

Congress of the United States
OFFICE OF TECHNOLOGY ASSESSMENT
WASHINGTON, DC 20510

JOHN H. GIBBONS
DIRECTOR

TECHNOLOGY ASSESSMENT BOARD
TED STEVENS, ALASKA, CHAIRMAN
MORRIS K. UDALL, ARIZONA, VICE CHAIRMAN
ORRIN G. HATCH, UTAH
CHARLES MCC. MATHIAS JR., MARYLAND
EDWARD M. KENNEDY, MASSACHUSETTS
ERNEST F. HOLLINGS, SOUTH CAROLINA
CLAIBORNE PELL, RHODE ISLAND
JOHN H. GIBBONS
GEORGE E. BROWN, JR., CALIFORNIA
JOHN D. DINGELL, MICHIGAN
CLARENCE E. MILLER, OHIO
COOPER EVANS, IOWA
DON SUNDOQUIST, TENNESSEE

ADMIN APR 3 1986

April 4, 1986

Mr. Samuel Chilcote
President
Tobacco Institute
1875 I St., NW
Washington, DC 20006

Dear Mr. Chilcote:

Enclosed is a draft OTA Staff Paper "Passive Smoking in the Workplace: Selected Issues," prepared at the request of Senator Ted Stevens, Chairman of the Subcommittee on Civil Service, Post Office, and General Services of the Senate Government Affairs Committee. It is being sent to you and to a number of other individuals in the Federal Government, State and local governments, and the private sector for the purpose of getting your comments and suggestions for improvement.

We are particularly interested in correcting any errors of fact and rectifying important omissions. Since this report is not meant to be an exhaustive review of all issues related to passive smoking, we do not plan to expand it to include entirely new sections unless they are directly relevant to workplace-related issues, and could be of use to the Congress.

OTA is obligated to deliver a final report to Senator Stevens by the end of April. Therefore, the comment period will be relatively short, unfortunately. If possible, we would like to receive your comments by April 23. A pre-addressed, franked envelope is included, if you would like to return a marked up copy or written comments by mail. We also will be happy to take your comments by telephone. Brad Larson, Karl Kronebusch, and I can all be reached at 202/226-2070, and any one of us will be happy to talk with you. Thank you in advance for your help.

Sincerely,



Hellen Gelband
Project Director

enclosure

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

PASSIVE SMOKING IN THE WORKPLACE: SELECTED ISSUES

**Draft Staff Paper
prepared by the**

**Special Projects Office of the
OTA Health Program**

**Office of Technology Assessment
U.S. Congress**

April 1986

This is a draft of an Office of Technology Assessment Staff Paper. It is being made available solely for review purposes and should not be quoted, cited, circulated, reproduced, or represented as an official OTA document. The material is undergoing revision and should not be considered final.

DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT DRAFT

OTA PROJECT STAFF

**Passive Smoking in the Workplace:
Selected Issues**

Hellen Gelband, *Project Director*

Brad Larson, *Research Analyst*

Karl Kronebusch, *Analyst*

EXECUTIVE SUMMARY

Over the last decade, knowledge about smoking-related disease and death has become commonplace. As doubt about the effects of smoking has yielded to solid evidence, concern over the possible effects of tobacco smoke on nonsmokers has grown. Public pressure has led to a number of actions to protect nonsmokers' rights to breathe air uncontaminated by tobacco smoke, a trend that continues to gain momentum. Much of the recent activity has been toward controlling smoking in the workplace. This Staff Paper responds to a request for information about the health effects of passive smoking, the types of policies that are in force in the public and private sectors to control workplace smoking, and the costs and effects of those policies. The request for this study came from Senator Ted Stevens, Chairman of the Subcommittee on Civil Service, Post Office, and General Services of the Senate Government Affairs Committee.

Three major areas are covered in this Staff Paper: 1) a review of the studies of health effects related to passive smoking; 2) a review of current Federal, State and local, and private sector workplace smoking policies; and 3) a discussion of the factors that would be considered in an analysis of the costs and benefits of implementing a workplace smoking policy.

Health Effects and Exposure Measures

There is ample evidence, supported by common sense, that nonsmokers are exposed to elements of tobacco smoke when they are in enclosed spaces with people who are smoking. Investigators have measured the concentrations of various tobacco smoke constituents in "mainstream" smoke inhaled by smokers,

in "sidestream" smoke from the lit end of a cigarette, and in "environmental" tobacco smoke, the combination of exhaled mainstream smoke and sidestream smoke and other compounds formed by interactions of smoke constituents with other elements present in the air.

Lung cancer and effects on lung function are the physical phenomena that have been studied most extensively in adults passively exposed to tobacco smoke. Since 1981, evidence has slowly accumulated suggesting a small increase in the risk of developing lung cancer among those passively exposed to tobacco smoke. Individually, each of the half dozen or so studies cannot be considered conclusive evidence for a link between passive smoking and lung cancer, but taken together, they allow a cautious conclusion that, more likely than not, passive smoking does increase the risk of lung cancer in nonsmokers.

Passive exposure to environmental tobacco smoke produces measurable effects on the nonsmoker's lung functioning, as quantitated by the amount of air that can be moved in and out of the lungs before, during, and after exposure. Individuals with preexisting lung disease, such as asthma, are affected to a greater degree than are healthy individuals. These changes in lung capacity are not necessarily "health effects" in themselves and at present there is no information on which to judge whether they might lead to impaired health in the long term.

In a number of surveys, a large percentage of respondents have reported both "annoyance" at exposure to environmental tobacco smoke, as well as physical irritation of the eyes and mucous membranes. Such effects as headaches and coughs are also commonly reported. There is experimental evidence supporting an effect on the eyes, but by and large, well-designed studies investigating the other effects have not been carried out.

Workplace Smoking Policies

Some Federal agencies have had office smoking policies for more than ten years and one State law restricted workplace smoking as early as 1975, but most smoking policies and laws in the public and private sectors have been put into place in the past four or five years.

Three Executive branch agencies administer 90 percent of Federal office space: the General Services Administration (GSA), the Department of Defense (DoD), and the Postal Service. Except for certain areas, such as conference rooms, where smoking is commonly restricted, the heart of much contention is in shared work areas, where smoke may drift into nonsmokers' work areas. In buildings administered by GSA, these shared work areas may be declared nonsmoking, however the decision must be unanimous among workers in the area. DoD's policy permits smoking in these areas only if space and ventilation are adequate, but adequate ventilation is not defined. And Postal Service policies were designed mainly with workroom safety considerations in mind; smoking in office areas is not addressed on an agency wide basis.

Eight States and about 35 communities have passed laws regulating smoking in the workplace, most of them in the past four years. Two provisions are common among many of the State laws: restricting smoking to designated areas and requiring signs to define smoking and nonsmoking areas. Employers are given leeway in designating smoking areas. Most States rely on employers' compliance with the law's intent to provide a healthful environment; one State law further stipulates that the rights of the nonsmoker take precedence over the rights of the smoker in determining work area smoking policies.

Smoking policies in the private sector reflect the variety of types of businesses. Among manufacturing industries, the most common smoking policies are restrictions for occupational safety or product purity. In recent years, some businesses have restricted smoking further, searching for a balance between smokers' and nonsmokers' rights. The most common policy of this type appears to be a ban on smoking in specific areas such as auditoriums, elevators, and conference rooms. A more stringent policy is to limit smoking to certain areas such as sections in the cafeteria and private offices. Some companies, although not many, have banned smoking entirely from the workplace and some hire only nonsmokers.

Costs and Effects of Workplace Smoking Policies

Any administrative or physical changes made to alter smoking behavior in the workplace are likely to generate costs and a variety of effects, including possible monetary and health benefits. Quantitative information from which to predict the magnitude of total costs and effects is scanty, and therefore OTA has not conducted a formal cost-effectiveness analysis of workplace smoking policies. Instead, we have provided a short discussion of some of the factors that would be included in an analysis of the costs and effects of these policies.

INTRODUCTION

This Staff Memorandum responds to a request from Senator Stevens, Chairman of the Subcommittee on Civil Service, Post Office, and General Services of the Senate Government Affairs Committee. Senator Stevens interest relates to a bill he has introduced to restrict smoking to designated areas in Federal buildings.

Three subject areas are covered in this memorandum: 1) a review of the literature about the health effects of passive, or involuntary, smoking, including studies related to potential exposure to environmental tobacco smoke; 2) a description of workplace smoking policies in Federal Government, at the State and local level, and in the private sector; and 3) a discussion of factors to consider when evaluating the cost-effectiveness of smoking policies in the workplace.

Information about health effects comes in part from previous reviews, including work done by the National Academy of Sciences (NAS) and from various volumes of the Surgeons General reports on The Health Consequences of Smoking. A portion, but not all, of the primary health effects literature has been reviewed by OTA. Most of the more recent studies have been reviewed by OTA staff, but for earlier work, we have relied on previously published synopses.

While some information exists in the literature about workplace smoking policies, the workplace situation is changing rapidly. OTA staff collected a great deal of the information presented here through personal contact with individuals in the Federal Government, in State and local governments, and in the private sector. The section on costs and benefits builds on earlier OTA work on the costs of tobacco-related disease (OTA, 1985).

As a point of information, the National Research Council's (NRC) Board on Toxicology and Environmental Health Hazards has a study in progress "to evaluate the problem of obtaining optimal measurements of exposure to tobacco smoke by nonsmokers in epidemiological studies and to evaluate the literature regarding health effects of such exposures." NAS has assembled a committee of experts in the relevant fields to carry out this task. The final report will include (National Research Council, 1985):

a toxicologic profile of sidestream and exhaled smoke; review of its biological, chemical and physical characterization; identification of potential biochemical markers of exposure to a variety of the constituents of tobacco smoke; review of existing literature on the epidemiology of passive smoking; recommendations for future exposure monitoring, modeling, and epidemiologic research.

