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FACT SHEET
OCCUPATIONAL CANCER AND RESPONSE TO REPORTS OF CANCERS AT WORK

Growing awareness about health and increased concern about exposures to occupational hazards among workers have led to many questions in recent years about occupational cancers. This information bulletin provides information about cancer and how the New Jersey Department of Health and Senior Services (NJDHSS) responds to concerns about cancers at work.

WHAT IS CANCER?[1-3]

Cancer is a diverse group of more than 100 diseases in which abnormal cells multiply and spread out of control. Cancer is common; in this country, men have a 45 percent chance and women have a 39 percent chance of being diagnosed with some form of cancer during their lifetime. The chances of getting cancer increase with age. However, the survival rate for many cancers has improved in recent years due to earlier diagnosis and improved treatment. The most common cancers among U.S. men are prostate, lung, colon and rectum, urinary bladder, and skin. Among women in this country, the most common cancers are breast, lung, colon and rectum, uterine, ovary, and skin.

The causes are not known for many cancers, but scientists estimate that most cancers are due to lifestyle factors such as smoking, drinking heavily, and a diet with excess calories, high fat, and low fiber. Other important factors related to cancer are reproductive patterns, sexual behavior, and sunlight exposure. Factors related to work or residence, environment, infections, and heredity are thought to be less common causes of cancer. Ten to thirty years or more may pass between the initial exposure to the cause of cancer and the diagnosis of the cancer.

[1]American Cancer Society, *Cancer Facts and Figures - 2003*.
[2]Brownson RC, Reif JS, Alavanja MCR. Cancer. In: *Chronic Disease Epidemiology and Control*. Ed. Brownson RC, Remington PL, Davis JR. American Public Health Association, Washington, D.C., 1993:137-167.
[3]Ries LAG, Eisner MP, Kosary CL, Hankey BF, Miller BA, Clegg L, Mariotto A, Fay MP, Feuer EJ, Edwards BK (eds). *SEER Cancer Statistics Review, 1975-2000*, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2000, 2003.

WHAT IS A CANCER CLUSTER?

A cancer cluster is defined as a much greater number of cancer cases than expected in a group of people, a geographic area, or a period of time. Most suspected cancer clusters are shown not to be true clusters.[4]

HOW ARE REPORTS OF CANCERS AT WORK RESPONDED TO BY THE NJDHSS?

A concern about cancer at work may be reported to the NJDHSS by a worker, a union representative, or an employer. The NJDHSS responds to a report of concern about cancer at work with the assistance of the person who reported the cancers. The following steps describe this process:

Initial Information Collection on the Occurrence of Cancer and the Working Population

The first step in responding to a report of cancer at work is for the person reporting the cancers to provide as much of the following information as possible to the NJDHSS staff:

* the number of people with cancer and the time period; for example, ten people with cancer diagnosed between 1990 and 2002;
* the types of cancer; for example, colon cancer, breast cancer, lung cancer, Hodgkin disease;
* the date of diagnosis, age, sex, and occupation of each of the individuals with cancer;
* how many years the persons with cancer worked in their current jobs or at this workplace;
* the type and size of the work unit; for example, a school with 20 teachers or a fire department with 40 firefighters;
* if there is or was direct exposure to a specific hazard at work, especially anything that is known or suspected to cause cancer; for example, workers who have been exposed to arsenic for the past twenty years;
* the type of work activities; e.g. welding, mixing chemicals, office work.

Decision About the Need for Additional Investigation

The above information is then used by the NJDHSS staff to decide if additional investigation is needed. Some considerations in making this decision are:

* How many cases of cancer are there? Cancer is common so it is expected that some people in a workplace will develop cancer.
* Are the reported cancers of many different types? If there are many different types of cancer, a single occupational cause is less likely than if there is one or only a few types.
* Are the workers with cancer concentrated in a particular job title or location? An occupational exposure is less likely to be the cause if the cancer cases are distributed among different job titles and locations.

