

## Avoidable Occupational and Environmental Causes of Cancer

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## Global Cancer Incidence and Mortality

- 12.1 million new cases estimated in 2007 (5.4 million in developed countries, 6.7 million in developing countries)
  - Lung cancer is the leading site (excluding non-melanoma skin cancer), followed by breast cancer
- 7.6 million cancer deaths estimated in 2007 (2.9 million in developed countries, 4.7 million in developing countries)
  - Lung, followed by stomach and colo-rectal cancer
    - Source: American Cancer Society, "Global Cancer Facts & Figures - 2007" available at [www.cancer.org](http://www.cancer.org)

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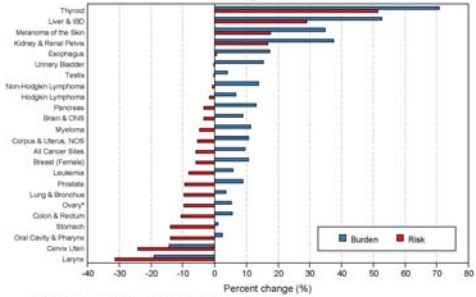
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Incidence Percent Change between 1994 and 2003  
 Numbers (burden) vs Rates (risk)  
 All Ages



US incidence estimates based on SEER age-specific rates applied to US population.  
 Burden is the change in the number of incident cases between 1994 and 2003.  
 Risk is the change in the cancer incidence rates between 1994 and 2003.  
 \*Ovary includes borderline cases or histologies 8442, 8451, 8452, 8472, and 8473.

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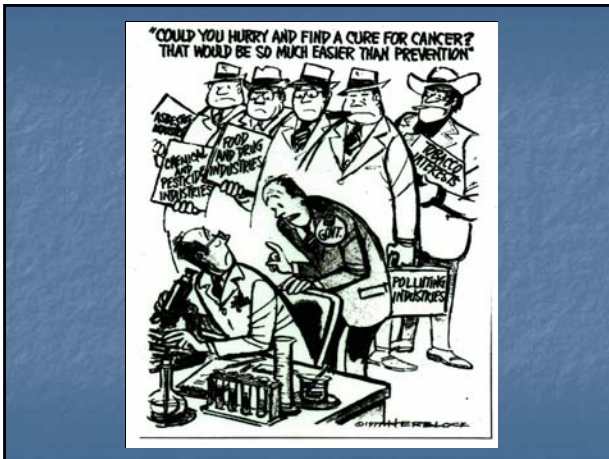
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### Doll & Peto, 1981

TABLE 20.—Proportions of cancer deaths attributed to various different factors

Text section No.	Factor or class of factors	Percent of all cancer deaths	
		Best estimate	Range of acceptable estimates
5.1	Tobacco	30	25-40
5.2	Alcohol	3	2-4
5.3	Diet	35	10-70
5.4	Food additives	<1	-5 <sup>a</sup> -2
5.5	Reproductive <sup>b</sup> and sexual behaviour	7	1-13
5.6	Occupation	4	2-8
5.7	Pollution	2	<1-5
5.8	Industrial products	<1	<1-2
5.9	Medicines and medical procedures	1	0.5-3
5.10	Geophysical factors <sup>c</sup>	3	2-4
5.11	Infection	10 <sup>d</sup> ?	1-?
5.12	Unknown	?	?

Source: Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. *Journal of the National Cancer Institute*. 1981. 66(6):1191-1308.

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### Doll & Peto, 1981

#### Notable Limitations:

- Relied on epidemiologic studies of workers in large industries.
- Did not consider exposures in smaller work places.
- Did not consider exposures from indirect contact with carcinogens.
- Excluded deaths of people 65 and over

Source: Clapp R, Howe G, Jacobs M. "Environmental and Occupational Causes of Cancer," 2005.