EPA's Office of Air and Radiation and the Office on Smoking and Health of the Department of Health and Human Services are supporting the NAS study. The report is scheduled for publication in late 1986.

This review comes at a time when public attitudes toward smoking have been changing rapidly. Beyond the near universal acceptance of tobacco as the single most important cause of death in the United States, the rights of nonsmokers are being considered. A July 1985 survey of attitudes toward smoking conducted by the Gallup Organization for the American Lung Association elicited the following responses. Sixty-two percent of smokers, 85 percent of nonsmokers, and 78 percent of former smokers believe that smokers should refrain from smoking in the presence of nonsmokers. There was an increase of several percentage points for each category of respondents since the same

question was posed in a 1983 survey. Of particular relevance to this staff paper was the question, "Should companies have a policy on smoking at work?" The response of 76 percent of current smokers, and 80 percent of both nonsmokers and former smokers was that certain areas of the workplace should be assigned for smoking. A further eight percent of all respondents thought smoking should be banned totally at work (American Lung Association, 1985).

CHARACTERIZING PASSIVE EXPOSURE TO TOBACCO SMOKE

It has been relatively easy to quantitatively represent exposure of smokers to cigarette smoke as the number of cigarettes smoked per day and the number of years that the person has smoked. Quantifying passive exposure of nonsmokers to cigarette smoke is more difficult. One part of the effort to characterize exposure of nonsmokers has been to measure the constituents of cigarette smoke in indoor environments and to determine the contributions of "sidestream" and "mainstream" smoke to "environmental" tobacco smoke. There have been about two dozen investigations of environmental tobacco smoke constituents, including both controlled studies in special experimental chambers and measurements in the air of smoky restaurants, bars, and nightclubs, and other smoky, enclosed spaces. The second and more recent thrust has been to test the body fluids--blood, urine, and saliva--of passively exposed nonsmokers for elevated levels of tobacco smoke constituents or their metabolites (smoke constituents modified within the body to become different chemical entities).

Mainstream, Sidestream, and Environmental Smoke

Mainstream smoke is the tobacco smoke that is generated during a puff

and is drawn through the butt end into the smoker's respiratory system. Sidestream smoke comes directly from the burning end of the cigarette. Environmental tobacco smoke refers to what passive smokers are actually exposed to. Smokers, of course, are exposed to both mainstream and environmental smoke.

A smoker's exposure results primarily from the mainstream smoke drawn into the lungs. Non-smokers are exposed primarily to sidestream smoke (nearly 85 percent of the smoke in a room is sidestream smoke), and to smaller amounts of exhaled mainstream smoke, smoke that comes from the nonburning end of the cigarette (but that is not inhaled by the smoker), and smoke that diffuses through the paper wrapper of the cigarette.

Mainstream and sidestream smoke differ from each other in the relative quantities of their chemical and physical constituents. This is because different amounts of tobacco are burned when producing mainstream and sidestream smoke, the cigarette's burning temperature is different during puffing compared to when it is only smoldering, and some substances are absorbed by the tobacco and filter as the mainstream smoke passes through.

Researchers have designed laboratory apparatus to measure the amounts of the various substances contained in sidestream and mainstream smoke. The instruments measure the concentrations in the smoke immediately after it leaves the butt end (mainstream smoke) or the burning end (sidestream smoke) of the cigarette. Measured in this fashion, the concentrations of many toxic substances in sidestream smoke are greater than those found in mainstream smoke (for a detailed discussion of this topic, see NRC, 1981).

Environmental tobacco smoke refers to the smoke that passive smokers actually breathe. Because sidestream smoke is diluted by the air in the room, the exposures of non-smokers are much less than the measured concentrations of toxic substances in sidestream or mainstream smoke. In addition to the effects of dilution, environmental tobacco smoke differs from mainstream and sidestream smoke as a result of chemical and physical changes that occur as mainstream and sidestream smoke cool and react in the air. For example, the largest particles in sidestream smoke tend to settle out of the air and some gases react to form different substances.

The speed and extent of the chemical and physical changes are important variables in evaluating passive smoking. Some changes, such as the settling of the largest smoke particles, may occur relatively quickly, in a matter of minutes, while other reactions may take place over the course of hours. It is not clear, however, whether these changes increase or decrease the toxicity of environmental tobacco smoke.

Measurements of Specific Constituents of Environmental Tobacco Smoke

A number of studies have measured the levels of various constituents of environmental tobacco smoke. Some studies were published in the 1960's, but the pace of this research picked up through the 1970's, when most of the research took place. The most frequently-measured product of cigarette smoke in indoor air is carbon monoxide. Other constituents, such as dimethylnitrosamine, benzo[a]pyrene, and nicotine, have also been measured. This literature, including studies carried out under both controlled experimental and real life conditions is reviewed in the 1981 National Research Council study, Indoor Pollutants (NRC, 1981) and in the 1984 Surgeon General's

Report on Chronic Obstructive Lung Disease (USDHHS, 1984).

Measurements of environmental tobacco smoke usually distinguish between the gaseous phase and the particulate phase. Since the importance of various smoke components, in terms of health effects, are not well known, it has been impossible to select single compounds to measure as important to passive smoke exposure. Most investigators have chosen to measure one or more compounds thought to be representative of smoke levels in general. These differ for the particulate phase, which tends to settle out fairly quickly, and the gaseous phase, which remains for relatively long periods. The characteristics of enclosed spaces, such as their size and particularly their ventilation, affect the fate of cigarette smoke and therefore the opportunity for passive exposure to smoke. Based on the results of studies of environmental tobacco smoke, investigators have estimated that people exposed to environmental cigarette smoke are subject to between 1/10 and 1/100 of the dose of the smoker in the same environment (NRC, 1981).

Carbon monoxide is an easily measured combustion product of burning tobacco, and the most frequently quantified component of the gaseous phase. The Occupational Safety and Health Administration has set a workplace permissible exposure limit of 50 parts per million (ppm) averaged over eight hours. In 1972, the National Institute for Occupational Safety and Health recommended a 10-hour average limit of 35 ppm, and a ceiling limit of 200 ppm. The Environmental Protection Agency National Primary Ambient-Air Quality Standard one-hour limit for carbon monoxide in outdoor air is 35 ppm, and their eight-hour standard is 9 ppm, limits that may be exceeded only once per year. In Japan, the carbon monoxide standard for indoor air is 10 ppm. Carbon monoxide is generated by sources of combustion other than burning tobacco, such

as automobiles and gas cooking.

In the studies that have been done, carbon monoxide levels in areas where people have been smoking are consistently higher than in "control" areas, which are outdoors in some cases or similar indoor spaces where there has been no smoking. Levels of between 10 ppm and 20 ppm are not uncommon in areas such as nightclubs, taverns, and automobiles. Most measurements reported in restaurants are in the range of 5 to 10 ppm.

Acrolein is the gaseous constituent responsible for most of the odor associated with cigarette smoke, and also may cause eye and throat irritation. Levels of acrolein found in enclosed spaces under conditions of heavy smoking have exceeded the levels recommended in industrial conditions (NRC, 1981).

Nicotine settles out with the particulate phase and is technically difficult to measure. A few studies have quantified nicotine concentrations, however, showing significant increases over background levels.

A more common measurement has been of total particulates, which also are elevated in areas where people have been smoking. In one study of 69 homes in six cities, average particulate concentrations were 43 micrograms per cubic meter (ug/m^3) of air in homes with one cigarette smoker; 75 ug/m^3 in homes with two or more smokers; compared with 24 ug/m^3 in homes without smokers and 22 ug/m^3 outdoors (Spengler et al., 1981, cited in NRC, 1981).

Other gaseous constituents that have been measured and found elevated in smoky conditions are nitrogen oxides, nitrosamines, carbon dioxide, methane, acetylene, ammonia, hydrogen cyanide, methylfuran, acetonitrile, and pyridine. Tar, water, toluene, phenol, methyl-naphthalene, pyrene, benzo[a]pyrene, aniline and naphthylamine, constituents of the particulate phase, also are elevated in smoky conditions.

Biologic Markers of Passive Smoke Exposure

The presence of environmental tobacco smoke in a room with a nonsmoker, or the fact that a nonsmoker's spouse smokes are not precise indicators of exposure of the nonsmoker. Certain constituents of tobacco smoke are measurable, some easily so, in the blood, urine, and saliva of smokers. These indicators have been used, for instance, to verify self-reported smoking status, especially among people who claimed to have stopped smoking. In nonsmokers, these same indicators have been used in a handful of studies to estimate the actual passive exposure levels of nonsmokers.

When carbon monoxide is inhaled, it enters the bloodstream via the lungs. Carbon monoxide has an extremely strong affinity for hemoglobin contained in red blood cells, and competes successfully with oxygen for carriage on the hemoglobin molecule. (At very high doses, carbon monoxide is lethal as it displaces so much oxygen that the tissues become oxygen-starved.) The combination of carbon monoxide and hemoglobin is called "carboxyhemoglobin," which is relatively easily measured in blood. The studies that have been done show modest increases in carboxyhemoglobin after heavy passive exposure to cigarette smoke. With a half life of about four hours in blood, carboxyhemoglobin is a good indicator of acute exposure to cigarette smoke (or other types of combustion), but is not a good indicator of chronic exposure (USDHHS, 1984).

Serum thiocyanate (SCN), the metabolite of hydrogen cyanide, a constituent of tobacco smoke, has also been used to verify self-reported smoking status, and has been used in a few studies of nonsmokers' environmental smoke exposure. The value of SCN measurements is limited by many factors

unrelated to smoke exposure that influence levels of thiocyanate in the blood.

