand aerosol emitted from ENDS is not merely water vapor. Liquids formulated for ENDS use commonly contain nicotine and flavorings in a propylene glycol or glycerin carrier, but exact formulations of these predominant constituents and other additives and contaminants vary widely and are not well standardized [Cheng 2014]. In addition to nicotine, which itself is associated with various systemic toxicities at sufficient doses [NIOSH 2012] and adverse vascular effects at low doses [DHHS 2010b], substances that have been measured or can be reasonably anticipated in aerosol produced by ENDS include known carcinogens, respiratory irritants, and other harmful and potentially harmful constituents [FDA 2009; McAuley et al. 2012; Schripp et al. 2013; Schober et al. 2013; Shaller et al. 2013; Cheng 2014; Goniewicz et al. 2014].

Currently there are insufficient data to determine whether adverse long-term effects are likely to result from personal use of ENDS or from secondhand exposure to ENDS aerosol [Wagener et al. 2012; BMA 2013; Kamerow 2013; Drummond and Upson 2014; Schraufnagel et al. 2014], and evaluating long-term safety of ENDS use is an important current research priority [Andrade and Hastings 2013]. A recent

1 review of the safety of ENDS use concluded that more research is warranted to determine the risk of
2 various components of the nicotine-containing liquids used in ENDS, including flavoring components in
3 particular “because the effects of inhaling flavoring substances approved for food use are largely
4 unknown” [Farsalinos and Polosa 2014]. Some flavorings intended for ingestion have been shown to
5 cause serious lung disease when inhaled at high concentration in other contexts [NIOSH 2004; CDC
6 2013c].

7
8 An experimental chamber study in which air contaminants were measured documented degradation of
9 indoor air quality during ENDS use and found that air measurements of polycyclic aromatic
10 hydrocarbons classified as probable carcinogens by IARC increased an average of 20% during ENDS use
11 [Schober et al. 2013]. In light of irritant compounds (e.g., formaldehyde, acetaldehyde, and acrolein)
12 identified in emissions from ENDS, it has been recommended that research be done to evaluate possible
13 adverse effects of exposure to these compounds among ENDS users and individuals exposed to
14 secondhand ENDS aerosol [Goniewicz et al 2014]. Indeed, findings relating to short-term adverse effects
15 on ENDS users include preliminary reports of significantly increased airways resistance [Gennimata et al.
16 2012] and respiratory irritation and cough, particularly among individuals with asthma [Tsikrika et al.
17 2013]. No studies to date have observed similar short-term effects due to secondhand exposure to ENDS
18 aerosol, but one experimental study demonstrated that passive exposure of human volunteers to ENDS
19 emissions did cause measurable changes in serum levels of cotinine, a metabolite of nicotine [Flouris et
20 al. 2013].

21 **Occupational Traumatic Injuries and Fatalities Caused by Tobacco Use**

22
23
24 Smoking in the workplace can ignite explosive and other flammable materials, resulting in injury, death,
25 and property loss. Smoking has been implicated as the known or suspected cause of several major
26 industrial disasters in the United States, including the infamous Triangle Shirtwaist Factory fire in 1911
27 [Leistikow et al. 2000b]. To help prevent occupational explosions and fires, the Occupational Safety and
28 Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) have established
29 a number of regulations prohibiting use and possession of smoking-related materials (i.e., cigarettes,
30 cigars, pipes, lighters, matches, etc.) in designated hazardous work areas (see Appendix Table A-3).
31 Despite existing regulations and widespread awareness of the risk, occupational injuries and fatalities
32 caused by smoking have continued to occur in the United States. Though prohibited in underground coal
33 mines, MSHA investigations concluded that smoking materials ignited three fatal coal mine explosions
34 between 1990 and 2000 [MSHA 2000]. OSHA records for 2000 through 2012 include documentation of
35 13 work-related fires or explosions—five of them fatal and all of them involving employee injuries—
36 where smoking materials were implicated as the ignition source [OSHA 2013a] (see Box 3-5).
37

Box 3-5. Smoking-ignited Fire Engulfs a Painting Crew—Two Dead and 11 Others Hospitalized [OSHA 2013b]

On July 29, 2003, two painting crews were working in a new residential subdivision and one of their two box trucks broke down near the end of the day. The company had the driver of the other truck pick up the stranded crew. That put 13 employees in the back of the truck and four in the cab. The truck was loaded with paints, lacquer thinner, stains, and acrylics, among other paint chemicals. A can of lacquer thinner spilled while employees were smoking in the truck. A lighted cigarette or a spark from a lighter ignited the lacquer thinner vapors. The truck was engulfed immediately. All 13

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employees in the back of the truck were hospitalized for severe burns, and two of them died as a result of their injuries.

1
2 Even in the absence of fires or explosions, there is evidence that occupational traumatic injuries and
3 property loss can be caused by tobacco use on the job. Use of tobacco products is recognized as a
4 distracting factor while operating motor vehicles [NHTSA 2009], and smoking while driving increases the
5 risk of being involved in a crash [Young et al. 2003]. While smokers are more likely to be injured at work
6 than nonsmokers [Ryan et al. 1992; Sacks and Nelson 1994; Craig et al. 2006], specific explanations for
7 this association are unlikely to be limited to mere distraction. Adverse smoking-associated physiological
8 alterations in bone mineralization, blood vessels, and inflammatory response may also contribute to
9 higher risk of occupational injuries and higher rates of associated disability among smokers [Lincoln et
10 al. 2003]. A detailed discussion of how smoking can adversely impact unintended injuries and recovery
11 from injuries has been published [Leistikow 2000a].
12

13 **Part 4: PREVENTIVE INTERVENTIONS**

14
15 Comprehensive efforts to decrease tobacco use include various policies and education/cessation
16 programs. Most of these intervention efforts focus on smoking, which is the most prevalent form of
17 tobacco use (see Part I, above). Policies related to tobacco use in workplaces originally focused on
18 prohibiting smoking in industrial work areas where explosion hazards were present. Currently,
19 workplace tobacco policies increasingly center on: smoke-free or tobacco-free indoors or campus-wide
20 prohibitions; other restrictions on tobacco use by employees; removal of tobacco vending machines and
21 prohibiting other onsite sales of tobacco in workplaces; provision of tobacco cessation programs;
22 employer-provided health insurance benefits designed to increase access and remove barriers to
23 evidence-based cessation treatments and to provide incentives to quit tobacco use; and design of hiring
24 policies based on smoking status.
25

26 Many preventive policies relating to smoking and the workplace are governed by local, state, or federal
27 government laws and/or regulations. Others are independently implemented by employers as
28 workplace requirements or conditions of employment. Employees and/or labor organizations can share
29 in a sense of joint ownership if they meaningfully collaborate with the employer on policy language,
30 approaches and timing, cessation supports, and compliance and consequence issues. Involving
31 employees in the development, implementation, and evaluation of workplace programs is an effective
32 strategy for changing employee culture and behavior [NIOSH 2008b].
33

34 Workplace tobacco policies are underpinned by several motivating interests (Tables 4-1 and 4-2). First
35 and foremost is an interest in protecting tobacco users' health, given that tobacco use causes the top
36 five health conditions that impact the U.S. population [Task Force on Community Preventive Services
37 2010]. Protecting the health of others, especially nonsmoking workers, is an important additional
38 motivating interest. Legally determined employer responsibility to provide employees with a safe
39 workplace can motivate action by employers. OSHA does not currently apply the "general duty clause"
40 [29 USC § 654, 5(a)1] in the Occupational Safety and Health Act of 1970 (OSH Act), Public Law 91-596, to
41 SHS exposure, but this is "a matter of prosecutorial discretion" [OSHA 2003], and employers would do

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1 well not to ignore legal implications of their duty to provide safe workplaces, including workplaces that
2 are free from SHS exposure [Zellers et al. 2007].

3
4 Although the health and safety consequences of tobacco use offer sufficient rationale for workplace
5 tobacco policies, economic considerations are also important. Government (i.e., taxpayers), employers,
6 and employees all bear financial costs associated with adverse effects of tobacco use by workers and
7 occupational exposure to SHS.

8
9 With respect to personal costs paid by individual smokers, there are obvious direct costs associated with
10 consumer purchases of tobacco products and related materials. However, many smokers, especially
11 those with the least discretionary income, are unaware of longer term financial costs. One financial
12 writer estimated in 2007 that a typical pack-a-day smoker who is spending nearly \$2,000 annually just to
13 purchase cigarettes could instead amass more than \$1 million by investing that amount each year from
14 ages 18 to 65 in an individual retirement account invested with an emphasis on growth [Karp 2007].
15 That estimate did not encompass costs of smoking other than the purchase price of tobacco. Smokers
16 are often charged higher premiums for health and life insurance and generally pay more out-of-pocket
17 costs for health care. Families can experience substantial loss of income when their smoking
18 breadwinner becomes disabled or dies prematurely from a smoking-related disease. Financial
19 devastation can also result from smoking-caused residential fires through costly personal injury to the
20 smoker and/or family members and through loss of residence and other personal property. In addition,
21 smokers and their families may incur additional costs for more frequent cleaning, repairing, or
22 replacement of clothing and other personal furnishings to remove smoke odors and tobacco-related
23 stains.

24
25 With respect to employers' costs, a recent study estimated excess annual cost to U.S.-based private
26 employers associated with employees who smoke cigarettes compared to those who do not.
27 Considering aggregate cost and productivity impacts associated with smoking breaks, absenteeism,
28 presenteeism, healthcare expenses, and pension benefits, the study estimated that the annual cost to
29 employ a smoker was, on average, \$5,816 greater than the cost to employ a nonsmoker [Berman et al.
30 2013]. Interventions that help smoking workers quit can benefit a business' bottom line [NBGH 2013].
31

Table 4-1. Some Reasons for Employees to Quit Tobacco Use

- **To improve one's own health**
 - **Reduce risk for lung, mouth, throat, and other types of cancer. For example, lung cancer risk drops by as much as 50% ten years after quitting, and risks for cancers of the mouth and throat and bladder drop by 50% five years after quitting.**
 - **Diminish risk for coronary heart disease, stroke, and peripheral vascular disease. For example, heart disease risk drops by as much as 50% one year after quitting. Stroke risk attributable to tobacco use may be eliminated five years after quitting.**
 - **Ease symptoms such as coughing, wheezing, and shortness of breath within months of quitting and long-term risk for chronic obstructive pulmonary disease (COPD) and other respiratory diseases.**
 - **Lower risk of ulcer.**
 - **Reduce risks of infertility (for women who stop smoking during their reproductive**

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- years).
- **To protect the health of others**
 - **Avoid exposing family, friends, coworkers, and others to the harmful effects of secondhand smoke (SHS).**
 - **Lessen the risk of having a low-birth-weight baby (for women who stop smoking before becoming pregnant or during the first trimester of pregnancy).**
 - **Increase the likelihood that one's young children will not use tobacco when they reach adolescence and adulthood.**
- **To improve personal/family finances**
 - **Save money by not spending money on tobacco and other tobacco-related expenditures (e.g., differential cost of insurance premiums).**
 - **Reduce the risk of financial devastation resulting from income loss due to smoking-related disability or premature death, or from property loss due to a smoking-related home fire.**
- **To avoid personal inconvenience**
 - **Avoid the need for breaks to go outside, sometimes in the rain and cold, when working or socializing in tobacco-free venues.**

1 Adapted from ALA [undated] and CDC [2004]

2

3

Table 4-2. Some Reasons for Employers to Implement Workplace Tobacco Interventions

- **To reduce occupational disease and injuries (and workers' compensation insurance costs).**
- **To lower health insurance and life insurance costs and claims.**
- **To decrease costs of training workers to replace those who die or become disabled.**
- **To increase productivity through reduced absenteeism and reduced presenteeism.**
- **To reduce accidents and fires (and related insurance costs).**
- **To lessen property damage (and related insurance costs).**
- **To eliminate indoor smoke pollution (and related cleaning, maintenance, and ventilation costs).**
- **To limit liability and legal costs for failing to provide a safe and healthful working environment.**
- **To enhance worker morale and corporate image by showing concern for employees/customers.**

4 Adapted from DHHS [1996]

5

6 **Workplace Policies Prohibiting or Restricting Smoking**

7

8 For safety reasons, smoking has long been prohibited in particular work settings where explosive or
9 extremely flammable materials are present (see Appendix Tables A-2 and A-3). A century ago, such
10 prohibitions may have been motivated more out of concern about property loss than concern for the
11 well-being of workers. Subsequently, concern about worker health has motivated additional policies
12 prohibiting the use of tobacco products in specific work sites where exposure to certain hazardous

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1 occupational agents can be increased as a result of tobacco use (see Appendix Tables A-1 and A-3). The
2 need for such venue-specific prohibitions on tobacco use has been widely understood and accepted;
3 however, compliance with these prohibitions has been imperfect [MSHA 2000], indicating a need for
4 ongoing training and vigilance.