[4] *Cancer Clusters*. National Cancer Institute, U.S. Department of Health and Human Services. January 23, 1997.

* Were the workers with cancer employed in the job or at the worksite for at least ten years before the diagnosis of cancer? Cancer usually takes ten to thirty years to develop after first exposure to the cancer-causing agent.
* Are there any known or suspected occupational causes for the reported cancers; and if so, were the workers with the cancers directly exposed to these causes at work? Some common cancers such as breast and prostate do not have a known occupational cause.
* Have scientific studies found an association between the jobs (e.g. firefighter, metal worker) or the industry (e.g. production of benzene or products containing benzene) of the affected workers and the types of reported cancers?

Often a decision is made that additional investigation by the NJDHSS is not necessary. For example, two women with breast cancer among twenty women in an office probably would not need to be further investigated because breast cancer is a common cancer in women with no known cause related to occupation. A situation of two men, one with lung cancer and another with colon cancer, who both worked less than five years at their present workplace would not need further investigation. These cancers are very common among men and would not be very likely due to exposures that began less than five years ago. If no further investigation is needed, NJDHSS staff send a letter to the person who contacted us summarizing our conclusion that no further investigation is needed and why, along with information about the cancers and exposures of concern.

Additional Information Collection

If a decision is made that additional investigation by the NJDHSS is appropriate, the person who reported the cancer concern would be asked to collect more information, using the NJDHSS form, "Report of Cancers at Work." This form includes questions about each person with cancer - name, social security number, address, race, sex, type of cancer, date of diagnosis, date of birth, date of death if deceased, job title, and when the person began employment at this workplace, and the name and address of the physician who diagnosed the cancer. The form also has questions about the work group including the numbers of workers by age, sex and year. All of this information must be kept confidential by the person collecting the information and by the NJDHSS. The information on the types of cancer and dates of diagnosis is confirmed through the New Jersey State Cancer Registry, death certificates, or the physicians who diagnosed the cancers.

Statistical Analysis Based on the Additional Information

If the additional information is obtained and there are enough confirmed cases of cancer, the NJDHSS staff use statistical techniques to determine if there are more cases of cancer among the work group than expected, and if so, whether this is likely to be due to chance. The expected number of cancer cases usually is based on state-wide cancer incidence rates (number of new cases of cancer per 100,000 people) from the New Jersey State Cancer Registry and the age and sex distribution of the work group. The NJDHSS issues a report with the results of the statistical

analysis, any additional information, and recommendations.

Industrial Hygiene Evaluation of the Workplace

The NJDHSS staff may recommend an industrial hygiene evaluation of the workplace at any point in our response to a report of cancers at the workplace. Examples are:

* The person reporting the cancers describes a situation in which there appears to be current exposure at work to a cancer-causing or otherwise hazardous substance.
* The statistical analysis of the reported cancers shows that there is more cancer than expected in the work group.

The purpose of the industrial hygiene evaluation of the workplace is to determine if employees are currently exposed to hazards. Recommendations are made to protect workers from current hazards. Depending on the situation, a worksite industrial hygiene evaluation may be performed by:

* NJDHSS industrial hygiene staff, in the case of public employees;
* a consultant hired by the employer; or
* the employer's in-house industrial hygiene staff.

WHAT ARE THE KNOWN OCCUPATIONAL AND NON-OCCUPATIONAL CAUSES OF CANCER?

The tables on the following pages, which list the major causes of cancer, are used to help decide the response to reported cancers at work. For more information on cancer, contact the Cancer Epidemiology Services of the NJDHSS at (609) 588-3500.

Free information on cancer can also be obtained from:

* NJDHSS Cancer Resources Website (http://www.state.nj.us/health/cancer).
* American Cancer Society (http://www.cancer.org) publishes "Cancer Facts & Figures" - call 1-800-ACS-2345 or contact your local chapter.
* National Cancer Institute (http://www.cancer.gov) publishes "Cancer Rates and Risks" - call 1-800-4-CANCER.