Nicotine is the most tobacco-specific constituent in smoke that occurs in relatively large quantities. It is possible to measure nicotine in body fluids, but its half life of about 30 minutes makes nicotine unsuitable for estimating chronic exposure. Cotinine, the major metabolite of nicotine, has a half life 20 to 30 hours, so consistent, daily exposure to tobacco smoke should result in elevated levels of cotinine, as measured in blood, urine, or saliva (Surgeon General, 1983). A recent study in smokers (Sepkovic and Haley, 1985) indicates good correlation of cotinine levels and nicotine content of cigarettes smoked, and of changes in smoking habits. That study also points out that cotinine levels in blood, urine, and saliva are not equally sensitive to different types of changes, and the strengths of each test substance must be considered when evaluating results of studies using different body fluids.

Cotinine appears to be the most promising marker of passive smoke exposure (USDHHS, 1984). However, neither cotinine nor any of the other biologic markers has been used in an epidemiologic study looking at health outcomes. There also have not yet been studies to find out whether the surrogates for passive exposure of nonsmokers (e.g. smoking status of parents, spouses, or coworkers) generally used in epidemiologic studies correlate with measured biologic markers, but the area of biological measurements is an active and developing one.

HEALTH EFFECTS: INTRODUCTION

It is now accepted by most scientists and endorsed by several Surgeons General of the United States that cigarette and other tobacco smoking is the cause of most lung cancer and a substantial number of cancers at other sites, a

large share of cardiovascular disease, and most chronic obstructive lung disease (COLD) in the United States. The mountain of evidence against tobacco smoking that has accumulated since the 1950's indicates that, at least for some endpoints, the level of health risk is related to dose. This "dose-response" effect is one reason that investigations of possible health effects of passively inhaled smoke have been undertaken, with the expectation that, if there are health risks, they should be smaller than the risks of smoking, at least in healthy people. The number of passively exposed individuals is much larger than the number of smokers, however, so even at low levels of risk, a large number of people might be harmed through passive smoking. Another concern of investigators has been the possibility that some subgroups in the population, for instance children and those with preexisting lung disease, might be more sensitive to the effects of cigarette smoke than would be predicted from studies of smokers.

Since the late 1970's, the pace of research on the health effects of passive smoking has increased considerably, but the body of literature now available is still relatively small. A problem that has beset all epidemiologic research on the effects of passive smoking is that of designing studies capable of detecting small or moderate effects with only imprecise measures of exposure.

The health effects that have been investigated most extensively in relation to passive smoking are lung cancer and COLD. A few studies of the irritant effects of cigarette smoke and surveys of self-reported physical irritation and annoyance are also available. OTA identified only one study looking specifically at the relationship of passive smoking to death from ischaemic heart disease (Garland et al., 1985). That study reported an

increased risk in nonsmoking women married to current or former smokers, but the result was not statistically significant. Other studies found some evidence to suggest an effect on cardiovascular disease mortality (e.g. Gillis et al., 1983), but in total, the evidence is too scanty to make reliable judgements in this area. A number of investigations of respiratory infections in babies and children have drawn links to parental smoking habits. The studies in children are not directly relevant to smoking in Federal workplaces, so they are not considered in this paper. There also are isolated studies reporting increased risks of developing several types of cancer not known to be related to smoking, and these are not included.

In this section, the literature on lung cancer, COLD, and irritation is reviewed. The material presented relies heavily on other published reviews, which are identified in the appropriate sections. OTA did not carry out an independent evaluation of all the primary literature, though much of it was reviewed by OTA staff. As is the case with respiratory infections, a large portion of the research on COLD has focused on children, particularly children with asthma. Only the COLD studies of adults are included here.

Lung Cancer and Passive Smoking

The first major study linking passive smoking to lung cancer in non-smokers, a prospective study of Japanese women, was published in 1981 (Hirayama, 1981). Since then about a half dozen other studies, of various designs, have been completed. The study populations are made up mainly, though not exclusively, of women, and studies have been carried out in, Greece (Trichopoulos et al., 1981) Hong Kong (Chan & Fung, 1982; Koo, Ho & Saw, 1983), Scotland (Gillis et al., 1983) and Germany (Knoth, Bohn, & Schmidt, 1983) as

well as in different parts of the United States (Garfinkel, 1981; Correa et al., 1983; Kabat & Wynder, 1984; Garfinkel, Auerbach, & Joubert, 1985).

An important shared characteristic of the studies is that all have been criticized on methodologic grounds, particularly concerning the various definitions of passive "exposure" to smoke that have been used in the studies. Many of the studies are also quite small, which means that, small or moderate, but still important, effects are likely to go undetected. There are other criticisms as well, many of which are acknowledged by the study investigators. More recent investigators have tried to devise ways to improve study designs and exposure definitions, but this is an area of investigation that presents some thorny problems in estimating exposure and in assembling large enough study populations so that small or moderate effects are likely to be seen, if they exist.

Results from all the studies are relatively consistent: most have reported a small to moderate increase in the risk of lung cancer among nonsmokers exposed to passive smoking compared with nonsmokers who were not regularly exposed to environmental tobacco smoke; two studies show no increase in risk. The International Agency for Research on Cancer (IARC), a unit of the World Health Organization, has recently reviewed the published studies (the study by Garfinkel, Auerbach, and Joubert, described below, had not yet been published when the IARC review took place) as part of a monograph about the carcinogenic effects of smoking, currently in press (IARC, 1986). They note that the risk estimates could actually be somewhat higher or lower than were calculated because of the uncertainties in measurements of passive exposure to cigarette smoke, as well as to other exposures that might have contributed to the development of lung cancer. They conclude that each study is compatible

with either an increase or an absence of excess risk of lung cancer from passive exposure to tobacco smoke.

The findings of a recent case-control study, published in September 1985, are generally consistent with the results of the aggregate of studies, and are described here. In this study by Garfinkel, Auerbach, and Joubert (1985), the passive smoking histories of 134 nonsmoking women with lung cancer were compared with the passive smoking histories of 402 nonsmoking women with colon-rectum cancer. Information was collected about several different aspects of passive exposure to cigarette smoke: current smoking habits of husbands or other cohabitants; number of cigarettes smoked per day at home by the cohabitant smokers; number of years the husband or cohabitant smoked; average number of hours per day the women had been exposed to smoke of others during the past five and 25 years at home, at work, or elsewhere, and during childhood.

Data were analyzed using a variety of standard statistical methods. In almost all cases, the women with lung cancer were somewhat more likely to have been passively exposed to cigarette smoke than were the controls, the women with colon-rectum cancer. However, in almost all cases the results were not statistically significant, meaning that, using generally accepted statistical standards, the results could be plausibly explained by chance alone. Several comparisons, however, did produce statistically significant results, and those occurred mainly where the most powerful types of analyses were used. For those results, chance alone is an unlikely explanation of the findings.

The strongest evidence for an effect of passive smoking in this study is from an analysis of risk related to the number of cigarettes smoked by the husband per day in total, and the number smoked at home. The risks for women whose husbands smoked more than 40 cigarettes per day (2 packs) total, or more than 20 cigarettes per day (1 pack) at home were significantly higher than the risks for women whose husbands did not smoke. More importantly, there was a trend of increasing risk that rose significantly with higher categories of husband's daily cigarette consumption.

As expected, the level of increased risk is much lower than the substantial increase in the risk of lung cancer incurred by smokers. Lifetime smokers are on the order of 10 to 15 times more likely to develop lung cancer than are lifetime nonsmokers (see OTA, 1981). Data from the study by Garfinkel and colleagues described here indicate that the risk of lung cancer among women passively exposed to the smoke of 20 cigarettes per day smoked at home by their husbands is somewhat less than two times the risk of nonsmoking women not passively exposed to cigarette smoke. While some other studies have found slightly higher risks (e.g. studies in Japan, Greece, and Louisiana) and others slightly lower risks (e.g. studies in Hong Kong and a previous American Cancer Society study), this level of risk is within the range of uncertainty of all the major studies.

Lung Function and Chronic Obstructive Lung Disease

The 1984 Surgeon General's report (DHHS, 1984) examined the relationship between smoking and chronic obstructive lung disease (COLD), which killed more than 60,000 Americans in 1983. The report states:

...the experimental and epidemiologic evidence leaves no room for reasonable doubt on the fundamental issue: cigarette smoking is the major cause of COLD in the United States.

The 1984 Surgeon General's report also reviewed the studies of passive smoking and COLD published up to that time. The information base today is little changed from what it was in 1984, therefore this section relies heavily on that report.

In general, COLD is thought of as narrowing of the airways of the bronchial tree and loss of elasticity in the lungs, with a resultant loss of airflow driving pressure. Increased secretion of mucous and an increase in the size of mucous glands, as well as inflammation, abnormal cell types, ulceration, and a variety of other changes in the cellular makeup and condition of lung and bronchial tissue are also signs of COLD. Emphysema, characterized by specific pathologic changes in lung tissue, is the type of COLD most closely associated with smoking.

The case for a connection between passive exposure to tobacco smoke and COLD is much more tenuous than is the case for an effect in smokers themselves. Two types of studies in this area have been done: 1) laboratory-based experiments in controlled chambers, in which the endpoints are short-term effects on lung function, and 2) epidemiologic studies of the relationship between passive exposure to cigarette smoke and either measures of lung function or morbidity. Most of the epidemiologic studies focus on children, classified according to parental smoking.

