AMERICAN CANCER SOCIETY
Hope. Progress. Answers.

PENNSYLVANIA DIVISION, INC.
Route 422 & Sipe Avenue • P O Box 897 • Hershey, PA 17033-0897
(717) 533-6144 • FAX (717) 534-1075

June 7, 2001

Michael S. Schwoyer
Chief Counsel
House Box 202020
Room 25, Speaker Matthew J. Ryan
Legislative Office Building
Harrisburg, PA 17120-2020

Re: Public Hearing SB 216

Dear Mr. Schwoyer:

Per your May 31, 2001 letter and our subsequent conversation, enclosed is information the American Cancer Society has on asbestos that I hope will be helpful to you.

If I can be of further assistance, please let me know.

Sincerely,

Garry L. Pincock
Chief Executive Officer

GLP:ldf

Enclosures

ASBESTOS

What Is Asbestos?

Asbestos is a group of naturally occurring fibrous minerals. These minerals, found in soil and rocks in many parts of the world, are made of magnesium, silicon, and other elements. Some asbestos fibers are curly (or "serpentine"). The most common asbestos in industrial use, known as chrysotile, or white asbestos, has curly fibers. Other asbestos fibers are straight and needle-like (or "amphibole"). These include amosite, crocidolite, tremolite, actinolite, and anthophyllite. Asbestos fibers are resistant to heat and many chemicals. As a result, asbestos has been used as an insulating material since ancient times. Since the industrial revolution, asbestos was used to insulate factories, schools, homes, and ships, to make automobile brake and clutch parts, roofing shingles, ceiling and floor tiles, cement, and textiles, and hundreds of other products.

During the first half of the 1900s, growing evidence demonstrated that asbestos is a health hazard causing scarring of the lungs. In the early 1900s, exposure to asbestos dust in the workplace was not controlled. Beginning in England in the 1930s, steps were taken to protect workers in the asbestos industry by installing ventilation and exhaust systems. However, in the huge shipbuilding effort during World War II, large numbers of workers were exposed to high levels of asbestos. As asbestos-related cancers became better recognized in the second half of the twentieth century, additional measures were taken to reduce exposure, and exposure standards were established. In addition to more careful handling, there has been a dramatic decrease in the import and use of asbestos since the mid-1960s, and alternative insulating materials have been developed. As a result, asbestos exposure has dropped dramatically in the United States. However, exposure continues in some other countries. And in this country, there is still a potential for exposure from asbestos that remains in place in older buildings, water pipes, and other settings.

How Are People Exposed to Asbestos?

People are exposed to asbestos mainly through inhalation of fibers in the air they breathe. This may occur during mining and processing of asbestos, during the production of asbestos-containing products, or during the installation of asbestos insulation. It may also occur when older asbestos-containing materials begin to break down. In any of these situations, asbestos fibers tend to create a dust composed of tiny particles that can float in the air. In addition, asbestos can enter the body through ingestion. This may occur when people consume contaminated food or liquids (such as water that flows through asbestos cement pipes). It may also occur when people cough up asbestos they have inhaled, then swallow their saliva.

Many people are exposed to very low levels of naturally occurring asbestos in outdoor air as a result of erosion of asbestos-bearing rocks. However, the people with the heaviest exposure were those who worked in asbestos industries, such as shipbuilding and insulating. Many of these people recall working in thick clouds of asbestos dust, day after day.

Family members of asbestos workers are also potentially exposed to higher levels of asbestos because the fibers are carried home on the workers' clothing, and can then be inhaled by others in the household. Removal of asbestos from homes and other buildings can cause some exposure, although modern asbestos abatement workers are trained to use appropriate protective equipment to minimize exposure.