5
6 In the last decades of the past century, as the public became more aware of the hazards of exposure to
7 SHS, government (at the local, state, and federal levels) acted with intent to reduce workplace
8 exposures to SHS and subsequently to eliminate SHS from workplaces. The Surgeon General has
9 concluded that there is no risk-free level of exposure to SHS [DHHS 2006, 2010b, 2014]. Complete
10 prohibitions on workplace smoking have been shown to be effective in essentially eliminating SHS in
11 workplaces [Hammond 1999]. Other measures, such as separating smokers from nonsmokers, cleaning
12 the workplace air, and ventilating buildings, cannot eliminate exposures of nonsmokers to SHS [NIOSH
13 1991; DHHS 2006; ASHRAE 2013]. Thus, ventilation is not an acceptable alternative to making
14 workplaces completely smoke-free/tobacco-free.

15
16 Federal actions have been implemented to eliminate SHS from some workplaces. Actively supported by
17 flight attendants and their union as a way to protect their health by eliminating SHS in their workplace, a
18 federal law has prohibited smoking during all commercial passenger flights originating and/or
19 terminating in the United States since 1990 [Pan et al. 2005]. In that same year, the Interstate
20 Commerce Commission acted to ban smoking on interstate buses [49 CFR Part 374.201]. A 1997
21 Presidential Executive Order has prohibited tobacco smoking in all interior space owned, rented or
22 leased by the executive branch of the Federal Government, with limited exceptions (e.g., specially-
23 equipped designated smoking areas, certain residential settings, and space occupied by non-federal
24 parties)[Cook and Bero 2009]. OSHA proposed a rule that would have more universally restricted
25 smoking in the workplace [OSHA 1994], but later withdrew the proposed rule, noting workplace
26 regulation of SHS was being advanced by private employers and by state and local governments [OSHA
27 2001].

28
29 The first comprehensive local and state laws restricting smoking in workplaces went into effect in 1993
30 (Shasta County, California) and 2002 (Delaware), respectively [CDC 2011b, 2012]. By the end of 2010,
31 CDC reported that 26 states, the District of Columbia, and a majority of the 50 largest U.S. cities had
32 enacted comprehensive smoke-free laws prohibiting, with no exceptions, smoking in all indoor areas of
33 private workplaces, restaurants, and bars [CDC 2011b, 2012]. . Additionally, there has been a recent
34 decline (from 12/31/04 to 12/31/09) in the number of states with laws preempting the regulation by
35 local authorities of smoking in government workplaces (from 16 to nine states), private workplaces
36 (from 15 to nine states), and restaurants (from 18 to 12 states) [CDC 2010].

37
38 The private sector has taken independent actions to eliminate exposure to SHS in the workplace. In the
39 early 1990s, accredited hospitals were the first workplaces to accept a voluntary almost industry-wide
40 smoke-free workplace policy, achieving a high level of compliance within just two years [Longo et al.
41 1995]. In addition to its intended effect on exposure to SHS, this policy has been associated with
42 additional beneficial impacts on workplace safety and property loss (see Box 4-1). Many other
43 businesses also voluntarily implemented smoke-free policies in their workplaces and, by the late 1990s,
44 nearly 70% of U.S. workers employed in non-residential indoor worksites were working in smoke-free
45 workplaces [Shopland et al. 2004; Fichtenberg and Glantz 2002].

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Box 4-1. Smoke-free Policies and Reduction in Structural Fires in Health Care Facilities [Arhens 2010].
Coincident with the implementation of comprehensive smoke-free workplace policies across the U.S. health care industry, the number of smoking-ignited structure fires involving health care facilities dropped from well over 3,000 per year in the early 1980s to only about 100 per year since the late 1990s. Notably, the percentage of all structural fires in health care facilities determined to have been caused by smoking materials dropped from 30% to 5% over the same period.

2

3 A number of studies, including meta-analyses, have shown that smoke-free workplace policies decrease
4 exposure of nonsmoking employees to SHS at work and increase cessation among employees who
5 smoke [DHHS 2006; IARC 2009; Hopkins et al. 2010]. While one review of the literature found
6 inconclusive evidence that smoke-free workplace policies cause smokers to quit altogether [Callinan et
7 al. 2010], there is strong evidence that such policies are associated with increased quit rates among
8 smoking workers and with a reduction in the amount of smoking among those workers who continue to
9 smoke [Fichtenberg and Glantz 2002; Bauer et al. 2005; IARC 2009; Hopkins et al. 2010]. In contrast, less
10 restrictive workplace smoking policies are associated with sustained tobacco use among workers [IARC
11 2009]. A nationally representative survey found that in workplaces without a workplace rule limiting
12 smoking, workers were significantly more likely to be smokers [Ham et al. 2011].

13

14 There is clear evidence of improved health among workers as a result of policy interventions to make
15 indoor spaces, including workplaces, smoke-free [Callinan et al. 2010]. This is especially true for workers
16 in the hospitality industry (see Box 4-2). Smoke-free policies have been shown to improve indoor air
17 quality, reduce SHS exposure, reduce respiratory symptoms, and improve lung function among bar
18 workers, but these policies also have been shown to reduce hospitalizations for heart attacks in the
19 general population [IARC 2009; IOM 2010; Tan and Glantz 2010; DHHS 2014]. Results of recent studies
20 suggest that such policies may also reduce hospitalizations and emergency department visits for asthma
21 [Hahn 2010; Mackay et al. 2010; Tan and Glantz 2010; Herman and Walsh 2011; Millet et al. 2013].
22 Smoke-free policies in the hospitality industry have been found to receive high levels of public support
23 and compliance, and have not had a negative economic impact on the hospitality industry [DHHS 2006;
24 IARC 2009].

25

Box 4-2. Prohibiting Smoking in Bars Improves the Health of Bartenders [Eisner et al. 1998]
A state law prohibited smoking in most California taverns and bars began on January 1, 1998. Bartenders were surveyed in the month before the law took effect and again about one month afterward. Self-reported exposure to SHS fell from a median of 28 hours per week before the law took effect to 2 hours per week afterward. Respiratory symptoms and eye, nose, and throat irritant symptoms were each reported by about 75% of bartenders before the law took effect. Of those with symptoms at baseline, 59% with respiratory symptoms and 78% with irritant symptoms experienced resolution of those symptoms after the law took effect (p<0.001). On average, lung function measurements also improved. The authors of this study concluded that making taverns and bars smoke-free resulted in a rapid improvement in the health of bartenders.

26

27 On the basis of a finding of strong evidence of effectiveness available by 2001, the Task Force on
28 Community Preventive Services recommended workplace smoking bans and restrictions as effective

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1 means for reducing exposure to SHS [Hopkins et al. 2010]. More recent evidence has led the Task Force
2 to now recommend smoke-free workplace policies (i.e., total prohibition of smoking in the workplace),
3 not only as a means to reduce exposure to SHS, but also as an effective means to increase tobacco
4 cessation, reduce tobacco use prevalence, and reduce tobacco-related morbidity and mortality [Hopkins
5 et al. 2010; Task Force on Community Preventive Services 2010; GCPS 2012a].
6

7 A World Health Organization study group has recommended that, in the absence of evidence that can
8 assure authorities that use of ENDS does not expose others to toxic emissions, ENDS should not be
9 exempted from laws which restrict the places in which cigarette smoking is allowed [WHO 2009]. The
10 British Medical Association has taken the position that use of e-cigarettes should be prohibited in
11 workplaces and public places not only to limit potentially harmful effects of secondhand exposures, but
12 also to ensure that their use does not undermine smoking prevention and cessation efforts by
13 reinforcing cigarette use as normal behavior [BMA 2013]. Similarly concerned about potentially
14 hazardous secondhand exposure, the Federal German Institute for Risk Assessment has likewise
15 recommended prohibiting use of e-cigarettes wherever tobacco smoking is prohibited [FGIRA 2012]. The
16 Forum of International Respiratory Societies has concluded that ENDS use “should be restricted or
17 banned until more information about their safety is available” [Schraufnagel et al. 2014]. In the United
18 States, the number of states and localities that explicitly prohibit use of e-cigarettes in public places
19 where tobacco smoking is already prohibited is increasing with time [ANRF 2014].
20

21 **Employer Prohibitions on Tobacco Use Extending Beyond the Workplace**

22
23 Some employers have taken action to extend restrictions on tobacco use by their employees beyond the
24 workplace. For example, in 2013, the U.S. Public Health Service Commissioned Corps became the first
25 federal uniformed service to prohibit tobacco use by its officers whenever and wherever they are in
26 uniform [ACPM 2013]. More controversial are attempts of private employers to control the behavior of
27 their employees outside of the workplace. For example, at a major medical center that had a smoke-free
28 campus policy in place for years, the employer recently announced plans to prohibit smoking by workers
29 during their workday breaks, including lunchtime, even when off campus [Toland 2013]. Several large
30 employers and organizations (including the Cleveland Clinic, Union Pacific Railroad, the World Health
31 Organization, and several others) have gone further by barring the hiring of smokers [Asch et al. 2013;
32 Schmidt et al. 2013].
33

34 Controversy surrounds many organizational policies that bar the hiring of smokers or prohibit tobacco
35 use by employees during the workday when they are away from the worksite even on their own time.
36 Proponents argue that a nonsmoking workforce serves as a positive role model for health, experiences
37 better health status, incurs substantially lower health care costs for employers and employees alike, and
38 improves productivity [Asch et al. 2013]. Opponents posit the addictive nature of tobacco, note that
39 tobacco use remains legal, and cite the disparate and potentially discriminatory effects such a policy
40 might have on minority, lower-income, or less educated workers—groups that tend to have higher levels
41 of tobacco use. They also point out that employers who refuse to hire smokers typically do not similarly
42 refuse to hire individuals with other personal health behaviors that, like tobacco use, have adverse
43 health consequences. They add that more than half of states have laws in place prohibiting employers
44 from refusing to hire individuals because they smoke [Schmidt et al. 2013].
45

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1 **Workplace Tobacco Use Cessation Programs**
2

3 Where employers establish smoke-free or tobacco-free workplace policies, smoking employees who
4 want to quit can benefit from employer-provided resources and assistance. In 2010, roughly 65% of
5 employed smokers in the United States expressed an interest in quitting tobacco and about half
6 reported having tried to quit in the previous year [Yong et al. 2014]. Just as policies increasing tobacco
7 taxes at the state and federal levels have led to increased calls to state telephone tobacco cessation
8 quitlines [McGoldrick and Boonn 2010], implementation of tobacco-free workplace policies can be
9 expected to increase worker interest in cessation support services. When a smoking cessation program
10 is established in a workplace, smokers employed at that workplace are more likely to intend to quit in
11 the next six months [Ham et al. 2011]. Various levels and types of cessation support can be provided
12 [DHHS 1996].
13

14 On a basic level, a healthcare provider’s inquiry about tobacco use and delivery of brief counseling
15 advice to tobacco users has been shown to increase quit rates, with more intensive intervention having
16 a greater effect [O’Hara et al. 1993; Clinical Practice Guideline 2008]. This basic approach can be readily
17 ‘piggy-backed’ on occupational health services that already exist in many workplaces. For example, all
18 workers enrolled in OSHA-mandated respiratory protection programs must be asked about tobacco use
19 as part of their medical evaluation (see Appendix Table A-2 for applicable OSHA standard numbers).
20 Other existing opportunities to ascertain individual smoking behavior include post-employment (pre-
21 placement) examinations, fitness-for-duty evaluations, and other health examinations already provided
22 by employers. Whenever workers who smoke are identified, they can be counseled and offered
23 cessation assistance.
24