Investigators have studied the exposure of 1) healthy people, to find out whether those passively exposed to tobacco smoke are more likely to develop respiratory problems than those not exposed; and 2) those with respiratory conditions, particularly asthma, to see whether exposure exacerbates their conditions. Most studies of asthmatics have been of children. Because the purpose of this Staff Paper is to provide information relevant to worksite exposure to cigarette smoke, this review concentrates on studies of adults.

Experimental Studies of Healthy Subjects

A few investigations have been conducted on subjects exposed to tobacco smoke in laboratory chambers, in which the environment can be carefully monitored. Measurements of lung function and, in some cases, measurements of carboxyhemoglobin levels (a measure of carbon monoxide intake) are carried out at specific times during the experiment. Two of the three such studies cited in the 1984 Surgeon General's report had positive results (Pimm, Silverman, & Shephard, 1978; Shephard, Collins, & Silverman, 1979): measurable decreases from initial levels in some measures of lung function occurred as a result of exposure to tobacco smoke in healthy volunteers. The third study (Dahms, Bolin, & Slavin, 1981) reported no statistically significant change.

While data in this area are sparse, they do suggest an acute effect of cigarette smoke on lung function in healthy people, which is consistent with the effect of smoking on the airways of smokers. The measurements taken are not direct measures of disease, and may or may not affect the long-term health of the nonsmoker.

Epidemiologic Studies of Healthy Adults

Four epidemiologic studies of pulmonary function in healthy adults classified as to their passive smoking history are reported in the 1984 Surgeon General's report. Two of the studies (Comstock et al., 1981; Schilling et al., 1977) found no effect on pulmonary function as a result of passive smoking history. In both studies, however, the study populations were relatively young and might not have had long-term passive exposure to cigarette smoke. Two other studies did find small, but statistically significant, decrements in pulmonary function. In one (White & Froeb, 1980), tobacco smoke at work was used as the measure of exposure, so it was really a study of current exposure, not necessarily representative of long-term exposure. The second was a study of adults in France (Kauffman, Tessier, & Oriol, 1983). Nonsmoking women married to smokers scored slightly worse in one measure of pulmonary function than did similar women married to nonsmokers, but the effect did not become apparent until the women had reached age 40.

The studies described above were not measuring the occurrence of lung disease, but only at the capacity of the lungs to move air. The findings in the positive studies did not represent levels of lung function that would be considered abnormal, but were slightly lower than expected. These changes could have an impact on the long-term health of nonsmokers, just as smokers' lungs are harmed by their habit over the long term, but the evidence does not exist right now either to draw that conclusion or to rule it out.

Studies of Adults With Asthma

Several investigators have studied the effect of parental smoking on asthmatic children, with mixed results that do not admit of a simple interpretation. Two experimental studies of asthmatic adults, conducted in

controlled environmental chambers, are cited in the 1984 Surgeon General's report. In one study (Dahms, Bolin, & Slavin, 1981), 10 patients with asthma and 10 healthy controls were subjected to tobacco smoke. Similar increases in blood carboxyhemoglobin levels were found in both groups. The asthmatics, however, experienced worsening pulmonary function over the course of the one-hour experiment, while no change was detected among the controls. In a similar study of pulmonary function (Shephard, Collins, & Silverman, 1979), no such differences were found in objective measures, but in the asthmatic group subjective symptoms--wheezing and chest tightness--were reported.

The data in this area are too limited to draw strong conclusions, but it is quite plausible that the health of people with preexisting pulmonary conditions is more apt to be compromised by passive smoking than are people with normal lung function.

Irritation

The most widespread physical effects of passive exposure to cigarette smoke are various types of "irritation." Eye irritation is the commonest complaint, but headaches, coughs, and irritation of the nose are also commonly reported. In one study cited in the 1984 Surgeon General's report, 69 percent of subjects reported eye irritation at some time in response to cigarette smoke (Speer, 1968). In one experimental chamber study (Weber, 1984), both a subjective and an objective measure of eye irritation were recorded. After an hour of exposure at smoke levels similar to those found in many public places, including offices, study participants reported increased eye irritation, and the objective measure, the rate of eye blinking, also increased.

There is sufficient evidence from surveys and observational studies that most people, including many smokers, believe they are physically irritated by tobacco smoke. The means to test this belief is limited and few studies have done so.

Health Effects: Summary

Taken piece by piece, much of the evidence for adverse health effects related to passive smoking is equivocal. There are no single "definitive" positive studies for any particular health effect. Examining the aggregate of studies in lung cancer and COLD, however, somewhat stronger conclusions can be drawn. As reported by IARC, the lung cancer studies taken individually each suggest a slightly increased risk or no excess risk from passive exposure to environmental cigarette smoke. Taken together, however, the studies are consistent with a slightly elevated risk associated with passive smoking, on the order of between 1.5 and two times the lung cancer risk of a nonsmoker who is not passively exposed to cigarette smoke. Further studies, with refinements in exposure estimations, may help to solidify the relationship. The studies of COLD suggest that people with asthma might be harmed by environmental tobacco smoke. Healthy adults may experience measurable effects on pulmonary function from passive smoke exposure, which may or may not have a long-term impact on health. There is reasonably good evidence that environmental tobacco smoke is an acute physical irritant. This may or may not have long-term health implications. Overall, passive exposure to tobacco smoke has measurable acute effects on the human body, some of which may have implications for long-term health effects and some of which may not. The evidence for an association with lung cancer, while not unequivocal, points in the direction of a somewhat

increased risk with passive exposure to tobacco smoke.

SMOKING POLICIES IN THE FEDERAL WORKPLACE

More than 2.8 million people work for the Federal government in the civilian workforce, and another 2.2 million serve in the armed forces. These people work in a variety of settings, many in offices, others in workshops or warehouses. This section of the report focuses mainly on the 2.1 million white collar Federal workers, many of whom work day to day in an office environment.

Federal offices are managed by several different agencies. The Department of Defense and the Postal Service manage their own offices, while the General Services Administration (GSA) manages most other Federal office buildings. These three agencies administer 90 percent of all Federal office space (GSA, 1984); together, their policies on smoking in the workplace cover, at least in theory, the vast majority of Federal workers. Other Federal bodies that manage their own buildings and determine their own workplace policies include Veterans Administration medical centers and Congressional and Judicial offices.

General Services Administration Regulations

GSA develops regulations for the buildings it manages in its role as administrator of Federal property. In 1983, GSA administered 34 percent of all Federal office space (GSA, 1984). GSA's smoking regulations are therefore the largest single source of workplace smoking policies for Federal civilian employees.

History of GSA Regulations

GSA's Public Buildings Service, responsible for the operation and maintenance of many Federal office buildings, first issued smoking regulations in 1973 after reports from the Surgeon General on the dangers of smoking and after receiving several letters from nonsmokers requesting that smoking in Federal buildings be restricted or prohibited (GSA, undated). These regulations prohibited smoking in certain common areas under GSA's jurisdiction such as conference rooms, auditoriums, and elevators. They also required no-smoking areas in GSA cafeterias and limited smoking in certain medical care facilities. They encouraged, but did not require, nonsmoking areas in open office spaces (GSA, 1973). In 1976, after resistance from Federal agencies, GSA permitted smoking in conference rooms if the room was "properly ventilated" in the opinion of the local building manager (GSA, undated, 1976). At the urging of the Department of Health, Education, and Welfare (DHEW) and the Office on Smoking and Health, GSA strengthened its regulations in 1979. GSA currently is consulting with the Office of Personnel Management and the Surgeon General's office as it reevaluates its smoking regulations. (Dutton, 1986).

Content of GSA Regulations

The intent of GSA's workplace smoking regulations is to provide a "reasonably smoke-free environment in certain areas" of GSA-administered buildings. The regulations cite a need to control smoking in some areas "because smoke in a confined area may be irritating and annoying to nonsmokers and may create a potential hazard to those suffering from heart and respiratory diseases or allergies" (44 FR 22464). In all buildings administered by GSA, smoking is prohibited in auditoriums, conference rooms, classrooms, and elevators unless excepted by the agency head. The regulations also require

nonsmoking areas, designated by signs and determined by the building manager, in building cafeterias.

Smoking in open office areas, where smoke may drift into a nonsmoker's work area, is often a point of contention. GSA's regulations are less strict in open office areas than in areas such as conference rooms, although the regulations suggest that creating nonsmoking open office areas should be "thoroughly investigated" provided that "(1) efficiency of work units will not be impaired, (2) additional space will not be required, and (3) costly alterations to the space or procurement of additional office equipment will not be necessary" (41 CFR part 101-20). Workers in an office "may unanimously declare that office as a 'no-smoking' area." However, because the decision must be unanimous, smokers retain the right to reject a no-smoking policy in the work area.

Implementation of GSA Regulations

While agencies with buildings administered by GSA are required to comply with GSA workplace smoking regulations, the agencies, not GSA, are responsible for the implementation and enforcement of the regulations. There exist, therefore, a variety of policies in Federal workplaces based on the minimum requirements established by GSA. The regulations state that "nothing in these regulations precludes an agency from adopting more stringent rules in space assigned to them," and some agencies, although certainly not a majority, have adopted more stringent policies. The Agency for International Development (AID), for example, chose to limit smoking in the workplace in August of 1985 after a poll showed that 90 percent of its employees favored restrictions (AID, 1985). AID's new policy stipulates that shared work areas will be nonsmoking

unless unanimously declared smoking by employees in the area. This policy makes nonsmoking the norm, compared with GSA's regulations in which smoking work areas are the norm.

A complete listing of policy variations under GSA's regulations is beyond the scope of this study, but there are other notable examples of agencies that have adopted stricter policies. The Indian Health Service (IHS), an agency of the U.S. Public Health Service, has announced its intention to ban smoking from its health and administrative facilities. Since late 1983, the Keams Canyon IHS hospital in Arizona has been smoke free (ODPHP, 1985). And as of September 1, 1984, Division X of the Department of Health and Human Services (HHS) has banned smoking in the office (ODPHP, 1985).