Exposure to asbestos-containing building material is also a concern, particularly in older buildings. If building materials such as insulation and ceiling and floor tiles begin to decompose over time, asbestos fibers can be found in indoor air, and may pose a threat to human health (EPA). There is no risk to human health if the asbestos is bonded into intact finished products, such as walls and tiles. As long as the material is not damaged or disturbed, for example by drilling or remodeling, there is no way for the fibers to be released into the air and inhaled. Maintenance workers who sweep up and dispose of the asbestos dust, or handle damaged asbestos-containing building materials are often exposed to higher levels than other occupants of these buildings.

Asbestos may be detected in the water supply as well as in the air. It may be released into the water through several sources, such as erosion or natural deposits, corrosion from asbestos-cement pipes, and disintegration of roofing materials containing asbestos that are then transported into sewers.

Does Asbestos Cause Cancer?

Lung Cancer

Inhalation of asbestos fibers has been proven to cause lung cancer. The connection between asbestos exposure and lung cancer was noted as early as 1925, and confirmed by many epidemiologic studies of asbestos-exposed workers over the next 70 years. All four main types of commercially used asbestos, chrysotile, amosite, anthophyllite, and mixtures containing crocidolite, are associated with an increased risk of lung cancer. An increase in lung cancer has also been observed after exposure to minerals containing tremolite and actinolite, and to tremolitic material mixed with anthophyllite and small amounts of chrysotile (IARC-Supp 17).

Approximately one in seven people who suffer from asbestosis, a lung disease

caused by prolonged high exposure, eventually develop lung cancer. The higher the exposure to asbestos, the higher the risk of lung cancer. There is synergy between cigarette smoking and asbestos exposure in causing lung cancer; asbestos workers who smoke face a much higher risk than asbestos workers who do not smoke. Evidence suggests that asbestos-exposed workers who quit smoking can reduce their risk of developing lung cancer by as much as fifty percent within five years of quitting (NCI).

Mesothelioma

Mesothelioma is a rare form of cancer that affects the thin membranes lining the abdomen and chest. Mesothelioma is closely linked with asbestos; most cases of mesothelioma result from asbestos exposure. The risk of developing mesothelioma increases with the amount of asbestos exposure, but cases of mesothelioma have occurred even after low levels of asbestos exposure. Mesotheliomas have been observed not only among workers who are occupationally exposed to crocidolite, amosite, and chrysotile, but also among their family members, and people living in the neighborhoods surrounding asbestos factories and mines (IARC). It is estimated that one third of the mesothelioma cases in the U.S. may be due to non-occupational exposure such as these (IARC). Unlike lung cancer, mesothelioma risk is not increased among smokers. Recently, some scientists have suggested that a virus, SV40, may also play a role in causing mesothelioma. Until other researchers confirm their findings, the role of this virus remains uncertain.

Other Types of Cancer

There is evidence that asbestos also causes other types of cancer, although the evidence is not as strong as for lung cancer and mesothelioma. Cancer of the larynx is one such cancer, although it has been difficult to separate the contributory role of asbestos from the strong effect of smoking. Many studies have also found an increase in stomach and colon cancer among workers in the asbestos industry, although this association is still debated.

What Do Epidemiologic Studies Show?

As explained above, much of the evidence about asbestos-associated cancers comes from epidemiologic studies.

What Do Animal Studies Show?

Tests on several different species, using several different routes of exposure, have confirmed that asbestos is carcinogenic to animals. Inhalation exposure of asbestos has been tested in rats, intrapleural administration (injection into the

chest cavity) in rats and hamsters; intraperitoneal (injection into the abdominal cavity) injection in mice, rats, and hamsters; and ingestion in rats and hamsters (IARC). All commercial forms of asbestos have produced tumors in animals. The size and shape of the asbestos fibers influence the incidence of tumors; smaller fibers (less than 0.5 m in diameter) seem more hazardous, perhaps because they are more likely to reach the deepest parts of the lungs (IARC).

A series of lifetime feeding studies have been done to determine if oral exposure to asbestos increases the risk of cancer. These studies reported that short-range asbestos fibers did not significantly increase the tumor incidence in rats; however, the incidence of benign tumors of the large intestines in male rats increased when the animals were exposed to intermediate-range asbestos fibers (EPA).