25 Occupational health providers and workplace health promotion staff can offer basic cessation assistance
26 by encouraging workers to use tobacco cessation telephone quitlines, internet cessation services, and
27 cessation text messaging programs such as that offered by the National Cancer Institute through
28 <http://smokefree.gov/smokefreetxt>. State quitlines exist in all 50 states and the District of Columbia, are
29 publically funded, are typically available at no cost to smokers, and often provide free or discounted
30 FDA-approved cessation medications. Callers can access their state quitline by dialing 1-800-QUIT-NOW.
31 The 2008 Public Health Service Clinical Practice Guideline Panel and the Community Preventive Services
32 Task Force recommend quitline interventions on the basis of strong evidence that they increase quit
33 rates [GCPS 2012b; Clinical Practice Guideline 2008]. The Public Health Service Guideline further
34 concludes that quitlines are effective with diverse populations and have broad reach [Clinical Practice
35 Guideline 2008]. Similarly, the Community Preventive Services Task Force found that quitlines can help
36 populations of smokers that have limited access to other tobacco cessation treatments [GCPS 2012b].
37 Their widespread availability, ease of accessibility, affordability, and potential reach to populations with
38 higher levels of tobacco use make quitlines an important component of any cessation effort [Clinical
39 Practice Guideline 2008]. Yet many employers do not make their employees aware of them. For
40 example, a 2008 Washington State survey of almost 700 employers with at least 50 employees found
41 that only 6% mentioned the availability of the state quitline in their health promotion messages to
42 workers [Hughes et al. 2011].
43

44 The most comprehensive workplace cessation programs go well beyond minimal cessation counseling
45 and referral to state quitlines. Employers can enter into preferred relationships with state quitlines or

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1 contract quitline providers to establish employer-specific quitlines with special services [Lichtenstein et
2 al. 2010]. Individualized counseling and support can often be provided by an existing employee
3 assistance program. A systematic review of the literature found that workplace-based smoking cessation
4 services such as individual and group counseling, pharmacological treatment, and social support are all
5 effective in enhancing quit rates when compared to no or minimal interventions [Cahill and Lancaster
6 2014]. Optimal work-based tobacco cessation programs are designed to provide follow-up assistance
7 and to support multiple quit attempts because most smokers try to quit repeatedly before before finally
8 succeeding [Clinical Practice Guideline 2008].
9

10 Ideally, employers should incorporate tobacco cessation support programs into a more comprehensive
11 approach that addresses the overall safety, health, and well-being of workers. A growing evidence base
12 supports the enhanced effectiveness of workplace programs that integrate health promotion efforts
13 such as smoking cessation with more specific occupational health protection programs [Hymel et al.
14 2011; NIOSH 2013c]. Such integrated workplace tobacco cessation programs may be most usefully
15 implemented among blue-collar workers, who generally have higher smoking (and lower quitting) rates
16 than office workers and who generally face higher risks from industrial hazards. A large randomized
17 study involving 15 manufacturing sites showed that smoking quit rates among unionized workers more
18 than doubled ($p < 0.03$) when tobacco cessation and other health promotion messages were combined
19 with occupational health and safety messages [Sorensen et al. 2003]. Another demonstration study of
20 an integrated program aimed at enhancing smoking cessation among blue collar workers targeted
21 participants in a union apprenticeship program [Barbeau et al. 2006] (see Box 4-3).
22

Box 4-3. Demonstration of a Smoking Cessation Program for Blue-Collar Workers [Barbeau et al. 2006]

Apprentice ironworkers at a local union in Boston were studied before and after a four-month smoking cessation demonstration program. With input from union leaders and members, the program was carried out in a local union hall, where posters promoting cessation and featuring photographs of ironworkers were displayed. Articles explaining and promoting the program were published in the union newsletter. Occupational health protection aspects of the program were featured in an educational module on 'toxics and tobacco.' This module was taught by an industrial hygienist and covered separate and combined adverse health effects, including cancer, caused by smoking and workplace hazards (i.e., asbestos, welding fumes, and diesel exhaust) commonly encountered by ironworkers. Tobacco treatment specialists led weekly group sessions on tobacco cessation. Incentives to participate in the sessions included free lunches and, for those attending all sessions, a chance for a raffle prize. Self-help quit kits were provided to apprentices who chose not to attend the group sessions. Nicotine replacement therapy was available at no cost to participants. Of 337 participants, 139 (41.2%) were current smokers at the time the program was initiated. One month after the program concluded, 27 (19.4%) of those smokers had quit—a rate much higher than the expected ~5% quit rate. Program participants were three times more likely to quit than non-participants.

23
24 **Health Insurance and Smoking Behavior**
25

26 Another recent phenomenon is the increasing use of health insurance to encourage employees to adopt
27 positive personal health-related behaviors (e.g., smoking cessation) through modification in the design

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1 of benefits and out-of-pocket cost for covered individuals. For example, it is known that use quit rates
2 are higher when health insurance covers the costs of evidence-based smoking cessation treatments
3 [Clinical Practice Guideline 2008]. Ideally, such coverage should provide access to all evidence-based
4 cessation treatments, including individual, group, and telephone counseling and all seven FDA-approved
5 cessation medications, while eliminating or minimizing barriers such as cost-sharing and prior
6 authorization [Clinical Practice Guideline 2008; CDC 2014c].

7 Many workers are covered by employer-provided health insurance, and the employer can negotiate
8 with the insurance company to set benefits, premiums, and cost shares for covered workers. For multi-
9 employer health insurance programs that cover millions of union workers, representatives of the union
10 also have a voice in the process. Insurance companies and human resources managers responsible for
11 designing and negotiating health insurance plans need to be aware of various laws at the state and
12 federal levels that limit what can be negotiated. Applicable federal laws include the Health Insurance
13 Portability and Accountability Act (HIPAA), Public Law 104-191, and the Patient Protection and
14 Affordable Care Act of 2010 (ACA), Public Law 111-148, now being implemented [Madison et al. 2013].

15 The ACA includes provisions pertinent to tobacco use and cessation. For the many workers covered by
16 group and individual private health insurance plans, the ACA requires non-grandfathered private plans
17 to cover—without cost sharing—all preventive services judged by the U.S. Preventive Services Task
18 Force to provide a high certainty of substantial (grade A) or a moderate to substantial (grade B) net
19 benefit; this includes tobacco use counseling and tobacco cessation interventions, to which the Task
20 Force assigned an ‘A’ grade [Kofman et al. 2012]. Subsequent guidance prepared by several Federal
21 agencies clarifies that health plans will be considered to be in compliance with this requirement if, for
22 example, they cover without cost-sharing: screening for tobacco use; and at least two quit attempts a
23 year, including coverage without prior authorization for a 90-day treatment regimen (with access to all
24 seven FDA-approved cessation medications) when prescribed by a health care provider and four
25 sessions of telephone, group, or individual counseling of at least ten minutes each [USDOL 2014].

26 Insurers and employers who sponsor health insurance coverage for their employees will have expanded
27 opportunities to design incentives for wellness programs, including interventions intended to enhance
28 tobacco cessation (or, with some limitations, disincentives for continued tobacco use). For example, in
29 order to motivate employees to quit smoking, the ACA will allow employer-sponsored health insurance
30 programs to charge tobacco users premiums that are up to 50% higher than premiums charged non-
31 tobacco users [Kofman et al. 2012; Madison et al. 2013]. However, tobacco users in the group market
32 can avoid these surcharges if they choose to participate in a cessation program, which employers are
33 required to make available. States can prevent employers from assessing these surcharges or further
34 restrict the size of the surcharge, and several states have done so.

35

36 **Using Incentives and Disincentives to Modify Tobacco Use Behavior**

37

38 Increasingly, governmental and employer actions are removing barriers and offering incentives for
39 employee quit attempts and success in quitting tobacco use. Likewise, such actions are increasingly
40 discouraging tobacco use by workers covered by employer-sponsored health insurance programs (e.g.,
41 through increased premiums for smokers). For example, more than one-third of surveyed large
42 employers who offer their employees smoking cessation programs incentivize participation in these
43 programs; and the number of large employers who are planning to reward or penalize smokers based on

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1 their smoking status is increasing—more than half of companies plan to do so by the end of 2013, up
2 from less than 25% of employers who did so in 2010 [TowersWatson 2011].

3
4 A clear barrier that reduces use of evidence-based cessation treatments is out-of-pocket costs for
5 cessation counseling and FDA-approved cessation medications. On the basis of strong evidence that the
6 number of tobacco users who quit can be increased by reducing these out-of-pocket costs, the
7 Community Preventive Services Task Force recommends reducing tobacco users' out-of-pocket costs for
8 cessation treatments [GCPS 2012c].

9
10 The Task Force had earlier examined the issue of providing incentives for tobacco cessation, finding
11 insufficient evidence at that time that workplace-based incentives or competitions by themselves
12 reduced tobacco use among employees [GCPS 2005]. Even then, the Task Force went on to recommend
13 worksite-based incentives and competitions when they are combined with other evidence-based
14 interventions (e.g., education, group support, telephonic counseling, self-help materials, smoke-free
15 workplace policies, etc.) as part of a comprehensive cessation program [GCPS 2005].

16
17 A subsequent systematic review of the literature identified a single well-designed study in which
18 financial incentives integrated into a smoking cessation program produced a substantial and sustained
19 beneficial impact [Cahill and Perera 2011]. Incentive payments for that randomized trial were structured
20 as: \$100 for completion of the smoking-cessation program; \$250 for abstinence (confirmed
21 biochemically) during the first 6 months after study enrollment; and \$400 for abstinence (also confirmed
22 biochemically) during the subsequent 6 months. Smokers offered the financial incentives were three
23 times as likely to enroll in the program (15.4% vs. 5.4%, $p < 0.001$), four times as likely to complete the
24 program (10.8% vs. 2.5%, $p < 0.001$), and three times as likely to remain abstinent more than a year later
25 (14.7% vs. 5.0%, $p < 0.001$) [Volpp et al. 2009]. Notably, this study did not involve establishing a new
26 smoking cessation program; rather, all participants were informed about existing smoking-cessation
27 resources available in their community and about employer-provided health benefits related to smoking
28 cessation.

29
30 A recent review explored ethical and legal issues relating to employer-provided incentives intended to
31 change individual health behaviors, including tobacco use [Madison et al. 2011]. The authors identified a
32 number of specific issues that call for scrutiny, including the need to ensure that incentive programs are
33 designed to work as intended and the potential for incentives to be used in an unduly coercive or
34 discriminatory manner. They emphasized that employers should play a collaborative, supportive role in
35 advancing the health of workers, and further suggested that, in order to limit the potential for
36 discrimination, programs should be designed to minimize differences in individual employees' abilities
37 to access incentives [Madison et al. 2011]. It should be recognized that, while imposing surcharges or
38 other disincentives on smokers has the potential to motivate them to quit smoking, the evidence that
39 they are effective in doing so is quite limited, and care is needed to avoid such practices having
40 unintended consequences. For example, these practices could lead smokers to conceal their smoking
41 (and thereby not benefit from cessation assistance) or even to forgo health insurance coverage or quit
42 their jobs [Madison et al. 2011]. The appropriate intent of incentives is to improve health and reduce
43 health care costs overall, and not merely to shift health care costs to high-risk individuals [Madison et al.
44 2011, 2013].

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1 In summary, workplace policies are powerful tools that can benefit worker health. Well-designed
2 policies protect workers from occupational risks, provide workplace-associated opportunities for
3 enhancing worker health, and motivate workers to take beneficial actions to protect their well-being.
4 While not a primary focus of this CIB, workplace policies that effectively sustain or improve worker
5 health can also be cost-effective and benefit the employer's bottom line.