Information on hazardous exposures in the workplace can be obtained from:

* Occupational Health Services, NJDHSS (http://www.state.nj.us/health/eoh/odisweb) - call 609-984-1863.
* National Institute for Occupational Safety and Health (http://www.cdc.gov/niosh or http://www.cdc.gov/niosh/topics/cancer) - call 1-800-356-4674.

* Agency for Toxic Substances and Disease Registry (ATSDR) (http://www.atsdr.cdc.gov) - call 1-888-422-8737.

* National Institute for Environmental Health Sciences (NIEHS) (http://www.niehs.nih.gov) - call 919-541-3345.
* National Toxicology Program (NTP) (http://ntp-server.niehs.nih.gov)

TABLE 1
KNOWN OCCUPATIONAL CAUSES OF CANCER[1]

EXPOSURE	CANCERS	TYPES OF WORKERS POTENTIALLY EXPOSED
4-Aminobiphenyl	Bladder	Workers in the production of 4-aminobiphenyl
Arsenic (inorganic compounds, e.g. arsenic pentoxide, arsenic trioxide)	Skin, lung, gastro-intestinal, kidney	Workers in mining and in copper and other smelting involving arsenic, in pesticide application, and in wood preservation
Asbestos	Lung, larynx, mesothelioma[2], gastrointestinal	Workers in mining and milling of asbestos, in manufacture of asbestos products, in ship-building and construction trades, in asbestos insulation, in building demolition, in asbestos abatement, and in brake repair and in building maintenance
Benzene (and benzene-containing solvents)	Leukemia	Workers in the production of benzene and in the use of products containing benzene; car mechanics; benzene is used extensively as a solvent in the chemical and drug industries and as a gasoline additive
Benzidine and dyes metabolized to benzidine	Bladder	Workers in the production of benzidine and benzidine-based dyes and in the garment, leather, printing, paper and homecraft industries where benzidine-based dyes are used
Beryllium (and beryllium compounds)	Lung	Beryllium miners, alloy makers and fabricators; phosphorus manufacturers; ceramics workers; missile technicians; nuclear reactor workers; electronic equipment workers; jewelers
1,3-Butadiene	Lymphatic system, blood-forming system	Workers in the chemicals and allied products, 1,3-butadiene manufacturing, and rubber industries

TABLE 1. continued

		TYPES OF WORKERS POTENTIALLY

EXPOSURE	CANCERS	EXPOSED
Cadmium (and cadmium compounds)	Lung	Workers in zinc and lead ore smelting; producing, processing, & handling cadmium powders; cadmium-coated steel welding; nickel-cadmium battery manufacture
Bis(chloromethyl) ether and technical-grade chloromethyl methyl ether	Lung (mainly small-cell type)	Chemical plant workers, ion exchange resin makers, laboratory workers, polymer makers
Chromium hexavalent compounds	Lung	Workers in stainless steel production and welding and the chromate production, chrome plating, ferrochrome alloys, chrome pigment, and tanning industries
Environmental tobacco smoke	Lung	Workers in restaurants, bars, casinos, and offices where smoking is permitted; workers in airplanes (before smoking was banned)
Erionite (a zeolite[3])	Mesothelioma[2]	Workers in mining and production of other natural zeolites or in the production or use of zeolite-containing products
Ethylene oxide	Lymphatic system, blood-forming system	Workers in manufacture of ethylene oxide and its derivatives; manufacture of products where ethylene oxide is used as a sterilant; hospital/healthcare workers; ethylene oxide is used as a sterilant in the manufacture of medical devices, healthcare products, pharmaceuticals, and spices.
Mustard gas	Respiratory tract	Not manufactured or used in the U.S. at present; to date, workers most likely exposed have been military personnel
2-Naphthylamine	Bladder	Laboratory technicians and scientists who use it in research
Nickel Compounds	Lung, nasal	Workers in mining, smelting, welding, casting, spray painting and grinding, electroplating, production and use of nickel catalysts, polishing of nickel-containing alloys, other jobs where nickel compounds are produced or used