What Do the Expert Agencies Say?

Based on animal and human evidence like the examples above, expert agencies have evaluated the carcinogenicity of asbestos.

The National Toxicology Program evaluates exposures that may be carcinogenic. Exposures that are thought to be carcinogenic are included in the Reports on Carcinogens, published every two years. Each exposure is assigned to one of two categories: "known to be human carcinogens," and "reasonably anticipated to be human carcinogens." The first category includes substances for which human studies (epidemiology studies and/or experimental studies) provide "sufficient evidence" of carcinogenicity in humans. The second category includes substances for which there is limited evidence of carcinogenicity in humans and/or sufficient evidence of carcinogenicity in experimental animals. Using this scheme, the National Toxicology Program classifies asbestos as a known human carcinogen.

The International Agency for Research on Cancer (IARC) also evaluates exposures that may be carcinogenic. IARC classifies exposures into one of four categories: Group 1 exposures are those "known to be carcinogenic to humans," usually based on "sufficient" human evidence, but sometimes based on "sufficient" evidence in experimental animals and "strong" human evidence. Group 2 exposures are divided into two categories. Group 2A ("probably carcinogenic to humans") has stronger evidence, and Group 2B ("possibly carcinogenic to humans") has weaker evidence. Group 3 exposures are not considered classifiable, because available evidence is limited or inadequate. Finally, Group 4 exposures are "probably not carcinogenic to humans," based on evidence suggesting lack of carcinogenicity in humans and in experimental animals. IARC rated asbestos a known human carcinogen (Group 1).

The Environmental Protection Agency, through its Integrated Risk Information System, uses a classification scheme very similar to that of IARC. It classifies

exposures into one of five categories: (A) Human carcinogen, (B) Probable human carcinogen, (C) Possible human carcinogen, (D) Not classifiable as to human carcinogenicity, and (E) Evidence of noncarcinogenicity for humans. EPA classified asbestos as a human carcinogen.

Does Asbestos Cause Any Other Health Problems?

The major health problem caused by asbestos exposure, aside from cancer, is asbestosis. This is a scarring (or "fibrotic") disease of the lungs that develops when a person breathes high levels of asbestos over time. The principal symptoms of asbestosis are shortness of breath and cough. Asbestosis is a serious disease that can result in disability or death. It is most commonly found among asbestos workers. Asbestos can also result in scar-like tissue in the membranes around the lung, called pleural thickening, skin lesions like warts, and immunological effects.

What Should I Do if I've Been Exposed to Asbestos?

If you have been exposed to asbestos, it is important to assess the amount of your exposure. If you were exposed only very briefly, or only at very low levels, your risk of a resulting disease is minimal. However, it you were exposed at high levels, you may be at increased risk of the diseases discussed above. You can protect your health in several ways:

- If you are a smoker, it is essential that you stop smoking.
- Get regular health checkups from a doctor experienced with asbestos-related diseases. People with heavy asbestos exposure often have periodic chest x-rays and lung function tests.
- It may be advisable for you to receive vaccines against flu and pneumonia. Discuss this with your physician.
- Get prompt medical attention for any respiratory illness.

How Can I Avoid Exposure to Asbestos?

You should also avoid any future exposure to asbestos. If there is a possibility of on-the-job exposure, say, in renovation of old buildings, then you should use all protective equipment, work practices, and safety procedures designed for working around asbestos (NCI). If you live in an older home, there may be asbestos-containing insulation or other materials. A knowledgeable expert can check your home to determine if there is any asbestos and if it poses any risk of exposure. This may involve testing the air for asbestos levels. You may then decide to have the asbestos removed from your home. You should hire a qualified contractor to perform this job, to avoid contaminating your home further or

causing any exposure to the workers. You should not attempt do remove asbestos-containing material yourself.

What's the Bottom Line?