Department of Defense Workplace Smoking Policies

The Department of Defense (DoD) is the largest employer in the Federal workforce, employing more than 1 million civilian workers (34 percent of the Federal civilian workforce) and over 2 million military personnel on active duty. DoD manages 31 percent of all Federal office space (GSA, 1984), making it the second largest source of workplace smoking policies in Federal offices, behind GSA.

History of DoD Smoking Policies

The Office of the Assistant Secretary of Defense for Force, Management, and Personnel developed DoD's first workplace smoking policy in 1977. Recently the policy has been modified and incorporated into a more general health directive. The original policy prohibited smoking in certain portions of all DoD buildings, including auditoriums, conference rooms, and classrooms. It

also required the establishment of nonsmoking areas in eating facilities "wherever practicable." Smoking was permitted in shared work areas "only if ventilation is adequate to remove smoke from a work area and provide an environment that is healthful" (DoD, 1977). DoD defined "adequate ventilation" as at least "10 cubic feet of fresh air per minute per person." In theory, this meant that if a nonsmoker were to formally complain about smoke in his or her work area, an industrial hygienist would be called in to take measurements, the results of which might lead to a nonsmoking policy for the area. DoD's original workplace smoking policy was superseded by a more general health directive on health promotion signed by the Secretary of Defense on March 11, 1986.

Content of DoD Smoking Policies

The workplace smoking policies established in DoD's recent health directive are a bit more stringent than the policies implemented in 1977, although the changes do not appear to be large. Smoking is prohibited in auditoriums, conference rooms, and classrooms, just as it was in 1977, and in the new directive, nonsmoking areas are required in all eating facilities rather than just "wherever practicable." The new directive also states that "smoking shall not be permitted in common work areas shared by smokers and nonsmokers unless adequate space is available for nonsmokers and ventilation is adequate to provide them a healthy environment" (DoD, 1986), eliminating the 10 cubic feet of fresh air per minute standard of the 1977 policy. The directive places more emphasis on smoking cessation programs than the 1977 policy, and in a separate memorandum, the Secretary of Defense has announced DoD's intention to carry out "an intense anti-smoking campaign" in the military (DoD, 1986b).

Implementation of DoD Policies

Major divisions within DoD include the Office of the Secretary of Defense, the Military Departments (Army, Navy, and Air Force), and the twelve Defense Agencies, including the Defense Intelligence Agency and the Defense Mapping Agency. The DoD health directive requires each division to implement the health promotion directive, which includes policies on smoking in the workplace. Each of the divisions, therefore, drafts its own set of policies based on the minimum requirements of the directive (Gunnels, 1986).

Postal Service Policies

The U.S. Postal Service, a quasi-governmental agency in the Executive branch, employs over 700,000 workers and administers 25 percent of all Federal office space (GSA, 1984). The Postal Service is divided into five regional areas within the United States, and among these areas there are nearly 40,000 branch offices and stations.

History of Postal Service Smoking Policies

Unlike many other Federal agencies, the Postal Service has a long history of workplace smoking policies dating back to the time before its reorganization from the Department of the Post Office in 1971. In contrast to the policies adopted by GSA in 1973 and DoD in 1977, the Postal Service policies were issued not because of concern for nonsmokers, but because of the flammable nature of the mail. This consideration has been the primary impetus for smoking policies in the Postal Service, and it has been only in the most recent years that the discomfort of nonsmoking employees has been considered a

factor in determining workplace smoking policies (Herman, 1986).

Content of Postal Service Regulations

Today the flammable nature of the mail is still the main focus of Postal Service smoking policies. The regulations state that "smoking areas must be clearly designated" and that "employees must not smoke, under any circumstances, while receiving mail from the public, around belt conveyor tunnels, collecting mail from letter boxes, loading or unloading mail, distributing mail into pouches and sacks, or hanging, working, or closing pouches or sacks on racks" (Postal Bulletin, 1983).

These limitations apply particularly to postal workroom areas; in contrast, office smoking policies are not clearly delineated, varying from office to office (Herman, 1986). Postal regulations state that "smoking on duty is a privilege, not a right, and must not be indulged in to the detriment of the Postal Service or an employee's work, nor at the risk or discomfort of nonsmoking employees" (Postal Bulletin, 1983). While this reflects consideration to nonsmokers, it does not establish procedures to be followed in carrying out a policy. The Postal Service headquarters in Washington has issued a smoking policy for its immediate office; smoking there is prohibited if a nonsmoker objects (P.S. Headquarters Circular, 1984). However, this policy is presented to other offices as an example only and is not binding.

Implementation of Postal Service Smoking Policies

To a much greater extent than other Federal agencies, Postal Service employment policies are governed by the process of collective bargaining. The Office of Safety and Health within the Postal Service has a contractual

obligation to consult with unions while making policies regulating smoking in the workplace (Jones, 1986). If a new policy were to be agreed upon, it would be printed and distributed through the Postal Bulletin to the five regional offices and nearly 40,000 branch offices across the country.

STATE AND LOCAL WORKPLACE SMOKING LAWS

State Workplace Smoking Laws

Minnesota was the first State to regulate smoking in the workplace with the passage of its Clean Indoor Air Act of 1975. Utah followed in 1976, Nebraska in 1979, and since 1983, five other States have passed laws regulating smoking in the workplace. These laws restrict smoking in several different ways (see Table 1); some simply require each workplace to post a policy, many others restrict smoking to designated areas only. The eight States with workplace smoking laws have adopted one or more of the following components.

Components of State Workplace Smoking Laws

Restricting smoking among State employees. Alaska's workplace smoking law restricts smoking among State employees only; laws in the seven other States that restrict smoking in the workplace apply to both State and private workplaces. Alaska's legislation prohibits smoking in State and local workplaces except in designated areas. According to the law, employers in charge of designating smoking areas must "make reasonable accommodations for the needs of the smokers and nonsmokers." After some confusion over what constituted "reasonable accommodations," a State Labor/Management Committee developed guidelines for establishing smoking and nonsmoking areas in State buildings (Ballentine, 1986).

Requiring an established policy. Laws passed in Connecticut, Florida, Maine, and New Jersey all require that employers establish a workplace smoking policy. Connecticut requires only that "each employer shall establish and post written rules governing smoking and nonsmoking in that portion of any business facility for which he is responsible." The law does not specify any part of the policy's content and it applies only to businesses with 50 or more employees in a "structurally enclosed location." New Jersey's law, passed in late 1985, also specifies that policies must be established in businesses with more than 50 employees; however, New Jersey's law also requires that nonsmoking areas must be designated. The laws in Florida and Maine are the most explicit of the four States which require employees to develop policies. In Florida, the policy "shall take into consideration the proportion of smokers and nonsmokers," and smoking is prohibited except in designated areas. In Maine also, the policy "shall prohibit smoking except in designated smoking areas."

Giving preference to nonsmokers in resolving conflicts. In Utah, where smoking is limited by law to designated areas in the workplace, the rights of nonsmokers prevail in conflicts between smokers and nonsmokers. Utah's law, passed in 1976 and ammended in 1986, allows "an employee who has a defined, individual work area in the workplace to designate his immediate work area as a "no smoking" area and to post it with appropriate signs. With regard to this subsection, the employer shall give precedence to the rights of a nonsmoking employee when attempting to reach agreements between the preferences of smoking and nonsmoking employees."

Prohibiting action against nonsmokers who complain about smoking. Utah and Maine prohibit discrimination against nonsmokers who have complained about smoking in the office. In Utah, an employer is not allowed to "discriminate against an employee who expresses concern about smoke pollution in the place of employment which is detrimental to his health or comfort." And in Maine, "it is unlawful for any employer to discharge, discipline or otherwise discriminate against any of its employees because that employee has assisted in the supervision or enforcement of this section."

Limiting smoking to designated areas. Six of the eight States with workplace smoking laws restrict smoking to designated areas: Alaska (State and local employees only), Florida, Maine, Minnesota, Nebraska, and Utah. Minnesota's law was the first among States to limit smoking in the workplace, stating that "No person shall smoke in a public place or at a public meeting except in designated smoking areas". Utah, Nebraska, and Florida followed Minnesota, using the same language to restrict smoking to designated areas. Each of these States defines "public place" to include places of work. This definition is important because other States such as Oregon also restrict smoking in public places, however Oregon does not include the workplace in its definition of a "public place." Alaska and Maine also restrict smoking to designated areas in the workplace; Maine's law, reflecting a concern about the health effects of passive smoking, states that, "In order to protect the employer and employees from the detrimental effects of smoking by others, the policy shall prohibit smoking except in designated smoking areas."

One obvious concern in the State laws is what constitutes a "designated area" for smoking. In each of the above six States, designation of smoking areas is left up to the person in charge of the public place. Maine's law also includes the provision that the employer may "negotiate through the collective bargaining process" to establish designated areas. Although Utah's law is the only one to specifically state that nonsmokers' rights prevail over smokers' rights, each of the above laws was written with the intention of providing a healthful work environment. Shared work areas may thereby be discouraged from being designated smoking; however, in some cases an employer may technically be in compliance with the law but in conflict with its intent by designating a shared work area smoking (Richards, 1986). All of the laws except Alaska's and Maine's state that "existing physical barriers and ventilation systems" should be used to separate smoking and nonsmoking areas, thereby not holding the employer liable for costly alterations to the building. All laws implicitly allow enclosed offices occupied solely by a smoker or group of smokers to be designated smoking; laws in Minnesota, Utah, and Nebraska, explicitly mention that these offices may be designated smoking.