TABLE 1. continued

		TYPES OF WORKERS POTENTIALLY

EXPOSURE	CANCERS	EXPOSED
Radon	Lung	Underground uranium miners, other underground workers and certain mineral processing workers
Silica, crystalline (respirable size)	Lung	Workers in quarrying and mining of coal and other minerals; stone cutting and construction; ceramics; foundry work; sandblasting; polishing & grinding; manufacture of abrasives, plastics, rubber and paint; production of cement, scouring soap, tile and clay; boiler scaling; road construction and repair; insulation production and installation
Strong inorganic acid mists containing sulfuric acid	Lung, laryngeal	Workers in the chemical manufacture, building and construction, lead-acid battery, phosphate fertilizers, metal, petroleum and coal products, oil and gas extraction, printing, paper, and tannery industries
2,3,7,8-Tetrachlo-rodibenzo-ρ-dioxin (TCDD or "Dioxin")	Lung, non-Hodgkin lymphoma	Workers in waste incineration; firefighting; chemical research; paper bleaching; herbicide production; and production or use of pentachlorophenol and other chlorinated compounds
Thorium dioxide	Liver	Ceramic makers, incandescent lamp makers, magnesium alloy makers, metal refiners, nuclear reactor workers, chemists, vacuum tube makers, workers in tin, rare-earth metal and phosphate mining and processing industries, workers in formulation, packaging, preparation or administration of thorium dioxide as a pharmaceutical
Vinyl chloride	Liver, brain, lung, lymphatic system, blood-forming system	Workers involved in vinyl chloride polymerization to form other materials, usually PVC resins, and in the piping to storage or transport or maintenance of the finished polymer

TABLE 1. continued

EXPOSURE	CANCERS	TYPES OF WORKERS POTENTIALLY EXPOSED
Wood dust	Nasal	Workers who use machinery or tools to cut or shape wood, especially sanders in the transportation equipment and wood cabinet industries, press operators in the wood products industry, and lathe operators in the furniture industry
Coke oven emissions	Lung, genitourinary system	Workers in the production of coke from coal or in using coke to extract metals from their ores, in the synthesis of calcium carbide, or in the manufacture of graphite and electrodes
Soots	Lung, skin (particularly of the scrotum)	Chimney sweeps, heating-unit service workers, brick masons and helpers, building demolition workers, insulators, firefighters, metallurgical workers, horticulturalists
Coal tars and coal tar pitches	Skin (including scrotum), lung	Workers in coke production, coal gasification, aluminum production, foundries, and wood preservation and in production or use of pavement tar, roofing tar, coal tar pitch, coal tar paints, coal tar coatings, coal tar enamels, and refractory bricks
Untreated and mildly refined mineral oils	Skin (particularly of the scrotum), lung	Workers in the manufacture of automobiles, airplanes and parts, steel, screws, pipes, precision parts, transformers, in brass products and aluminum production, and in engine repair, copper mining, and newspaper and commercial printing

[1]National Toxicology Program, *U.S.D.H.H.S. Report on Carcinogens, Tenth Edition,* 2002.
[2]Cancer of the lining of the lung or abdomen.
[3]Zeolites are minerals, common in the western United States.