Asbestos is well recognized as a carcinogen. It causes lung cancer, mesothelioma, and other cancers. The people at highest risk are those with very heavy exposure, usually over many years on the job. Smoking acts together with asbestos to greatly increase the risk of lung cancer. While asbestos use is much less common now than it was years ago, there is still a potential for exposure in older buildings and products.

Are There Other National Organizations Addressing Asbestos?

Agency for Toxic Substances and Disease Registry (ATSDR)
Internet Address: http://www.atsdr.cdc.gov/tfacts61.html

Environmental Protection Agency (EPA)
Internet Address: http://www.epa.gov/ttnuatw1/hlthef/asbestos.html

International Agency for Research on Cancer (IARC)
Internet Addresses: Asbestos, Vol 14 (1977) at
http://193.51.164.11/htdocs/Monographs/Vol14/asbestos.html
Asbestos, Supplement 17, at
http://193.51.164.11/htdocs/monographs/Supp17/Asbestos.html

National Cancer Institute (NCI)
Internet Address:
http://cancernet.nci.nih.gov/cgi-bin/srchcgi.exe?TYPE=search&ZUI=600321&DBID=pdq&SFMT=pdq_statement/1/0/0#1

National Institutes of Health, National Institute of Environmental Health Sciences, National Toxicology Program
Internet Address:
http://ntp-server.niehs.nih.gov/htdocs/8_RoC/KC/Asbestos.html

Revised: 01/23/2001

ENVIRONMENT AND CANCER RISK

Environmental causes probably account for well over half of all cancer cases. Most environmental risks are determined by lifestyle choices (smoking, diet, etc.), while the rest arise in community and workplace settings. The degree of cancer hazard posed by these voluntary and involuntary risks depends on the concentration or intensity of the *carcinogen* (a substance that is capable of causing cancer) and the exposure dose a person received. In situations where high levels of carcinogens are present and where exposures are extensive, significant hazards may exist, but where concentrations are low and exposures limited, hazards are often negligible. However, when low-dose exposures are widespread, they can represent significant public health hazards (for example, secondhand tobacco smoke). Strong regulatory control and constant attention to safe occupational practices are required to minimize the workplace potential for exposure to high-dose carcinogens.

WHY IS RISK ASSESSMENT IMPORTANT?

Risks are assessed to protect people against unsafe exposures and to set appropriate environmental standards. The process of risk assessment has two steps. The first identifies the chemical or physical nature of a hazard and its cancer-producing potential, both in clinical and epidemiological studies and in laboratory tests using animals or cell systems. Special attention is given to any evidence suggesting that
cancer risk increases with increases in exposure. The second step measures levels of hazard in the environment (air, water, food, etc.) and the extent to which people are actually exposed (how much they eat of a particular food, use a particular water source, etc.). Knowledge of how the body absorbs chemicals or is exposed to radiation is essential for such dose measurements.

Unfortunately, evidence of risk for most potential carcinogens is usually the result of high-dose experiments on animals or observations where high-dose exposures have occurred in humans. To use such information to set human safety standards, scientists must extrapolate from animals to humans and from high-dose to low-dose conditions. Because both extrapolations involve much uncertainty, conservative assumptions are used so that risk assessment will err on the side of safety. For cancer safety standards, only increased risks of one case or less per million persons over a lifetime are usually acceptable.

Safety standards developed in this way for chemical or radiation exposures are the basis for federal regulatory activities at the Food and Drug Administration, the Environmental Protection Agency, and the Occupational Safety and Health Administration. The application of laws and procedures by which standards are implemented and risks are controlled is called risk management.

CAN CHEMICALS CAUSE CANCER?

Various chemicals show definite evidence of human carcinogenicity (for example, benzene, asbestos, vinyl chloride, arsenic, aflatoxin) or are probable human carcinogens based on evidence from animal experiments (for example, chloroform, dichlorodiphenyl-trichloroethane [DDT], formaldehyde, polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons). Often in the past, direct evidence of human carcinogenicity has come from studies of workplace conditions involving sustained, high-dose exposures. Occasionally, risks are greatly increased when particular exposures occur together (for example, asbestos exposure and cigarette smoking).