7 **Part 5: CONCLUSIONS**

- 9 • Tobacco smoking by workers and SHS exposure in the workplace have both declined
10 substantially over recent decades, but about 20% of all U.S. workers still smoke and about 20%
11 of nonsmoking workers are still exposed to SHS at work.
- 12 • Smoking prevalence among workers varies widely by industry and occupation, approaching or
13 exceeding 30% in construction, mining, and accommodation and food services workers.
- 14 • Smokeless tobacco is used by about 3% of U.S. workers overall, but smokeless tobacco is used
15 by more than 10% workers in construction and extraction jobs and by nearly 20% of workers in
16 the mining industry.
- 17 • Tobacco use causes serious diseases, including cancer, respiratory diseases, and cardiovascular
18 diseases, mainly among users but also among those exposed to SHS. More than 20 million U.S.
19 adults live with a disease caused by tobacco, and each year nearly a half million die prematurely
20 from smoking or exposure to SHS.
- 21 • Tobacco use is associated with increased risk of injury and property loss due to fire, explosion,
22 and vehicular collisions.
- 23 • Tobacco use by workers can interact with hazardous occupational exposures, worsening the risk
24 of disease and injury from these exposures for smoking workers and workers who are exposed
25 to SHS.
- 26 • Restrictions on smoking and tobacco use in specific work areas where particular high-risk
27 occupational hazards (e.g., explosives, highly flammable materials, or highly toxic materials that
28 could be ingested via tobacco use) are present have long been used to protect workers.
- 29 • There is no risk-free level of exposure to SHS, and ventilation is insufficient to eliminate indoor
30 exposure to SHS.
- 31 • Policies that prohibit tobacco smoking throughout the workplace (i.e., smoke-free workplace
32 policies) are now widely implemented, but have not yet been universally adopted. These
33 policies improve workplace air quality, reduce SHS exposure and related health effects, increase
34 the likelihood that workers who smoke will quit, decrease the amount of smoking during the
35 working day by employees who continue to smoke, and have an overall impact of improving the
36 health of workers (i.e., among both nonsmokers who are no longer exposed to secondhand
37 smoke on the job and smokers who quit).
- 38 • Workplace-based efforts to help workers quit tobacco use can be easily integrated into existing
39 occupational health and wellness programs. Even minimal counseling and/or simple referral to
40 state quitlines can be effective, and more comprehensive programs are even more effective at
41 increasing quitting among workers.
- 42 • The integration of both occupational safety and health protection components into workplace
43 health promotion (e.g., smoking cessation) programs can increase participation in tobacco
44 cessation programs and successful cessation among blue-collar workers.

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- 1 • On average, it is substantially more costly to employ a smoker than a nonsmoker.
- 2 • Some employers have policies prohibiting employees from using tobacco when away from work
- 3 or barring the hiring of smokers or tobacco users, but the ethics of these policies remain under
- 4 debate and they may be legally prohibited in some jurisdictions.
- 5

6 **Part 6: Recommendations**

7
8 The following recommendations relate specifically to the issues raised in this CIB.

9 **NIOSH recommends that employers:**

- 10
- 11
- 12 ○ Establish and maintain tobacco-free workplaces for all employees, allowing no use of any
- 13 tobacco products, including but not limited to cigarettes, cigars, pipes, and smokeless tobacco
- 14 products by anyone at any time in the workplace. Ideally, this should be done in concert with an
- 15 existing tobacco cessation support program. At a minimum, the tobacco-free zone should
- 16 encompass all indoor areas with no exceptions and no indoor smoking areas of any kind
- 17 (including separately enclosed and/or ventilated areas), as well as areas immediately outside
- 18 building entrances and air intakes, and all work vehicles. Optimally and whenever feasible, the
- 19 entire workplace campus, including all outdoor areas, should be established as tobacco-free. All
- 20 tobacco-related restrictions and prohibitions should be equitably enforced.
- 21 ○ Assure compliance with current OSHA and MSHA regulations prohibiting or limiting smoking,
- 22 smoking materials, and/or use of other tobacco products in work areas characterized by the
- 23 presence of explosive or highly flammable materials or potential exposure to toxic materials
- 24 (see Table A-3 in the Appendix). To the extent feasible, follow all similar NIOSH
- 25 recommendations (see Table A-2 in the Appendix).
- 26 ○ Provide information on tobacco-related health risks and on benefits of quitting to all employees
- 27 and other (e.g., contracted or voluntary) workers on a regular basis.
- 28 ○ Inform all workers about health risks of tobacco use.
- 29 ○ Inform all workers about health risks of exposure to SHS.
- 30 ○ Train workers who are exposed or potentially exposed to occupational hazards at work
- 31 about health and/or injury risks of tobacco use combined with exposure to workplace
- 32 hazards, about what the employer is doing to limit the risks, and about what the worker
- 33 can do to limit his/her risks.
- 34 ○ Provide information on employer-provided and publically available tobacco cessation services to
- 35 all employees and other (e.g., contracted or voluntary) workers on a regular basis.
- 36 ○ At a minimum, include information on available quitlines and self-help materials, and
- 37 information on employer-provided cessation programs and tobacco-related health
- 38 insurance benefits available to the worker.
- 39 ○ Ask about personal tobacco use as part of all occupational health and wellness program
- 40 interactions with individual workers and promptly provide encouragement to quit and
- 41 guidance on tobacco cessation to each worker identified as a tobacco user and to any
- 42 other worker who requests tobacco cessation guidance.
- 43 ○ Offer and promote more comprehensive tobacco cessation support to all tobacco-using workers
- 44 and, where feasible, to their dependents.

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- 1 ○ Provide employer-sponsored cessation programs at no-cost or subsidize cessation
2 programs for lower wage workers to enhance the likelihood of their participation. If
3 health insurance is provided for employees, the health plan can be designed to provide
4 employees with comprehensive cessation coverage, including evidence-based cessation
5 treatments, unimpeded by co-pays and other financial or administrative barriers.
- 6 ○ Assure inclusion of occupational health protection content specific to the individual
7 workplace in employer-sponsored tobacco cessation programs offered to workers with
8 jobs involving (potential) exposure to other occupational hazards.
- 9 ○ Become familiar with available guidance (e.g., CDC’s ‘Implementing a Tobacco-Free Campus
10 Initiative in Your Workplace’) (see Box 6-1) before developing, implementing, or modifying
11 tobacco-related policies, interventions, or controls.
- 12 ○ Develop, implement, and modify tobacco-related policies, interventions, and controls in a
13 stepwise and participatory manner—with input from employees, labor representatives, line
14 management, occupational safety/health and wellness staff, and human resources
15 professionals. Those providing input should include current and former tobacco users, as well as
16 those who have never used tobacco. Seek voluntary input from employees with health
17 conditions exacerbated by exposure to SHS, such as heart disease and asthma.
- 18 ○ Make sure that any differential employment benefits policies that are based on tobacco-use or
19 participation in tobacco cessation programs are designed with a primary intent to improve
20 worker health and comply with all applicable federal, state, and local laws and regulations. Even
21 when permissible by law, these differential employment benefit policies, as well as differential
22 hiring policies based on tobacco use, should be implemented only after serious consideration is
23 given to ethical concerns and possible unintended consequences, including the potential for
24 adverse impacts on individual employees (e.g., coercion, discrimination, and breach of privacy)
25 and the workforce as a whole.

26

27 **NIOSH recommends that workers who smoke cigarettes or use other tobacco products:**

- 28
- 29 ○ Comply with all workplace tobacco policies.
- 30 ○ Ask about available employer-provided tobacco cessation programs and cessation-related
31 health insurance benefits.
- 32 ○ Quit using tobacco products, with the understanding that
 - 33 ○ Quitting tobacco use is beneficial at any age, but the earlier one quits, the greater the
34 benefits.
 - 35 ○ Many people find various types of assistance to be very helpful in quitting, and
36 evidence-based cessation treatments have been found to increase smokers’ chances of
37 quitting successfully. Assistance may be obtained from some or all of the following:
 - 38 ▪ tobacco cessation programs
 - 39 ▪ your state quitline (phone: 1-800-QUIT-NOW [1-800-784-8669])
 - 40 ▪ your health care provider.
- 41 In addition, individual workers who want to quit tobacco may find several of the
42 websites listed in Box 6-1 helpful.

43

44 **NIOSH recommends that all workers, including workers interested in quitting tobacco use and**

45 **nonsmokers exposed to SHS at their workplace:**

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- 1
- 2 ○ Know the occupational safety and health risks associated with their work, including those that
- 3 can be made worse by personal tobacco use, and how to limit those risks.
- 4 ○ Consider sharing a copy of this CIB with their employer.
- 5

Box 6-1. Selected Web Resources

Government

U.S. Department of Health And Human Services

- **Smokefree.gov**
<http://www.Smokefree.gov>
- **BeTobaccoFree.gov**
<http://betobaccofree.hhs.gov/index.html>
- **The Guide to Community Preventive Services
Reducing Tobacco Use and Secondhand Smoke Exposure**
<http://www.thecommunityguide.org/tobacco/index.html>

CDC

- **Office on Smoking and Health**
http://www.cdc.gov/tobacco/quit_smoking/index.htm
- **Tobacco Use Cessation**
<http://www.cdc.gov/workplacehealthpromotion/implementation/topics/tobacco-use.html>
- **Tips from Former Smokers**
<http://www.cdc.gov/tips/>
- **Implementing a Tobacco-Free Campus Initiative in Your Workplace**
<http://www.cdc.gov/nccdphp/dnpao/hwi/toolkits/tobacco/index.htm>
- ***Save Lives, Save Money: Make Your Business Smoke-Free***
http://www.cdc.gov/tobacco/basic_information/secondhand_smoke/guides/business/pdfs/save_lives_save_money.pdf
- ***A Practical Guide to Working with Health-Care Systems on Tobacco-Use Treatment***
http://www.cdc.gov/tobacco/quit_smoking/cessation/practical_guide/pdfs/practical_guide.pdf
- **Total Worker Health™**
<http://www.cdc.gov/niosh/twh/>
<http://www.cdc.gov/niosh/twh/essentials.html>
- **Tobacco Smoke in the Workplace**
<http://www.cdc.gov/niosh/topics/tobacco/>

Other

North American Quitline Consortium (NAQC)

- **Quitline Map**
<http://map.naquitline.org/>

American Lung Association

- **Stop Smoking**
<http://www.lung.org/stop-smoking/>

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- **Workplace Wellness**
<http://www.lung.org/stop-smoking/workplace-wellness/>

American Cancer Society

- **Great American Smokeout**
<http://www.cancer.org/healthy/stayawayfromtobacco/greatamericansmokeout/index>
- ***Strategies for Promoting a Smoke-free Workplace Policy***
http://www.cancer.org/downloads/gahc/hp_strategies_for_promoting_and_implementing_smokefree_workplace.pdf
- ***Making Your Workplace Smokefree: A Decision Maker's Guide***
<http://www.cancer.org/acs/groups/content/@highplains/documents/document/makingyourworkplacesmokefreegu.pdf>

American Heart Association

- **Quit Smoking**
http://www.heart.org/HEARTORG/GettingHealthy/QuitSmoking/QuitSmoking_UCM_001085_SubHomePage.jsp

American Legacy Foundation

- **EX: A New Way to Think About Quitting Smoking**
<http://www.becomeanex.org/about-ex.php#>

National Business Group on Health

- **Tobacco: The Business of Quitting – An Employer's Website for Tobacco Cessation**
<http://www.businessgrouphealth.org/tobacco/>

PACT (Professional Assisted Cessation Therapy)

- ***Employers' Tobacco Cessation Guide: Practical Approaches to a Costly Workplace Problem***
<http://www.endsmoking.org/resources/employersguide/pdf/employersguide-2nd-edition.pdf>

1
2

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APPENDIX

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Table A-1. Previous NIOSH Current Intelligence Bulletins on Tobacco Use