Requiring signs to be posted. Seven States require that signs designating smoking and/or nonsmoking areas must be posted in the workplace. Alaska, Minnesota, Nebraska, New Jersey, and Utah all require signs designating smoking and nonsmoking areas; Florida requires that signs must be posted in smoking areas, and in Connecticut signs must be posted in nonsmoking areas. Many of the laws specify a minimum size for the signs; in Minnesota, signs "shall be in printed letters of not less than 1.5 inches (3.8 centimeters) in height," unless used on a table or seat.

Enforcement of State Laws

State laws regulating smoking in the workplace have varied provisions for enforcement. Connecticut and New Jersey, for instance, don't have provisions for enforcement. Alaska distinguishes between smokers who smoke in nonsmoking areas and employers who fail to post such areas; smokers may be subject to fines of \$10 to \$50 and employers, \$20 to \$300. In Maine, only employers who fail to comply may be fined up to \$100. Other States, such as Utah and Florida specify a fine ranging up to \$299 and \$500, respectively, although there is uncertainty about how the Florida fine would be levied (Richards, 1986). In Minnesota, Nebraska, and Utah, violation of the law is a misdemeanor. Utah's law has been in effect since 1976, and in that time, the State official responsible for enforcement estimated that about 6 fines, ranging from \$25 to \$50 had been levied (Marx, 1986). In general, there seem to be few problems enforcing State laws restricting smoking in the workplace; the laws tend to be self-enforcing (Shopland, 1985, Kahn, 1983). In telephone conversations with some State employees responsible for implementing the laws, OTA found that they encountered few problems.

Local Workplace Smoking Ordinances

More than 30 cities and ten counties in the United States, most of them in California, have passed ordinances regulating smoking in the workplace (ALA, 1985). Local workplace smoking ordinances are a recent and rapidly developing phenomenon; nearly all of them have been written since 1983, and in the two months since OTA began this study, Nassau county in New York and New York City have considered or adopted workplace smoking ordinances.

City Ordinances

The most active State in passing workplace smoking ordinances at the city level has been California. After nonsmokers' legislation was defeated twice at the State level, groups such as the Californians for Non-smokers Rights shifted their emphasis to ordinances at the local level (Shopland, 1985).

In 1983, 13 California cities passed nonsmoking ordinances, including San Francisco and Palo Alto (ALA, 1985). In San Francisco, each employer must establish an office smoking policy. San Francisco's workplace smoking ordinance states that "if an employer allows employees to smoke in the workplace, then this ordinance requires (1) that the employer make accommodations for the preferences of both nonsmoking and smoking employees, and (2) if a satisfactory accommodation to all affected nonsmoking employees cannot be reached, that the employer prohibit smoking in the office workplace" (ALA, 1985, SF ord. 298-83). The ordinance does not apply to enclosed offices occupied solely by smokers, State or Federal governmental buildings, or homes which serve as workplaces. The ordinance is enforced with a fine of up to \$500 for any employer who fails to comply, however few problems with enforcement have been reported (Schuh, 1984).

Palo Alto's ordinance, passed in 1983 after San Francisco's ordinance, goes a step further in allowing a worker to declare his or her work area nonsmoking. According to the ordinance, "any employee in the office workplace shall be given the right to designate his or her immediate area as a nonsmoking area and to post it with appropriate signs or sign." The ordinance goes on to state that "in any dispute arising under the smoking policy, the rights of the

nonsmoker shall be given precedence." (ALA, 1985). As with the San Francisco ordinance, Palo Alto's ordinance does not apply to enclosed offices occupied solely by smokers, State or Federal office buildings, or private homes which serve as a workplace. Violation of the ordinance is an infraction of city code; fines range from \$50 to \$250.

Today 28 cities in California have ordinances regulating smoking in the workplace (ALA, 1985). For some companies with statewide offices, complying with the variety of ordinances in different cities has been something of a problem; the Pacific Telesis company in California developed a flexible corporate smoking policy in response to the situation (ODPHP, 1985).

County Ordinances

In 1984, Suffolk County in New York State adopted a workplace smoking ordinance for offices of 50 or more employees, similar in many ways to Palo Alto's city ordinance. According to the Suffolk ordinance, "any employee in the office workplace shall be given the right to designate his or her immediate area as a nonsmoking area and to post it with an appropriate sign or signs" (ALA, 1985). However, unlike Palo Alto's ordinance, it adds that "in any dispute arising under the smoking policy, the rights of the nonsmoker shall be governed by the rule of reason and the economic practicability of action by the employer." The ordinance also prohibits smoking in many areas where both smokers and nonsmokers might be present, including conference rooms, auditoriums, restrooms, and elevators. The maximum fine for violation of the ordinance is \$25.

Nassau County, a neighbor to Suffolk County in New York, passed a smoking ordinance in January 1986 which limits smoking in the workplace to designated areas. Cited as "among the toughest in the country" (May, 1986), the ordinance prohibits smoking in specific areas of the workplace, such as cafeterias, conference rooms, restrooms, and work areas. The ordinance states, however, that "an employer may designate a separate portion or portions of the work area, employees lounge, and cafeteria, for smoking." Designating open work areas as smoking areas is discouraged by the County Board of Health if it conflicts with the intent of the ordinance, "to provide residents protection from exposure to tobacco smoke" (Niebling, 1986). The ordinance is enforced by fines up to \$500; two full-time administrators are currently assigned to administering the ordinance (Niebling, 1986).

WORKPLACE SMOKING POLICIES IN THE PRIVATE SECTOR

The private sector is composed of a wide variety of businesses, from sales to manufacturing to services. Smoking policies vary in the private sector as well, often with the type of business. Smoking policies in manufacturing industries, for example, are likely to focus on safety and product purity, while policies in sales and other customer-oriented businesses may emphasize the client's comfort (NICSH, 1980b). More recently, many policies address nonsmokers' concerns in the workplace.

Estimates of the percentage of businesses with workplace smoking policies ranged from 15 percent to nearly 50 percent in 1980 (Thomas, 1980, Dartnell, 1980, NICSH, 1980). Unfortunately, few surveys have been published on the current percentage of businesses with smoking policies; the number or type of policies may well have changed in the last five years with the growth

of a nonsmokers' rights movement and the passage of workplace smoking laws in several States and communities. The most recent survey of workplace smoking policies, funded by the tobacco industry in 1985, found that 32 percent of the large corporations surveyed had some sort of smoking policy (HRPC, 1985). Workplace smoking policies range from occupational safety restrictions to banning smoking at the workplace and hiring only nonsmokers.

Occupational Safety and Health Smoking Restrictions¹

Workplace smoking restrictions seem to be most prevalent in blue collar work areas. In 1980, a survey of 3,000 small, medium, and large companies found that 69 percent of those surveyed restricted or prohibited smoking in these areas, primarily for safety reasons (e.g. flammable materials areas) and health concerns (e.g. food preparation areas) (NICSH, 1980). A more recent survey funded by the tobacco industry indicated that 25 percent of large corporations responding to the survey had smoking policies for "safety regulations" and another 20 percent had policies for "health reasons." (HRPC, 1985). In addition to the risks associated only with smoking, tobacco use increases the health risks associated with certain substances such as asbestos, and some companies have restricted smoking when those substances are present. The Manville Corporation, for instance, banned smoking at the worksite in 1978 (Surgeon General, 1985).

Product and Equipment Protection

A 1980 study of employers of 1,000 or more workers in Massachusetts indicated that, of those who responded, 54 percent had work areas in which

¹ Policy categories in this section are adapted from ODPHP, 1985.

smoking was prohibited because of potential damage to products or equipment (Bennett, 1980). These policies are most prevalent among manufacturing industries. Some industries, such as food manufacturers, have especially stringent smoking policies to protect the purity of their products (NICSH, 1980b).

Modifying the Work Environment

Although not so much an explicit policy as a more general means of accommodating smokers and nonsmokers, modifying the work environment is a step taken by many employers. According to a poll funded by the tobacco industry, 60 percent of businesses surveyed have modified the workplace in some way to accommodate smokers and nonsmokers (HRPC, 1985). Modifications range from the posting of signs to the separation of work areas and improvement of ventilation. Sometimes workplace modification is a step taken before more explicit policies are developed. In 1979, the Control Data Corporation in Minneapolis separated work areas into smoking and nonsmoking sections and designed ventilation systems to blow air currents away from nonsmokers; in 1984, Control Data banned cigarette smoking except in designated areas (Business Week, 1982, ODPHP, 1985). One factor limiting the extent of workplace modification is cost; Minnesota's state law for instance requires that "existing physical barriers and ventilation systems" be used in separating smoking and nonsmoking areas, rather than requiring new structures.

Banning Smoking in Specific Areas

Businesses where contact with clients is frequent often restrict smoking in lobbies and other client contact areas. A 1980 survey of 500 members of the

Administrative Management Society found that 46 percent of those who responded prohibited smoking in areas where employees came into contact with customers and clients, making it the most common policy among that service- and client-oriented group of businesses (Thomas, 1980). The policies did not restrict smoking in common work areas, rather they prohibited it in areas where clients would be present, such as bank teller windows. Therefore, these policies apply only to employees who normally work with clients. A more recent study, which included industrial as well as service companies, found a lower percentage of companies with specific bans on smoking in areas where clients are present. Seven percent of the companies who responded to the survey had such a policy (HRPC, 1985).

Smoking is often banned in other specific areas outside the actual work area. These policies ban smoking in areas such as meeting and conference rooms, auditoriums, elevators, bathrooms, and hallways. Although survey information is not available on the prevalence of this type of policy, it appears to be one of the more common workplace smoking policies (ODPHP, 1985). Often State laws or local ordinances will prohibit smoking in areas such as elevators; in 1984, 40 States and the District of Columbia prohibited smoking in certain public areas (Office on Smoking and Health, 1984). Some companies have used this type of policy as a first step in creating a more comprehensive workplace smoking policy (ODPHP, 1985).