CAN RADIATION CAUSE CANCER?

Only high-frequency radiation, *ionizing radiation* (IR) and *ultraviolet* (UV) radiation, has been proven to cause human cancer. Exposure to sunlight (UV radiation) causes almost all cases of basal and squamous cell skin cancer and is a major cause of skin melanoma. Disruption of the earth's ozone layer by atmospheric chemical pollution (the "ozone hole") may lead to rising levels of UV radiation.

Evidence that high-dose IR (x-rays, radon, etc.) causes cancer comes from studies of atomic bomb survivors, patients receiving radiotherapy, and certain occupational groups (for example, uranium miners). Virtually any part of the body can be affected by IR, but especially bone marrow and the thyroid gland. Diagnostic medical and dental x-rays are set at the lowest dose levels possible to minimize risk without losing image quality. Radon exposures in homes can increase lung cancer risk, especially in cigarette smokers; remedial actions may be needed if radon levels are too high.

CAN PESTICIDES CAUSE CANCER?

Many kinds of pesticides (insecticides, herbicides, etc.) are widely used in producing and marketing our food supply. Although high doses of some of these chemicals cause cancer in experimental animals, the very low concentrations found in some foods are generally well within established safety levels. Environmental pollution by slowly degraded pesticides such as DDT, a result of past agricultural practices, can lead to food chain bioaccumulation and to persistent residues in body fat. Such residues have been suggested as a possible risk factor for breast cancer. Studies have shown that concentrations in tissue are low, however, and the evidence has not been conclusive.

Continued research regarding pesticide use is essential for maximum food safety, improved food production through alternative pest control methods, and reduced pollution of the environment. In the meantime, pesticides play a valuable role in sustaining our food supply. When properly controlled, the minimal risks they pose are greatly overshadowed by the health benefits of a diverse diet rich in foods

from plant sources.

CAN NON-IONIZING RADIATION CAUSE CANCER?

Electromagnetic radiation at frequencies below ionizing and ultraviolet levels has not been shown to cause cancer. While some epidemiologic studies suggest associations with cancer, others do not, and experimental studies have not yielded reproducible evidence of carcinogenic mechanisms. Low-frequency radiation includes radiowaves, microwaves, and radar, as well as power frequency radiation arising from the electric and magnetic fields associated with electric currents (extremely low-frequency radiation).

CAN TOXIC WASTES CAUSE CANCER?

Toxic wastes in dump sites can threaten human health through air, water, and soil pollution. Although many toxic chemicals contained in such wastes can be carcinogenic at high doses, most community exposures appear to involve very low or negligible dose levels. Clean-up of existing dump sites and close control of toxic materials in the future are essential to ensure healthy living conditions in our industrialized society.

CAN NUCLEAR POWER PLANTS CAUSE CANCER?

Ionizing radiation emissions from nuclear facilities are closely controlled and involve negligible levels of exposure for communities near such plants. Although reports about cancer case clusters in such communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere in the population.

REFERENCE

American Cancer Society. *Cancer Facts and Figures 1998*. Atlanta, GA: American Cancer Society, 1998.

Revised: 02/26/98

Environmental Cancer Risks

Environmental factors, defined broadly to include smoking, diet, and infectious diseases as well as chemicals and radiation, cause an estimated three-quarters of all cancer deaths in the United States. Among these factors, tobacco use, unhealthy diet, and physical inactivity are more likely to affect personal cancer risk than trace levels of pollutants in food, drinking water, and air. However, the degree of risk from these pollutants depends on the concentration, intensity, and duration of exposure. Substantial increases in risk have been shown in settings where workers have been exposed to high concentrations of ionizing radiation, certain chemicals, metals, and other substances, as well as among radiation victims, and patients treated with drugs or therapies later found to be carcinogenic.