Publication (year)	Findings	Recommendations
Current Intelligence Bulletin 31 Smoking and the Occupational Environment (1979)	<p>Smoking and/or tobacco products defined as cigarettes, cigars, pipe tobacco, chewing tobacco, and any by-products resulting from their burning and/or use.</p> <p>Identified six ways by which smoking and/or other tobacco use can interact with workplace exposures:</p> <ol style="list-style-type: none"> 1. Certain toxic agents present in some workplaces may also be present in tobacco smoke, increasing exposure to those agents. 2. Some workplace chemicals can be transformed into more harmful agents by smoking – specifically by the heat generated by burning tobacco. 3. Tobacco products can become contaminated with toxic agents present in the workplace, thus facilitating entry of the agent into the body by inhalation, ingestion, and/or skin absorption. 4. Smoking can cause adverse health effects comparable to those caused by exposure to toxic agents present in some workplaces, thus causing additive effects. 5. Smoking can act synergistically with toxic agents present in some workplaces to cause a much more profound effect than anticipated simply from the separate influences of the occupational exposure and smoking. 6. Smoking can contribute to accidents in the workplace 	<p>Use of and/or carrying of tobacco products into the workplace should be curtailed in situations where employees may be exposed to physical or chemical substances which may interact with tobacco products.</p> <p>Curtailement of the use of tobacco products in the workplace should be accompanied by simultaneous control of worker exposure to hazardous physical and chemical agents.</p>
Current Intelligence Bulletin 54 Environmental Tobacco Smoke in the Workplace: Lung Cancer	<p>Main conclusion: “NIOSH has determined that the collective weight of evidence ... is sufficient to conclude that [SHS]* poses an increased risk of lung cancer and possibly heart disease to occupationally exposed workers.”</p> <p>Conclusions and recommendations based on:</p> <ul style="list-style-type: none"> •reports of Surgeon General on health effects of tobacco smoke •comparison of chemical compositions of SHS and mainstream smoke •results from recent epidemiologic studies of nonsmokers exposed 	<p>Risk of developing cancer should be decreased by minimizing exposure to SHS</p> <p>Workers should not be involuntarily exposed to tobacco smoke</p> <p>Employers should ... assess conditions that may result in worker exposure to SHS and take steps to reduce exposures to the lowest feasible concentration</p> <p>Best method for controlling worker exposure to SHS is to eliminate tobacco use from the workplace and implement a smoking cessation program.</p>

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and Other Effects* (1991)	to SHS •methods for controlling involuntary workplace exposures to ETS	Management and labor should work together to develop nonsmoking policies: •prohibit smoking at the workplace; post signs at workplace entrances •distribute information about health promotion and harmful effects of smoking •offer smoking-cessation classes to all workers •establish incentives to encourage workers to stop smoking Pending complete elimination of tobacco smoking in the workplace, smoking should be isolated to clearly posted, enclosed areas, with separate ventilation exhausted directly to the outside without recirculation.
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1 *The 1991 document used the term “environmental tobacco smoke” [ETS] to refer to what this CIB calls “secondhand smoke” [SHS].

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Table A-2. Other NIOSH Publications with Policy Recommendations Relating to Tobacco Use

	Year	Agent/Process	Tobacco-related Recommendation(s)	Selected Additional Content
Criteria Documents				
	1972	asbestos	smoking cessation (as medical management for exposed workers who smoke)	
	1972	carbon monoxide	medical exams, which could provide “opportunity to conduct anti-smoking programs for high-risk employees”	
	1973	Inorganic mercury	no smoking in designated areas; wash before smoking*	
	1975	inorganic fluorides	no smoking in designated areas; wash before smoking/chewing*; no carrying tobacco products in contaminated clothing	
	1976	boron trifluoride	no smoking or uncovered smoking materials in designated areas	
	1976	carbaryl	no smoking in designated areas; wash before smoking*	
	1976	formaldehyde	no smoking in designated areas; wash before smoking*	
	1976	methyl parathion	no smoking or carrying tobacco products in designated areas; wash before smoking*; post “No smoking” signs; provide area free of contamination for storing tobacco products	
	1976	organotin compounds	no smoking in designated areas	
	1976	parathion	no smoking or carrying tobacco products in designated areas; wash before smoking*; post “No smoking” signs; provide area free of contamination for storing tobacco products	
	1978	dinitro-ortho-cresol	no smoking in designated areas	
	1976	carbon tetrachloride	no smoking in designated areas; wash before smoking*	
	1979	chloroform	no smoking in designated areas; wash before smoking*	
	1988	welding, brazing, and thermal cutting	no use or storage of tobacco products in designated areas; wash before smoking*; counsel smokers about how smoking may enhance adverse effects of occupational hazards	

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	2006	refractory ceramic fibers	no smoking in workplace; collect smoking histories as part of the medical monitoring program; counsel workers who smoke tobacco products about increased risk of adverse respiratory effects induced by RCF; disseminate information about health promotion and the harmful effects of smoking; establish and offer smoking cessation programs to workers at no cost; all workers who smoke and are potentially exposed to RCFs should participate in smoking cessation program	<p>Entire sections (1.13 and 9.6) devoted to smoking cessation</p> <p>NIOSH recognizes a synergistic effect of smoking and exposure to RCFs, increasing risk of adverse respiratory health effects induced by RCFs. Interactive effect of tobacco smoking and exposure to airborne fibers previously documented.</p> <p>RCF-associated decreases in pulmonary function limited to current and former smokers.</p> <p>Finding consistent with studies of workers exposed to airborne contaminants, in which combined smoking and exposures to various airborne dusts results on increased risk of occupational respiratory diseases, including chronic bronchitis, emphysema, and lung cancer.</p>
	2013	hexavalent chromium	prohibit smoking in all areas of any workplaces in which workers are exposed to Cr(VI) compounds; as part of a comprehensive safety and health program, offer a no-cost smoking cessation program that informs workers about the hazards of cigarette smoking and provides assistance and encouragement for workers who want to quit smoking; all workers who smoke participate.	<p>Entire section (8.7) devoted to smoking cessation</p> <p>These elements, in combination with efforts to maintain airborne Cr(VI) concentrations below the REL and prevent dermal contact with Cr(VI) compounds, will further protect the health of workers.</p> <p>[A]ssociation of skin disease and/or smoking habit with elevated urinary Cr levels in cement workers.</p>

Alerts

	1984	carbon monoxide hazard in aircraft refueling operations	workers engaged in fueling operations should be encouraged to refrain from smoking because smoking elevates blood levels of carbon monoxide enough to reduce margin of safety.	
	1991	lead poisoning in construction	no use or carrying of tobacco products in designated area(s); wash before smoking*	
	1992	silicosis from sandblasting	no use of tobacco products in blasting area; wash before smoking*	
	1992	silicosis in rock drillers	no use of tobacco products in blasting area; wash before smoking*	
	1996	asthma from diisocyanate	wash before smoking outside work area	
	1996	silicosis in construction	no use of tobacco products in dusty areas; wash before smoking*	
	1999	phosphine	wash before smoking*	

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		poisoning and explosions during fumigation		
	2006	asthma from MDI exposure during spray-on truck bed liner and related applications	wash before smoking*	
	2007	explosions in industrial ethylene oxide sterilization facilities	no smoking where EtO is handled, used, or stored	
	2007	fire fighter fatalities due to heart attacks and other sudden cardiovascular events	prohibit smoking in all fire stations and other fire department facilities; include a smoking cessation program in any wellness program	Since not all fire stations are smoke free, involuntary exposure to tobacco smoke continues to present cardiovascular risks for fire fighters. Unrecognized sources of carbon monoxide exposure for fire fighters include: environmental tobacco smoke; diesel exhaust in firehouse; diesel exhaust from fire engine operating at fire scene.
	2011	sensitization and disease from beryllium exposure	no storage or use of tobacco products in beryllium work areas	
Fact Sheets				
	2003	asbestos associated with vermiculite from Libby, MT	workers who have been exposed and currently smoke should quit smoking; employers can assist them by offering smoking cessation programs.	
Workplace Solutions				
	2007	handling Micotil 300®	no smoking in designated area	
Infosheets				
	2012	cleaning chemicals	wash before smoking*	
Updates				
	1993	silicosis deaths	no use of tobacco products in designated area; wash before smoking*	

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Proposed National Strategies			
1989	Proposed National Strategy for the Prevention of Occupational Lung Diseases	<p>management and labor should work together to develop smoking policies:</p> <ul style="list-style-type: none"> •prohibit smoking at the workplace •distribute information about health promotion and harmful effects of smoking •offer no-cost smoking-cessation classes to all workers •establish incentives to encourage workers to stop smoking •post appropriate signs at workplace entrances 	<p>Smoking is strongly associated with many lung diseases.</p> <p>Smoking has an additive effect on the risk of chronic bronchitis in workers exposed to coal mine and other dusts, and it acts synergistically with asbestos to increase the risk of lung cancer.</p> <p>Evidence indicates adverse effects on those who are exposed to the smoke of others.</p> <p>Because of the overwhelming evidence of the health consequences from smoking and the number of workers affected, a focus on smoking is an important component of an effective prevention strategy.</p> <p><u>Elimination of smoking in the workplace is an effective strategy.</u></p>
1989	Proposed National Strategy for the Prevention of Occupational Cardiovascular Diseases	<p>identify groups of workers at high risk of cardiovascular and other diseases based on exposure in the workplace and personal risk factors; to ensure that workers have full and effective access, implement programs for health promotion and disease prevention at the worksite whenever possible or practical; programs should include efforts to reduce personal, modifiable risk factors for cardiovascular disease, including smoking</p>	<p>In an ideal situation, when occupational factors increase the risk of cardiovascular disease, both occupational and personal risks would be addressed at the workplace.</p> <p>Encouraging workers to quit smoking is particularly important because smoking contributes not only to several cardiovascular diseases but to other diseases as well.</p> <p>Increasing the availability of health promotion programs in the workplace requires the cooperation of industry, labor unions, community and voluntary groups, and the government.</p> <p>Most programs will be conducted in the private sector, but governmental agencies can play important roles in stimulating the development of effective programs and in evaluating them.</p>

1 *"Wash" in this context means wash hands and face.
2 To access individual documents, see NIOSH Publications and Products website [<http://www.cdc.gov/niosh/pubs/default.html>]. Disclaimer: Table is not necessarily
3 comprehensive. NOTE: Table does not include NIOSH recommendations focused solely on tobacco use (see Table A-1) or, for example, tobacco-related recommendations
4 included in agent-specific guidance included in *NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards* (DHHS NIOSH Publication No. 81-123).
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Table A-3. OSHA and MSHA Regulations with Provisions Relating to Tobacco Use

Hazard Category and Provisions	Agent/Process	Industry	Regulation CFR
<p>Fire/Explosion</p> <p><u>For designated area(s):</u></p> <ul style="list-style-type: none"> • Smoking prohibitions. <p>and (in most listed regulations)</p> <ul style="list-style-type: none"> • ‘No-smoking’ placard requirements. <p>and (in some listed regulations)</p> <ul style="list-style-type: none"> • Program to assure that no smoking materials are carried. <p>and (in some listed regulations)</p> <ul style="list-style-type: none"> • Smoking history required in medical surveillance. 	Hydrogen	General Industry	1910.103
	Hydrogen or hydrogen sealing systems	Electric Power Generation, Transmission, and Distribution	1910.269
	Oxygen	General Industry	1910.104
		Surface metal/nonmetal mines	56.7805
		Underground metal/nonmetal mines	57.7805
	Flammable liquids	General Industry	1910.106
		Shipyards	1915.36
		Marine Terminals Construction	1917.156
	Construction	1926.152	
	Surface metal/nonmetal mines	56.4100	
		56.4101	
	Underground metal/nonmetal mines	57.4100	
		57.4101	
Spray finishing using flammable and combustible materials	General Industry	1910.107	
	Marine Terminals	1917.153	
Explosives and blasting agents	General Industry	1910.109	
		1926.900	
		1926.902	
		1926.904	
	Surface metal/nonmetal mines	56.6904	
	Underground metal/nonmetal mines	57.6904	
	Underground coal mines	75.1702	
		75.1721	
Storage and handling of liquefied petroleum gases	General Industry	1910.110	
Dipping and coating operations that use flammable liquids or liquids with flashpoints greater	General Industry	1910.125	

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	than 199.4°F (93°C)		
	Battery-charging/changing areas	General Industry Surface metal/nonmetal mines Underground metal/nonmetal mines Marine Terminals Longshoring	1910.178 56.4502 57.4502 1917.157 1918.1
	Grain handling facilities	General Industry	1910.272
	Permit-required Confined Spaces	General Industry	1910.146
	Underground lines	Power Transmission and Distribution	1926.956
	Benzene	General Industry Shipyards Construction	1910.1028 1915.1028 1926.1128
	Acrylonitrile	General Industry Construction	1910.1045 1926.1145
	Ethylene oxide	General Industry Construction	1910.1047 1926.1147
	Formaldehyde	General Industry Shipyards Construction	1910.1048 1915.1048 1926.1148
	Gassy operations	Underground Construction Caissons, Cofferdams, and Compressed Air Underground metal/nonmetal mines	1926.800 57.22102 57.22105
	General Fire Prevention	Construction Underground metal/nonmetal mines Underground coal mines	1926.151 57.4100 57.4101 57.6904 57.7805 57.22101 57.22102 77.1102 77.1711
	Record-keeping areas	Underground metal/nonmetal mines	57.5041