Banning Smoking Except in Designated Areas

Some businesses have prohibited smoking in the workplace except in designated areas. The Control Data Corporation in Minnesota prohibits smoking in all areas except in private offices, sections of the cafeteria and

conference rooms, and certain refreshment rooms. Minnesota's Clean Indoor Air Act, which limits smoking to designated areas but allows it in private offices, is the basis of Control Data's policy (Andrew, 1986). MSI Insurance, also in Minnesota, limits smoking to part of the cafeteria (ODPHP, 1985).

Banning Smoking Throughout the Workplace

A small number of companies have banned smoking entirely from the workplace, and others have announced their intention to do so. The Group Health Cooperative of Puget Sound, Washington, a health maintenance organization with 300,000 members, banned smoking in its clinics and administrative offices after meeting with employees and bargaining units (ODPHP, 1985). The Provident Indemnity Life Insurance Company in Norristown, Pennsylvania banned smoking on company property in the fall of 1983. The company reached that stage gradually, first by limiting smoking to the lunchroom during a certain time period, then by altering its job application so that smoking employees would pay for insurance at a greater rate than nonsmokers (ODPHP, 1985). The Boeing Company in Seattle currently lists nonsmoking areas, but has announced its intention of banning smoking entirely (ODPHP, 1985, Sifferman, 1986).

Companies have occasionally had problems implementing a total ban on smoking in the worksite, particularly when labor negotiations are required. In an arbitration case in California, an employer's ban on smoking was deemed unreasonable by an arbitrator because it did not cite reasons for the ban and was declared unilaterally by management (Jauvtis, 1983).

Hiring Only Nonsmokers

Although their numbers appear to be small, a few companies have a policy against hiring smokers. In a survey of 84 large employers in Massachusetts in 1980, none reported that they hired only nonsmokers (Bennett, 1980). And in a more recent study funded by the tobacco industry, four of 445 respondents reported that they did not hire smokers (HRPC, 1985). The Johns-Manville asbestos company stopped hiring smokers in 1978 (Surgeon General, 1985), and some fire departments hire only nonsmokers (N.J. GASP, 1985).

COST-EFFECTIVENESS OF SMOKING POLICIES

Previous studies of the costs of smoking have focused on the costs related to active smoking. For example, OTA has estimated that smoking caused 314,000 deaths in 1982--139,000 cancer deaths, 123,000 cardiovascular disease deaths, and 52,000 chronic obstructive lung disease deaths. The social costs attributable to those deaths include \$12 to \$35 billion in health care costs and \$27 to \$61 billion in lost earnings (OTA, 1985).

The benefits and costs of government activities designed to reduce smoking have been analyzed (see, e.g., Warner, 1982). There is also a literature on the costs and effectiveness of smoking cessation programs (see Fielding, 1982, for one review).

The cost-effectiveness of policies concerning smoking in the workplace, however, has not been extensively analyzed. Currently, quantitative information on the health effects of passive smoking is limited. Because of this limitation, OTA has not attempted to conduct a cost-benefit or cost-effectiveness analysis of workplace smoking policies. Instead, this section discusses some of the factors that would need to be considered when evaluating the costs and effects of these policies.

Such an analysis depends, of course, on both the costs of implementing those policies and their effects. While policies concerning smoking in the workplace seem to be successful, information on the costs and effects of these policies is difficult to obtain. Each of the components of the state laws influencing workplace smoking policies identified earlier (requiring a smoking policy, limiting smoking to designated areas, requiring signs, mandating that nonsmokers' desires prevail in disputes, and prohibiting discrimination against nonsmokers) will affect the degree of nonsmokers' exposures to tobacco smoke and influence the nature of the relationships between smokers and nonsmokers in the workplace.

Benefits of Reduced Passive Smoking

If passive smoking leads to an increased incidence of disease among nonsmokers, then reductions in exposures due to implementation of workplace smoking policies would reduce the incidence of disease. If treatment of these diseases requires the use of medical resources, less disease would imply savings in health care costs. Generally, reducing the incidence of nonfatal disease will lead to saving health care resources.

If the diseases caused by passive smoking are fatal, prevention will result in longer life. During the additional years of life gained, additional medical resources will be used. Thus, preventing a early death may lead to savings in health care costs in the present and increases in health care costs in future years. The net effect depends on the relative costs of the diseases in question and the discount rate used in the analysis of future effects (see OTA, 1985).

Life insurance rates will only be affected if the passive smoking-related diseases are fatal. Reducing the death rate of an insured group should lead to a reduction in the costs of providing life insurance.

A few companies have restricted employment to nonsmokers in a desire to reduce the incidence of occupational disease and associated workers' compensation payments. For example, the combined effect of exposures to asbestos and cigarette smoking is much greater than the effect of exposure to only asbestos or cigarette smoke. Hiring only nonsmokers might reduce the costs of compensating workers with asbestos-related disease, although reductions in asbestos exposures represent another alternative.

Eliminating smoking from the worksite would eliminate the workplace fires started by burning cigarette butts. The effect of restricting smoking to designated areas is less clear. Fire prevention and control might be better if smoking is restricted to particular locations, although the policy may need enforcement in order to prevent smoking in non-designated areas. The reduction in the frequency of fires and associated property damage should lead to reduction in the costs of fire insurance.

The beneficiaries of any of the reductions in insurance costs depends on the method used for financing the insurance (e.g. the percentage paid for by the employer and the employee) and whether the insurer has already implemented discounts for nonsmokers. Thus the analysis needs to be clear about who receives any particular benefit and who bears the costs of these policies.²

²It should also be noted that, in most cases, insurance payments represent transfers and, strictly speaking, may not be social costs.

Smokers tend to have more sick loss days than nonsmokers. If passive exposures also lead to an increase in sick time, then reducing passive exposures should lead to improvements in employee absenteeism.

Workplace smoking policies should also reduce or eliminate the irritation and annoyance experienced by nonsmokers when exposed to tobacco smoke. Economists usually suggest that this benefit could be evaluated by estimating how much nonsmokers might be willing to pay for this. Thus, on the benefit side would be how much nonsmokers would be willing to pay to reduce or eliminate exposure to tobacco smoke. On the cost side would be estimates of how much smokers might be willing to pay to continue to smoke in ways and places restricted by workplace smoking policies. Besides the difficulty in securing reliable estimates of the willingness to pay of both groups, ethical arguments are likely to be raised. Many consider clean air to be a right and, thus, reject the idea that nonsmokers should have to pay in order to breathe clean air. Others express concern that employers and the government have no right to restrict an individual's right to smoke.

Costs of Reduced Passive Smoking

Each component will also create implementation costs. For example, if a smoking policy includes the use of signs to indicate smoking and nonsmoking areas, the costs of the signs will need to be included in any evaluation.

While it might be desirable to analyze separately the costs and effects of each component, it is likely to be difficult. In addition, even when considering a policy as a whole, it is difficult to estimate the additional costs that a smoking policy might impose on employers. Once they are established and implemented, it is likely that smoking policies will simply be

administered along with the other employer policies concerning personnel and buildings. It will thus be difficult to separate the costs of administering the smoking policy from the general costs of administration.

Restrictions on smoking may lead to changes in employee productivity--nonsmokers may be more productive without the irritation of tobacco smoke; depending on where smoking is permitted, the time lost by smokers may either increase or stay the same. If smokers need to travel far from their desks to smoke, the total time lost may increase. If they can continue to smoke at their desks, the time lost through smoking will stay the same. If time has been lost through conflicts with nonsmokers concerning where smoking is permitted, implementation of a smoking policy could reduce those conflicts and the consequent productivity loss.

Consideration of Alternatives

An important part of a cost-effectiveness analysis is the consideration of alternatives. To handle the problem of passive smoking, one possibility is to establish smoking policies to designate smoking and nonsmoking areas in the workplace and to make accommodations for the needs of smokers and nonsmokers. Another alternative is physical modification of the workplace to separate smokers' work areas from those of nonsmokers. Finally, the ventilation system could be redesigned to increase substantially the air flow in all areas to reduce the nonsmokers' exposures to tobacco smoke.

For each of these, a complete listing of the costs and effects would be desirable. However, even without conducting a comprehensive analysis, it appears likely that physical modification of the workplace or the use of additional ventilation would be substantially more expensive than establishing

policies concerning smoking in the workplace.

The intended effect of such policies is to reduce or eliminate the nonsmokers' exposure to tobacco smoke. Another possible effect is that, faced with restrictions concerning when and where they may smoke, some smokers may reduce the amount of their smoking or give up the habit entirely. Of course, if that happens, those additional benefits need to be considered.