Even low-dose exposures that pose only small risk to individuals can still cause substantial ill health across an entire population if the exposures are widespread. For example, secondhand tobacco smoke increases risk in large numbers of people who do not smoke but are exposed to others' smoke. Strong regulatory control and attention to safe occupational practices, drug testing, and consumer product safety play an important role in reducing risk of cancer from environmental exposures. Additional information on environmental factors associated with cancer risks can be found at several web sites, including www.atsdr.cdc.gov, www.epa.gov, www.niehs.nih.gov, www.osha.gov, and www.who.int.

Risk Assessment

The risk assessment process evaluates both the cancer-causing potential of a substance as well as the levels of the substance in the environment and the extent to which people are actually exposed. However, the process is not perfect. For most potential carcinogens, data are only available from high dose experiments in animals or highly exposed occupational groups. To use such information to set human safety standards, regulators must extrapolate from animals to humans and from high-dose to low-dose conditions. Because both extrapolations involve much uncertainty, as does the effect of mixtures of chemicals and of especially susceptible subgroups of the population, risk assessment generally makes conservative assumptions to err on the side of safety. For cancer safety standards, acceptable risks are usually limited to those that increase risk by no more than one case per million persons over a lifetime.

Safety standards developed in this way for chemical or radiation exposures are the basis for federal regulatory activities at the Food and Drug Administration, the Environmental Protection Agency, and the Occupational Safety and Health Administration. The application of laws and procedures by which standards are implemented and risks are controlled is called risk management.

Chemicals

Various chemicals (for example, benzene, asbestos, vinyl chloride, arsenic, aflatoxin) show definite evidence of causing cancer in humans; others are considered probable human carcinogens based on evidence from animal experiments (for example, chloroform, dichlorodiphenyltrichloroethane [DDT], formaldehyde, polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons). Often in the past, direct evidence of human carcinogenicity has come from studies of workplace conditions involving sustained, high-dose exposures. Occasionally, risks are greatly increased when particular exposures occur together (for example, asbestos exposure and cigarette smoking).

Radiation

The only types of radiation proven to cause human cancer are high-frequency ionizing radiation (IR) and ultraviolet (UV) radiation. Exposure to sunlight (UV radiation) causes almost all cases of basal and squamous cell skin cancer and is a major cause of skin melanoma. Disruption of the earth's ozone layer by pollution (the "ozone hole") may cause rising levels of UV radiation.

Evidence that high-dose IR (x-rays, radon, etc.) causes cancer comes from studies of atomic bomb survivors, patients receiving radiotherapy, and certain occupational groups, such as uranium miners. Virtually any part of the body can be affected by IR, but especially bone marrow and the thyroid gland. Diagnostic medical and dental x-rays are set at the lowest dose levels possible to minimize risk without losing image quality and medical usefulness. Radon exposures in homes can increase lung cancer risk, and cigarette smoking greatly increases the effect of radon exposure in lung cancer risk. Fortunately there are tests which can be used to detect high levels of radon. Remedial actions may be needed if radon levels are too high.

Unproven Risks

Public concern about cancer risks in the environment often focuses on unproven risks or on situations in which known carcinogen exposures are at such low levels that risks are negligible, for example:

Pesticides. Many kinds of pesticides (insecticides, herbicides, etc.) are widely used in agriculture in the production of the food supply. High doses of some of these chemicals have been shown to cause cancer in animals, but the very low concentrations found in some foods have not been associated with increased cancer risk. In fact, people who eat more fruits and vegetables, which may be contaminated with trace amounts of pesticides, generally have lower cancer risks than people who eat few fruits and vegetables. Workers exposed to high levels of pesticides, in industry or farming, may be at higher risk of certain cancers. Environmental pollution by pesticides such as DDT, which is now banned but was used in agriculture in the past, degrades slowly and can lead to accumulation in the food chain and persistent residues in body fat. These residues have been suggested as a possible risk factor for breast cancer, although the evidence has not been conclusive.