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<p>Ingestion/absorption of toxic agent</p> <p><u>For designated area(s):</u></p> <ul style="list-style-type: none"> Prohibitions on smoking, storage of smoking materials, tobacco products (including chewing tobacco), and chewing of such products. <p>and</p> <ul style="list-style-type: none"> Requirements for washing prior to smoking/eating. <p>and (in most listed regulations)</p> <ul style="list-style-type: none"> Requirements to post 'No-smoking' placards. 	Asbestos	General Industry Shipyards Construction	1910.1001 1915.1001 1926.1101
	13 specified carcinogens (4-Nitrobiphenyl, etc.)	General Industry Shipyards Construction	1910.1003 1915.1003 1926.1103
	Inorganic arsenic	General Industry Shipyards Construction	1910.1018 1915.1018 1926.1118
	Lead	General Industry Shipyards Construction	1910.1025 1915.1025 1926.62
	Chromium (VI)	General Industry Shipyards Longshoring Construction	1910.1026 1915.1026 1918.1 1926.1126
	Cadmium	General Industry Shipyards Construction Agriculture	1910.1027 1915.1027 1926.1127 1928.1027
	Benzene	General Industry Shipyards Construction	1910.1028 1915.1028 1926.1128
	Coke oven emissions	General Industry Construction	1910.1029 1926.1129
	Bloodborne pathogens	General Industry Shipyards	1910.1030 1915.1030
	1,2-dibromo-3-chloropropane	General Industry Shipyards Construction	1910.1044 1915.1044 1926.1144
	Acrylonitrile	General Industry Construction	1910.1045 1926.1145
	Ethylene oxide	General Industry	1910.1047

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		Construction	1926.1147
	Ethylene oxide	General Industry Shipyards	1910.1047 1915.1047
	Formaldehyde	General Industry Shipyards Construction	1910.1048 1915.1048 1926.1148
	Methylenedianiline	General Industry Shipyards Construction	1910.1050 1915.1050 1926.60
	1,3-Butadiene	General Industry	1910.1051
	Methylene Chloride	General Industry Shipyards Construction	1910.1052 1915.1052 1926.1152
	Hazardous chemicals in laboratories	General Industry Shipyards	1910.1450 1915.1450
	General/Field Sanitation	Shipyards Agriculture	1915.88 1928.110
Misc. <ul style="list-style-type: none"> • Personal Protective Equipment Standard: requires a 15-minute no-smoking period prior to Bitrex fit-testing of respirators. • Cotton Dust Standard: required medical questionnaire asks about smoking. • Hazard Communication Standard: Appendices invoke smoking history in the assessment of evidence used to categorize substances as respiratory sensitizers, and 	Personal Protective Equipment	General Industry Shipyards Marine Terminals Longshoring Construction	1910.134 1915.154 1917.92 1918.102 1926.103
	Cotton Dust	General Industry	1910.1043
	Hazard Communication	General Industry Shipyards Construction	1910.1200 1915.1200 1926.59

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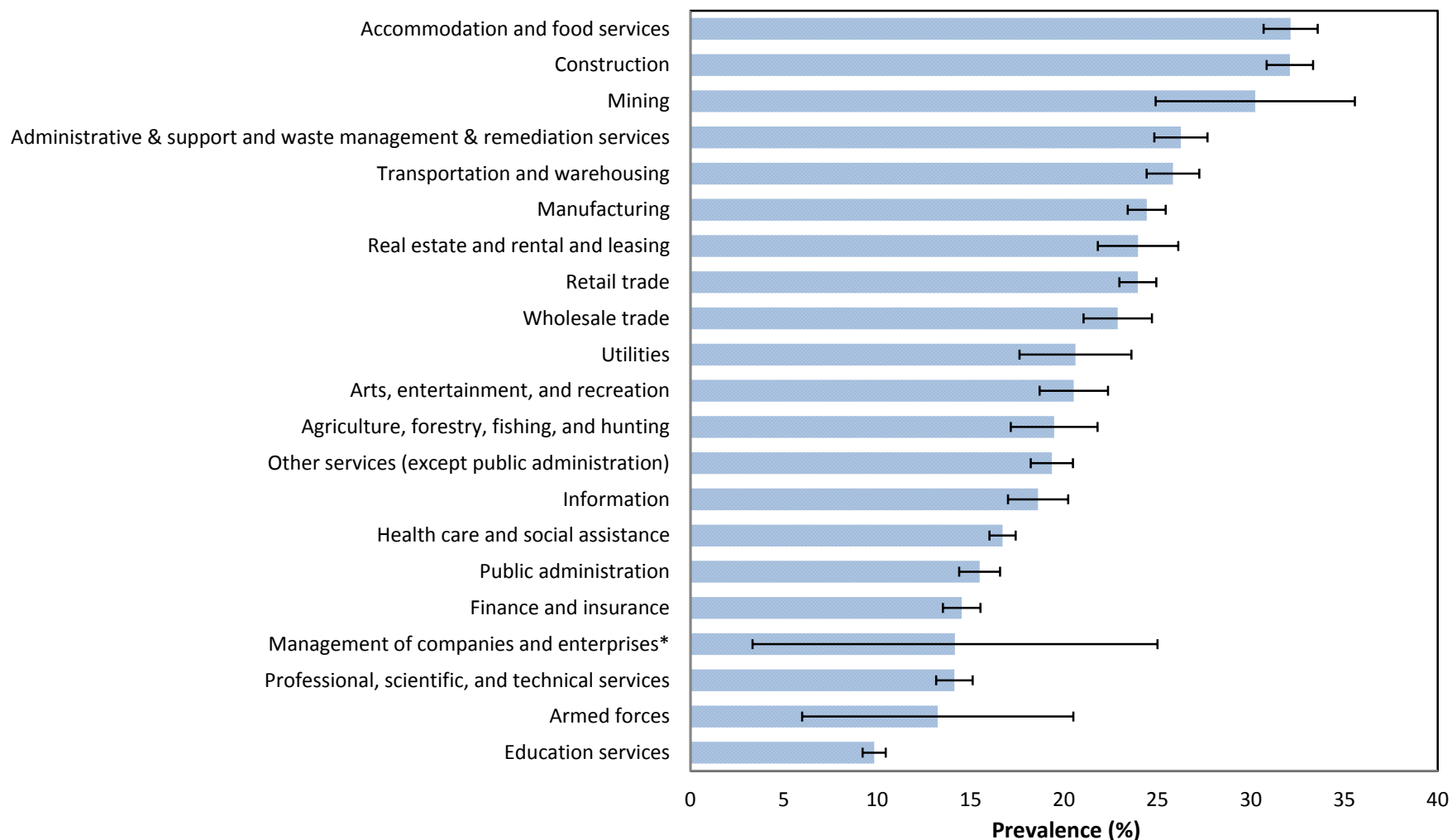
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detail requirements for “No smoking” warning labels.			
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- 1 Specific requirements of OSHA and MSHA regulations should be determined by directly consulting those regulations. Disclaimer: Table is not necessarily comprehensive and is
- 2 not intended to be used for compliance purposes. NOTE: Table does not include OSHA regulations that require retention of Department of Transportation markings, placards,
- 3 and labels relating to flammability/explosivity (e.g., 1910.1201, 1915.88, 1917.29, 1926.61). Nor does it include OSHA ‘model standards’ for carcinogens (1990.151; 1990.152),
- 4 which include a provision prohibiting smoking/chewing/tobacco.

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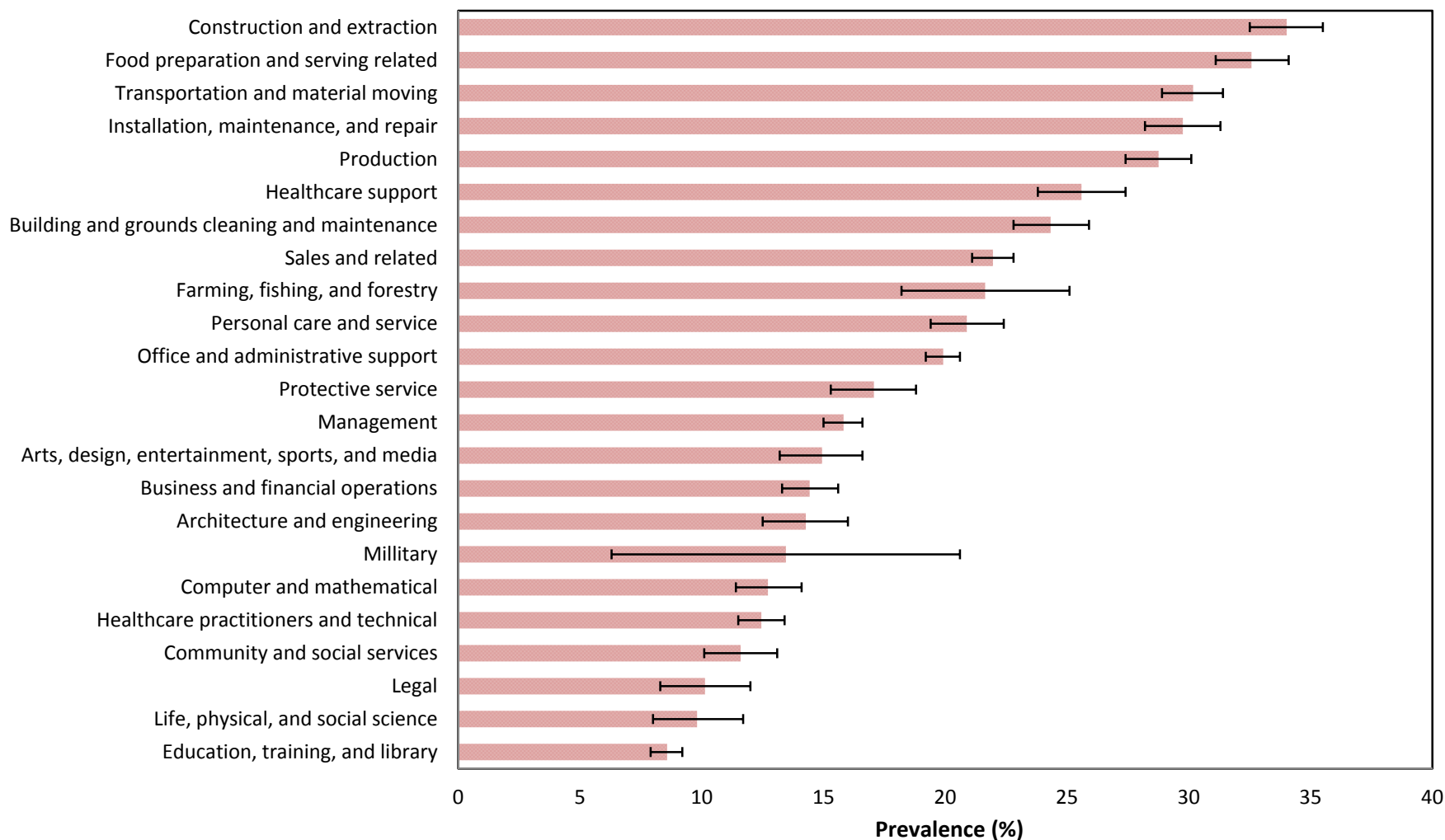
Figure A-1a. Cigarette smoking among working adults, by industry—United States, 2004–2010



Adapted from: NIOSH [2014]. *Estimates for industries with asterisks are statistically unstable due to large standard error.