REFERENCES

- American Lung Association, Freedom From Smoking at Work, program guidelines, New York, 1985.
- American Lung Association, "Summary of results of the July 1985 survey conducted by the Gallup Organization: 'Survey of attitudes towards smoking'", typescript, December 1985.
- Andrew, D., Public Relations Division, Control Data Corporation, Minneapolis, MN, personal communication, March 18, 1986.
- Ballentine, K., Section Chief, Environmental Sanitation Program, Alaska Department of Environmental Conservation, Juneau, Alaska, personal communication, March 11, 1986.
- Bennett, D., "Smoking Policies and Smoking Cessation Programs of Large Employers in Massachusetts," American Journal of Public Health 70(6): 629-631, June 1980.
- Business Week, "Office Smokers Feel the Heat," November 29, 1982, p. 102.
- Chan, W.C., and Fung, S.C., "Lung cancer in non-smokers in Hong Kong," pp. 199-202 in Cancer Campaign, Volume 6, Cancer Epidemiology, Grundmann, E., ed. (Stuttgart: Gustav Fischer Verlag, 1982).
- Comstock, G.W., Meyer, M.B., Helsing, K.J., and Tockman, M.S., "Respiratory effects of household exposures to tobacco smoke and gas cooking," American Review of Respiratory Disease 124(2): 143-148.
- Correa, P., Pickle, L.W., Fontham, E., et al., "Passive smoking and lung cancer," Lancet ii:595-597, 1983.
- Dahms, T.E., Bolin, J.F., and Slavin, R.G., "Passive smoking: Effects on bronchial asthma," Chest 80(5): 530-534, November 1981.
- Dartnell Institute of Business Research, "Target Survey: Smoking Still Not Policy Issue in Most Offices," Dartnell's Business 1980 1(4):37-40, June 1980.
- Dutton, S., Public Buildings Service, General Services Administration, Washington, DC, personal communication, Feb. 25, 1986.
- Fielding, J.E., "Effectiveness of employee health improvement programs," Journal of Occupational Medicine 24:907-16, 1982.
- Garfinkel, L., "Time trends in lung cancer mortality among nonsmokers and a note on passive smoking," Journal of the National Cancer Institute 66(6): 1061-1066, June 1981.

- Garfinkel, L., Auerbach, O., and Joubert, L., "Involuntary smoking and lung cancer: a case-control study," Journal of the National Cancer Institute, 75:463-469, September 1985.
- Garland C., Barrett-Connor, E., Suarez, L., et al., "Effects of passive smoking on ischemic heart disease mortality of nonsmokers," American Journal of Epidemiology 121(5): 645-650.
- Gillis, C.R., Hole, D.J., Hawthorne, V.M., and Boyle, P., "The effect of environmental tobacco smoke in two urban communities in the west of Scotland," pp. 121-126, in ETS--Environmental Tobacco Smoke: Report from a Workshop on Effects and Exposure Levels, R. Rylander, Y. Peterson, and M.-C. Snella, eds. (Geneva: Atar S.A, 1983).
- Gunnels, A.D., Office of the Assistant Secretary of Defense, Health Affairs, U.S. Department of Defense, Washington, DC, personal communication, March 26, 1986.
- Herman, I., National Medical Director, U.S. Postal Service, Washington, DC, personal communication, January 22, 1986.
- Hirayama, T., "Non-smoking wives of heavy smokers have a higher risk of lung cancer: A study from Japan," British Medical Journal 282: 183-185, 1981.
- Human Resources Policy Corporation, Smoking Policies in Large Corporations, Los Angeles, CA, 1985.
- International Agency for Research on Cancer, Epidemiological Studies of Cancer in Humans [need exact title of monograph], IARC Monographs Volume 38 (Lyons: IARC, in press, 1986).
- Jauvtis, R.L., "The Rights of Nonsmokers in the Workplace: Recent Developments," Labor Law Journal, March 1983, pp. 144-148.
- Jones, J., Safety and Management Division, U.S. Postal Service, Washington, DC, personal communication, March 5, 1986.
- Kabat, G.C., and Wynder, E.L., "Lung cancer in nonsmokers," Cancer 53:1214-1221, 1984.
- Kahn, P.L., "The Minnesota Clean Indoor Air Act: A Model for New York and Other States," New York State Journal of Medicine, 83(13):1300-1301, December 1983.
- Kauffmann, F., Tessier, J.-F., and Oriol, P., "Adult passive smoking in the home environment: A risk factor for chronic airflow limitation." American Journal of Epidemiology 117(3): 269-280, March 1983.
- Knoth, A., Bohn, H., and Schmidt, F., "Passivrauchen als Lungenkrebsursache bei Nichtraucherinnen," Medizinische Klinik 78: 66-69, 1983.

- Koo, L.C., Ho, J.H-C., and Saw, D., "Active and passive smoking among female lung cancer patients and controls in Hong Kong," Journal of Experimental and Clinical Cancer Research 4(367-375), 1983.
- Kristein, M.M., "How Much Can Business Expect to Profit from Smoking Cessation?" Preventive Medicine 12:358-81, 1983.
- Marx, D., Bureau of General Sanitation, Utah Department of Health, Salt Lake City, Utah, personal communication, March 7, 1986.
- May, C.M., "Antismoking Rules will go into Effect in Nassau Tomorrow," New York Times, p. B1 right column, January 31, 1986.
- National Interagency Council on Smoking and Health, "Smoking and the Workplace: Toward a Healthier Workforce," New York, Fall, 1980.
- National Interagency Council on Smoking and Health, Smoking and the Workplace Business Survey, 1980.
- National Research Council, Committee on Indoor Air Pollutants, Indoor Pollutants (Washington, DC: National Academy Press, 1981).
- National Research Council, Committee on Passive Smoking, "Statement of Work," typescript, October 15, 1985.
- New Jersey Group Against Smoking Pollution, Inc., "Toward a Smoke-Free Workplace," Summit, NJ, 1985.
- Niebling, R.H., Deputy Health Commissioner, Nassau County Department of Health, Mineola, NY, personal communication, March 24, 1986.
- Pimm, P.E., Silverman, F., Shephard, R.J., "Physiological effects of acute passive exposure to cigarette smoke," Archives of Environmental Health 33(4): 201-213, July-August 1978.
- Richards, M., Florida Department of Health and Rehabilitative Services, Tallahassee, Florida, personal communications, March 3 and April 1, 1986.
- Schilling, R.S.F., Letai, A.D., Hui, S.L., et al., "Lung function, respiratory disease, and smoking in families," American Journal of Epidemiology 106(4): 274-283, 1977.
- Schuh, S.D., "San Francisco Anti-Smoking Law a Success," Wall Street Journal, August 15, 1984.
- Shephard, R.J., Collins, R., and Silverman, F., "'Passive' exposure of asthmatic subjects to cigarette smoke," Environmental Research 20(2): 392-402, December 1979.

- Shopland, D., "Passive Tobacco Smoking Policies Indoors in Various U.S. States," Office on Smoking and Health, U.S. Department of Health and Human Services, Rockville, MD, May 1985.
- Sifferman, R., Medical Division, The Boeing Company, Seattle, WA, personal communication, March 18, 1986.
- Speer, F., "Tobacco and the nonsmoker: A study of subjective symptoms." Archives of Environmental Health 16(3): 443-446, March 1968.
- Spengler, JD, DW Dockery, WA Turner et al., "Long-term measurements of respirable sulfates and particles inside and outside homes," Atmos. Environ. 15:23-30, 1981.
- Thomas, E.G., "Smoking in the Office: A Burning Issue," Management World, pp. 11-12, 40, April 1980
- Trichopoulos, D., Kalandidi, A., Sparros, L., and MacMahon, B., "Lung cancer and passive smoking," International Journal of Cancer 27:1-4, 1981.
- U.S. Agency for International Development, Occupational Safety and Health Advisory Committee (OSHAC), "Questionnaire on Smoking in AID," February, 1985.
- U.S. Congress, Office of Technology Assessment, Assessment of Technologies for Determining Cancer Risks from the Environment (Washington, D.C.: U.S. Government Printing Office, 1981).
- U.S. Congress, Office of Technology Assessment, "Smoking-Related Deaths and Financial Costs," Staff Memorandum, September 1985.
- U.S. Department of Defense, Department of Defense Directive number 1010.10, Health Promotion, March 11, 1986.
- U.S. Department of Defense, Department of Defense Instruction number 6015.18, Smoking in DoD Occupied Buildings and Facilities, August 18, 1977.
- U.S. Department of Defense, Secretary of Defense, Memorandum for Secretaries of the Military Departments, March 10, 1986.
- U.S. Department of Health and Human Services, Office on Smoking and Health, The Health Consequences of Smoking--Chronic Obstructive Lung Disease: A Report of the Surgeon General (Washington, DC: U.S. Government Printing Office, 1984).
- U.S. Department of Health and Human Services, Public Health Service, Office of Disease Prevention and Health Promotion, and Office on Smoking and Health, "A Decision Maker's Guide to Reducing Smoking at the Worksite," 1985.

- U.S. Department of Health and Human Services, Public Health Service, Office on Smoking and Health, compilation of State smoking laws, 1984 category chart, unpublished data, Rockville, MD, undated.
- U.S. Department of Health and Human Services, Public Health Service, Office on Smoking and Health, The Health Consequences of Smoking: Cancer and Chronic Lung Disease in the Workplace. A Report of the Surgeon General, 1985.
- U.S. General Services Administration, GSA Bulletin FPMR D-102, November 27, 1973.
- U.S. General Services Administration, GSA Bulletin FPMR D-143, September 17, 1976.
- U.S. General Services Administration, Office of Administration, "Summary Report of Real Property Owned by the United States Throughout the World as of September 30, 1983," July 1984.
- U.S. General Services Administration, Public Buildings Service, "Information Sheet: GSA Smoking Regulations," unpublished mimeo, Washington, DC, no date.
- U.S. Postal Service, Employee Relations Department, Headquarters Circular, no. 84-12, September 5, 1984.
- U.S. Postal Service, Employee Relations Department, Postal Bulletin 21431, November 10, 1983, p. 41.
- Warner, K., Benefits and Costs of Antismoking Policies, report prepared for the National Center on Health Services Research, U.S. Department of Health and Human Services, May 1982.
- Weber, A., "Acute effects of environmental tobacco smoke," European Journal of Respiratory Disease 65(Supplementum 133): 98-108, 1984.
- White, J.R., and Froeb, H.F., "Small-airways dysfunction in nonsmokers chronically exposed to tobacco smoke," New England Journal of Medicine 302(13): 720-723, 1980.