Continued research regarding pesticide use is essential for maximum food safety, but pesticides play a valuable role in sustaining the food supply. When controlled properly, the minimal risks they pose are overshadowed by the health benefits of a diverse diet rich in foods from plant sources.

Non-ionizing radiation. Electromagnetic radiation at frequencies below ionizing and ultraviolet levels has not been proven to cause cancer. Some studies suggest it is associated with cancer, but most of the now extensive research in this area does not. Low-frequency radiation includes radiowaves, microwaves, and radar, as well as power frequency radiation arising from the electric and magnetic fields associated with electric currents, cellular phones, and household appliances.

Toxic wastes. Toxic wastes in dump sites can threaten human health through air, water, and soil pollution. Many toxic chemicals contained in such wastes can be carcinogenic at high doses, but most community exposures appear to involve very low or negligible dose levels. Clean-up of existing dump sites and close control of toxic materials in the future are essential to ensure healthy living conditions.

Nuclear power plants. Ionizing radiation emissions from nuclear facilities are closely controlled and involve negligible levels of exposure for communities near the plants. Reports about cancer case clusters in such communities have raised public concern, but studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere.

Summary of American Cancer Society Recommendations for the Early Detection of Cancer in Asymptomatic People

Cancer-related Checkup	A cancer-related checkup is recommended every 3 years for people aged 20-40 and every year for people age 40 and older. This exam should include health counseling and depending on a person's age, might include examinations for cancers of the thyroid, oral cavity, skin, lymph nodes, testes, and ovaries, as well as for some nonmalignant diseases.
Breast	Women 40 and older should have an annual mammogram, an annual clinical breast examination (CBE) by a health care professional, and should perform monthly breast self-examination (BSE). The CBE should be conducted close to and preferably before the scheduled mammogram. Women aged 20-39 should have a clinical breast examination by a health care professional every three years and should perform monthly BSE (see page 10).
Colon & Rectum	Beginning at age 50, men and women at average risk should follow one of the examination schedules below: 1) Fecal occult blood test (FOBT) every year, or 2) Flexible sigmoidoscopy every 5 years,* or 3) FOBT every year and flexible sigmoidoscopy every 5 years,* **(of these 3 options, the American Cancer Society prefers option 3, annual FOBT and flexible sigmoidoscopy every 5 years)** or 4) Double-contrast barium enema every 5 years,* or 5) Colonoscopy every 10 years.* *A digital rectal exam should be done at the same time as sigmoidoscopy, colonoscopy, or double-contrast barium enema. People who are at increased or high risk for colorectal cancer should talk with a doctor about a different testing schedule (see page 12).
Prostate	Beginning at age 50, the prostate-specific antigen (PSA) test and the digital rectal exam should be offered annually to men who have a life expectancy of at least 10 years. Men at high risk (African-American men and men who have a first-degree relative who was diagnosed with prostate cancer at a young age) should begin testing at age 45. Patients should be given information about the benefits and limitations of tests so they can make an informed decision (see page 16).
Uterus	**Cervix:** All women who are or have been sexually active or who are 18 and older should have an annual Pap test and pelvic examination. After three or more consecutive satisfactory examinations with normal findings, the Pap test may be performed less frequently. Discuss the matter with your physician. **Endometrium:** Beginning at age 35, women with or at risk for hereditary non-polyposis colon cancer should be offered endometrial biopsy annually to screen for endometrial cancer (see page 19).

AMERICAN CANCER SOCIETY

OCCUPATION & CANCER

Basic Description

Occupational exposure to cancer-causing (carcinogenic) substances may account for about 4% of all cancers in the United States There is uncertainty, however, about such issues as whether certain substances cause cancer or how much exposure is needed to cause cancer Therefore, truly reliable estimates of both the percentage of cancers caused by occupational exposure to carcinogens and the number of workers exposed to carcinogenic substances (some estimates as high as 7 million) are difficult to obtain

Nevertheless, it is known that certain industrial processes (e g , aluminum production, iron and steel founding, underground mining with exposure to uranium or radon), some chemicals and groups of chemicals (e g., benzene, nickel compounds, vinyl chloride), certain dusts (e g , leather or wood dusts, silica, asbestos), particular pesticides (e g., ethylene oxide, chlorophenoxyl herbicides, asbestos), and radiation exposure (e g , sunlight, nuclear power, medical radiology) are all potential occupational exposures that can cause cancer. In the United States, nearly all of these exposures are well-regulated, but accidents, prolonged unprotected exposure elsewhere, and the latent effects of earlier unprotected exposure can result in occupational cancer risk.