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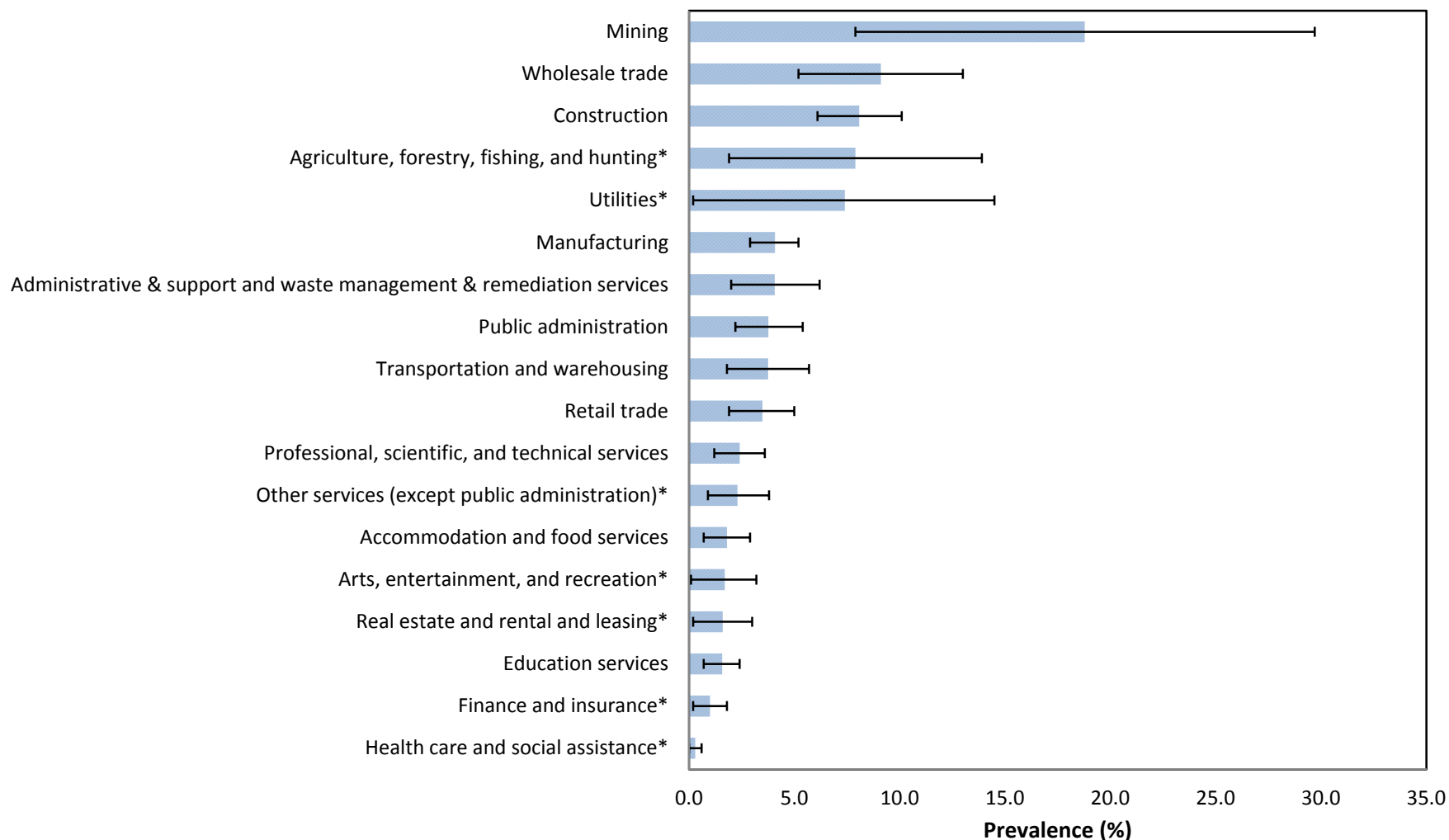
Figure A-1b. Cigarette smoking among working adults, by occupation—United States, 2004–2010



Adapted from: NIOSH [2014].

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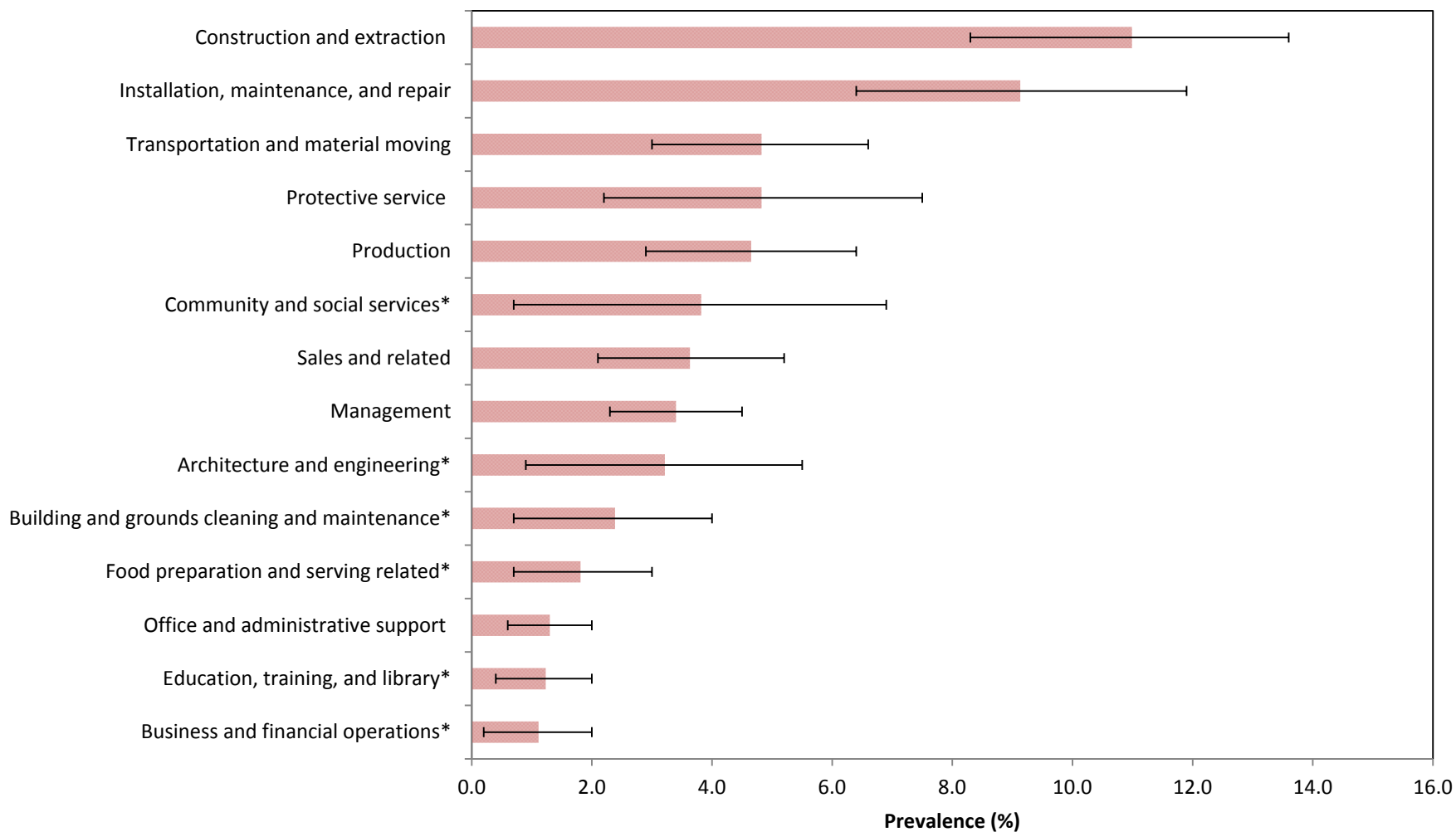
Figure A-2a. Smokeless tobacco use among working adults, by industry—United States, 2010



Adapted from: NIOSH [2014]. *Estimates for industries with asterisks are statistically unstable due to large standard error.

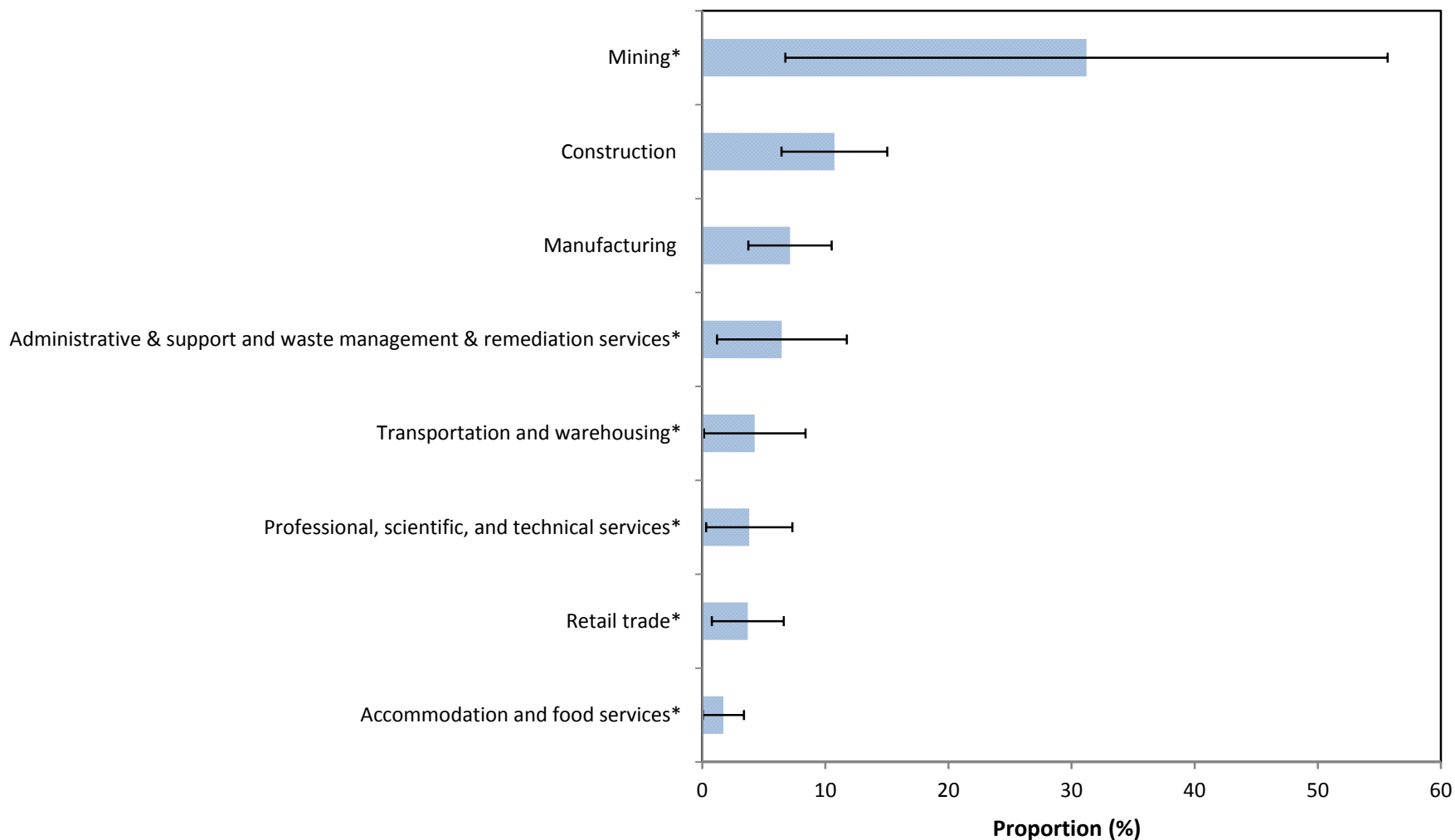
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Figure A-2b. Smokeless tobacco use among working adults, by occupation—National Health Interview Survey, 2010