TABLE 2

KNOWN NON-OCCUPATIONAL CAUSES OF CANCER[1-9]

CAUSE	CANCERS	HOW EXPOSED
Cigarettes	Lung, mouth, pharynx, larynx, esophagus, pancreas, uterine cervix, bladder, kidney, nasal, stomach, liver, myeloid leukemia	Smoking cigarettes
Smokeless tobacco	Oral cancers especially cheek, gum	Use of the plug, leaf, or snuff forms of tobacco, especially dipping snuff
Cigars	Oral, larynx, esophagus	Smoking cigars
Environmental tobacco smoke[10]	Lung	Breathing smoke from other people's cigarettes
Alcohol	Mouth, larynx, throat, esophagus, liver, breast	Heavy drinking of alcoholic beverages
Diet	Colon, rectum, prostate, uterus	Eating foods high in fat, especially red meat
	Stomach, lung, esophagus, colon, rectum	Low intake of fruits and vegetables
Infections		
Helicobacter pylori	Stomach	Person-to-person contact
Hepatitis B Virus	Liver	Contact with infected person's blood, sexual contact, mother-to-child transmission during pregnancy
Hepatitis C Virus	Liver	Contact with infected person's blood, mother-to-child transmission during pregnancy
Human Papilloma Virus (certain strains)	Cervix	Sexual contact

TABLE 2. continued

CAUSE	CANCERS	HOW EXPOSED
Obesity	Colon, rectum, prostate, uterus, breast (among postmenopausal women), kidney	Greater caloric intake than energy output
Sunlight[10] (ultraviolet radiation)	Skin (melanoma and non-melanoma)	Outdoor activities in which the skin is not protected, exposure to tanning lamps. Severe sunburns during childhood may greatly increase the risk of melanoma in later life.
Radon[10]	Lung	Radon in the ground, groundwater, or building materials enters homes in the air, decays, and is breathed in.
Reproductive history in women: Young age at first menstruation or older age at menopause Never bearing children Bearing first child after age 30	 Breast, uterus Breast, uterus, ovary Breast	Evidence suggests that the longer a woman is exposed to the hormone estrogen (estrogen made by the body, taken as a drug, or delivered by a patch), the more likely she is to develop breast cancer. For example, the risk is somewhat increased among women who began menstruation at an early age (before age 12), experienced menopause late (after age 55), never had children, or took hormone replacement therapy for long periods of time. Each of these factors increases the amount of time a woman's body is exposed to estrogen. Women who are exposed to estrogen for a longer time also have a higher risk for cancer of the uterus.
Oral contraceptives	Small <u>increased</u> risk for breast cancer, especially long-term use and among recent or current users <u>Decreased</u> risk for cancers of the ovary and uterus	Women take oral contraceptives for birth control purposes. Oral contraceptives used now contain lower dosages of hormones than in the past.

TABLE 2. continued

CAUSE	CANCERS	HOW EXPOSED
Peri- and post-menopausal hormonal replace-ment therapy, especially long-term use	Breast, uterus	Women use hormone replacement therapy to treat the symptoms during and after menopause.
Early age at first sexual intercourse, many sexual partners, having sex with a partner who has had many sexual partners	Cervix	Women with these risk factors are at increased risk for infection with human papilloma virus, which may increase the risk for cancer of the cervix.

[1]American Cancer Society. *Cancer Facts and Figures - 2003.*
[2]Harras A, editor. *Cancer Rates and Risks*. USDHHS. 1996.
[3]International Agency for Research on Cancer. Scientific review meeting on *IARC Handbooks of Cancer Prevention, Volume 8, Fruits and Vegetables*, 2003 (Website: http://www.iarc.fr).
[4]*IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 59, Hepatitis Viruses, 1994.
[5]*IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 61, Schistosomes, Liver Flukes, and *Helicobacter pylori*, 1994.
[6]*IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 64, Human papillomaviruses, 1995.
[7]*IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 72, Hormonal Contraception and Post-Menopausal Hormonal Therapy, 1999.
[8]*IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*. Volume 83, Tobacco Smoke and Involuntary Smoking (in preparation) (Website: http://www.iarc.fr).
[9]National Cancer Institute. What You Need To Know About Breast Cancer. Information about detection, symptoms, diagnosis, and treatment of breast cancer. NIH Publication No. 00-1556. Posted: 11/20/2000, Updated 06/04/2003.
[10]Environmental tobacco smoke, radon, and sunlight can also be occupational hazards.

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