Strength of Evidence

There is strong evidence that, as in the examples above, there are a number of things to which workers can be exposed that cause or may cause cancer

There has been a great deal of research on how to decide if an occupational exposure can cause cancer The International Agency for Research on Cancer (IARC) has developed a way of listing these types of exposures in terms of how strong the evidence is that they cause cancer The IARC lists chemicals, chemical compounds, industrial processes, and naturally occurring radiation and substances to which a worker might be exposed as carcinogenic (causes cancer in humans), probably carcinogenic (probably causes cancer in humans, but more research is needed to be certain), and possibly carcinogenic (some research indicates potential for human cancer, but more research is needed)

By using the IARC strength of evidence classification, scientists, physicians, and regulators can control worker exposure to carcinogens, although new substances and exposures are always being developed In addition, accidents and negligence occur, which require careful attention to workplace cancer safety by workers, employers, and regulators

Cancers Affected

A number of cancers have been associated with chemicals and chemical compounds, industrial processes, and naturally occurring radiation to which workers are exposed. Examples of these cancers and the substances or processes with which they are associated are summarized in the table on the back of this sheet.

Opportunities for Risk Reduction

All cancers of occupational origin are preventable. Strong regulatory control, worker education, and constant attention to safe occupational practices are needed to minimize the workplace potential for exposure to high-dose carcinogens. The U S Food and Drug Administration, the Environmental Protection Agency, and the Occupational Safety and Health Administration all have regulatory responsibilities for developing safety standards for chemical or radiation exposure

In addition, quitting the use of tobacco can dramatically reduce a worker's risk of getting occupationally caused cancers. For instance, among workers exposed to asbestos, smokers are 50 times more likely to get lung cancer than non-smokers

Emerging Trends

- Evidence of the strong contribution of cigarette smoking to occupational cancer risk continues to emerge
- New chemical compounds and industrial processes are being monitored to determine their cancer risk

Cancers Associated with Various Occupations or Occupational Exposure

CANCER	SUBSTANCES OR PROCESSES
Lung	Arsenic, asbestos, chromium compounds, coal gasification, nickel refining, foundry substances, radon, soot, tars, oils, silica
Bladder	Aluminum production, rubber industry, leather industry, 4-aminobiphenyl, benzidine
Nasal cavity and sinuses	Formaldehyde, isopropyl alcohol manufacture, mustard gas, nickel refining, leather dust, wood dust
Larynx	Asbestos, isopropyl alcohol, mustard gas
Pharynx	Formaldehyde, mustard gas
Mesothelioma	Asbestos
Lymphatic and hematopoietic system	Benzene, ethylene oxide, herbicides, X-radiation
Skin	Arsenic, coal tars, mineral oils, sunlight
Soft-tissue sarcoma	Chlorophenols, chlorophenoxy herbicides
Liver	Arsenic, vinyl chloride
Lip	Sunlight

Bottom Line

Most occupations in the United States do not present a risk for getting cancer. However, there are some industries—such as certain types of chemical manufacturing, mining, coal and coke production, and iron and steel founding—in which cancer risk is higher for certain workers Research has identified a range of carcinogens that can present a hazard to workers in these industries if they are exposed to them over time Protection from cancer risk in the workplace is therefore essential and involves a combination of aggressive, scientifically based regulation, worker education, and surveillance

AMERICAN CANCER SOCIETY

For more information call toll free 1-800-ACS-2345
or on the Internet, www cancer org