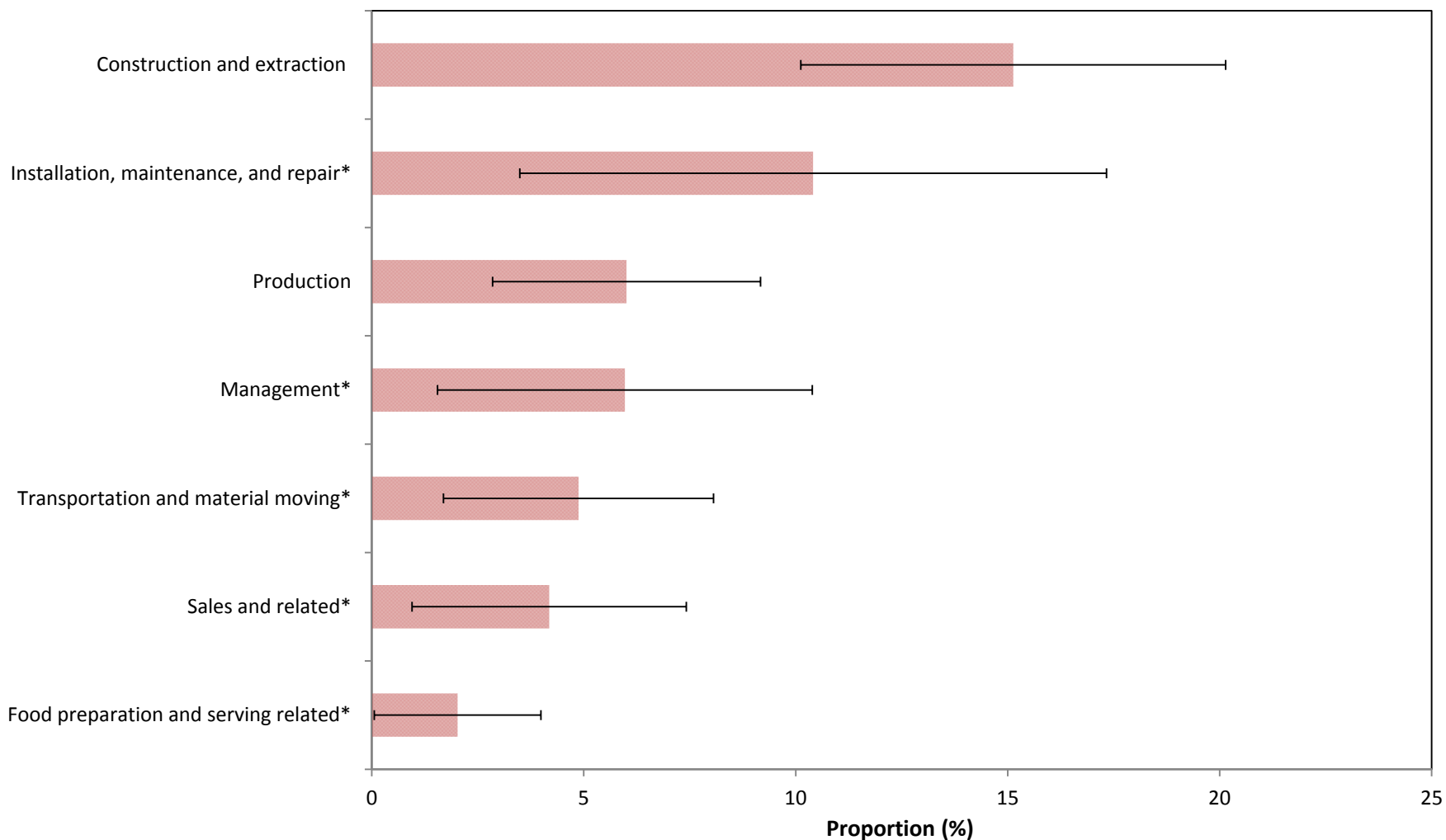
Adapted from: NIOSH [2014]. *Estimates for industries with asterisks are statistically unstable due to large standard error.

Figure A-3a. Dual use of tobacco: Proportion of cigarette smokers who also use smokeless tobacco among working adults, by industry—United States, 2010



Adapted from: NIOSH [2014]. *Estimates for occupations with asterisks are statistically unstable due to large standard error.

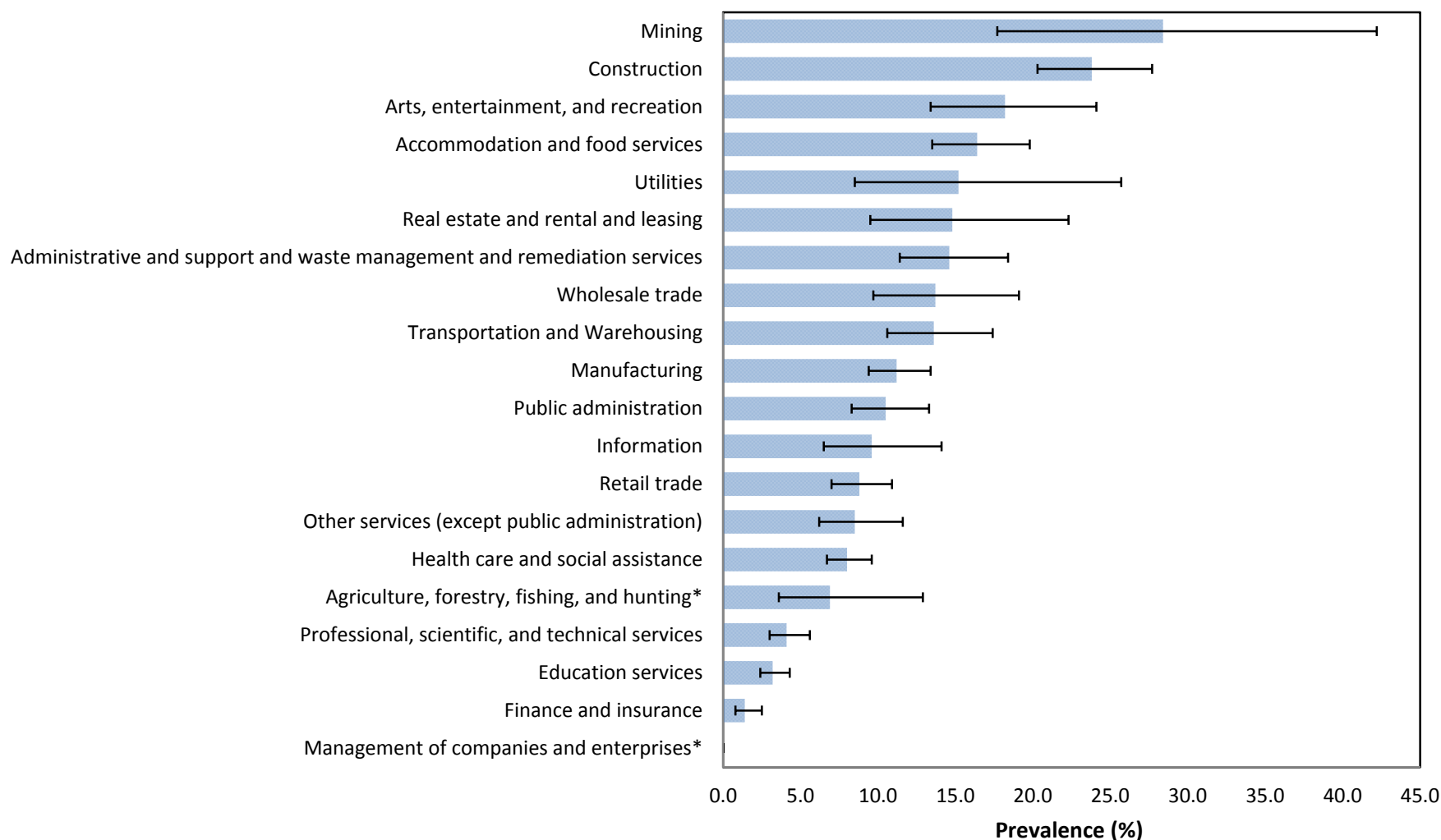
Figure A-3b. Dual use of tobacco: Proportion of cigarette smokers who also use smokeless tobacco among working adults, by occupation—United States, 2010



Adapted from: NIOSH [2014]. *Estimates for occupations with asterisks are statistically unstable due to large standard error.

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Figure A-4a. Prevalence of frequent exposure to SHS at work among nonsmoking adults who worked in the past 12 months, by industry—United States, 2010

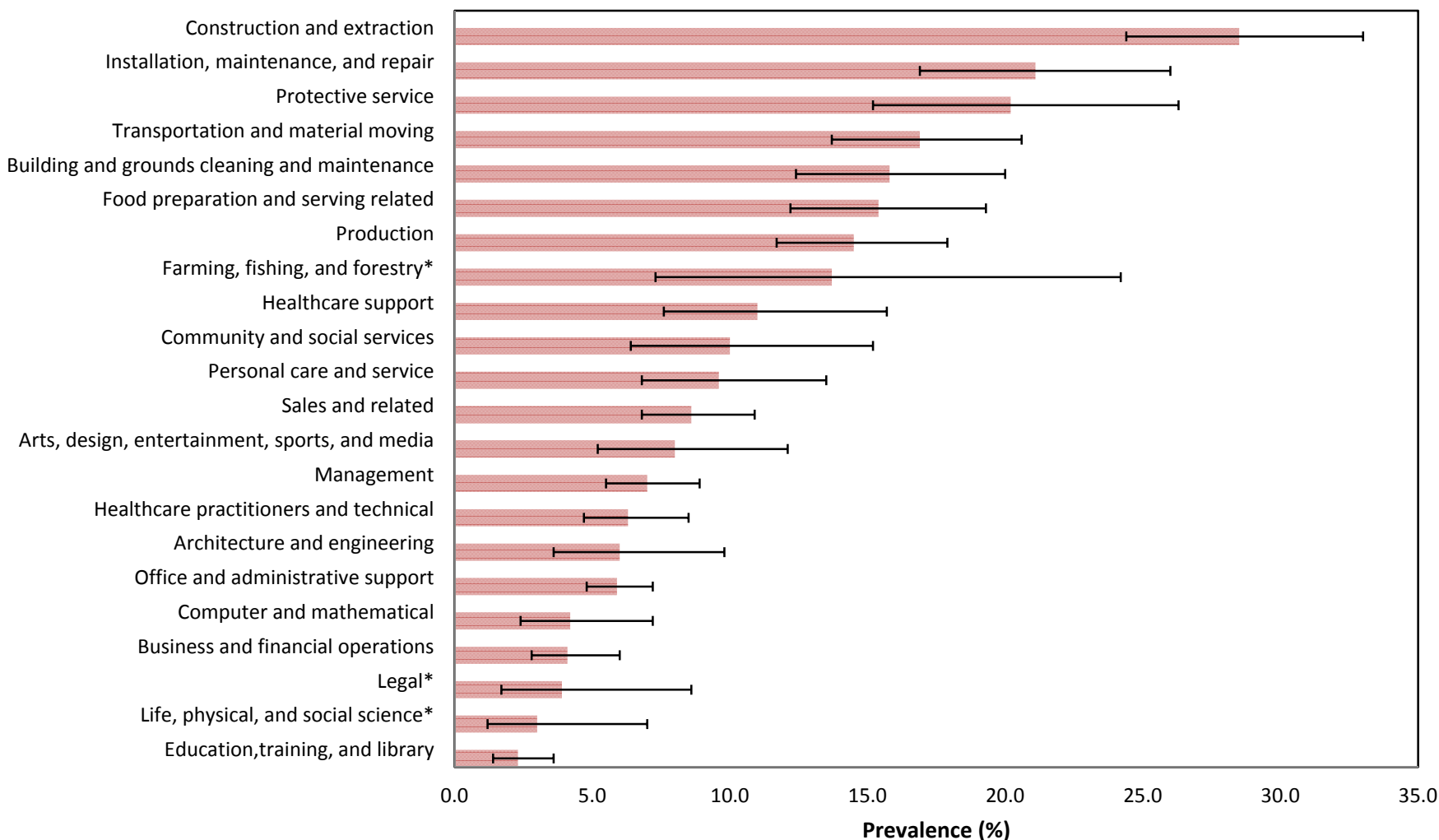


1

Adapted from: Calvert et al. [2013]. *Estimates for industries with asterisks are statistically unstable due to large standard error.

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Figure A-4b. Prevalence of frequent exposure to SHS at work among nonsmoking adults who worked in the past 12 months, by occupation—United States, 2010



1

Adapted from: Calvert et al. [2013]. *Estimates for occupations with asterisks are statistically unstable due to large standard error.