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IARC: Examples of agents classified as human carcinogens (not necessarily found in occupational settings)

- Alcohol - in alcoholic drinks
- Arsenic - in drinking water, wood preservatives, pesticides
- Benzene - in vehicle exhaust, cigarette smoke, some pesticides, around refineries
- Cadmium - as a stabilizer in PVC products, in re-chargeable batteries & phosphate fertilizers
- Dioxin - combustion of chlorinated plastics, wood preservatives
- Formaldehyde (IIA) - in resins and common household materials and products
- Radiation (ionizing) - in radioactive material, high-voltage equipment, around nuclear reactors
- Vinyl chloride - in polyvinyl resins and products

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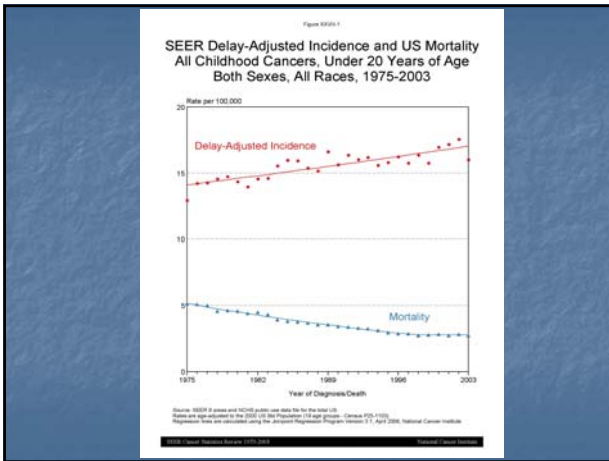
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Melanoma: Documented Links

- UV radiation [Strong]

Thyroid Cancer: Documented Links

- Ionizing radiation [Strong]
- ethylene thiourea (ETU) [Good]

Source: Solomon G, Schettler T, Janssen S. "CHE Toxicant and Disease Database." Accessed 3-22-06: <http://database.healthandenvironment.org/>.

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### Non-Hodgkin's Lymphoma: Documented Links

- 1,3-butadiene [Strong]
- Benzene [Strong]
- Dioxins/TCDD [Strong]
- 2,4-D [Good]
- Agent Orange [Good]
- Aldrin [Good]
- Aromatic amines [Good]
- Carbon tetrachloride [Good]
- Chlorophenols [Good]
- Creosotes [Good]
- DDT/DDE [Good]
- Dicamba [Good]
- Dichlorvos [Good]
- Ionizing radiation [Good]
- MCPA [Good]
- Organochlorine pesticides [Good]
- Organophosphates [Good]
- PCBs [Good]
- Phenoxyacetic acid herbicides [Good]
- Solvents [Good]
- Tetrachloroethylene (PCE) [Good]
- Trichloroethylene (TCE) [Good]

Source: Solomon G, Schettler T, Janssen S. "CHE Toxicant and Disease Database." Accessed 3-22-06: <http://database.healthandenvironment.org/>.

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### Breast Cancer: Documented Links

- Active smoking [Strong]
- Estrogens/DES [Strong]
- Ethyl alcohol (ethanol) [Strong]
- Ionizing radiation [Strong]
- Secondhand smoke [Strong?]
- Aromatic amines [Good]
- Ethylene oxide [Good]
- PAHs [Good]
- PCBs [Good]
- Progestins [Good]
- Solvents [Good]
- tetrachloroethylene (PCE) [Good]

Source: Solomon G, Schettler T, Janssen S. "CHE Toxicant and Disease Database." Accessed 3-22-06: <http://database.healthandenvironment.org/>.

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### New Endicott (New York) IBM study

- The original IBM manufacturing plant
  - Manufactured typewriters, guns, clocks, printed circuit boards
  - Exposures included asbestos, benzene, tetrachloroethylene, trichloroethylene, etc.
- Widespread community groundwater contamination with TCE
  - IBM sold the plant in 2002

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## Endicott mortality study results

- Melanoma PCMR=367; 95% CI: 119,856\*
- Lymphoma (males) PCMR=220; 95% CI: 101,419\*
- Kidney (males) PCMR=165; 95% CI: 45,421
- Brain (males) PCMR=190; 95% CI: 52,485
- Breast (females) PCMR=126; 95% CI: 34,321
  - \* statistically significant (p<.05)
  - Note: These results are very similar to the pattern seen in IBM San Jose (California) workers in a study published in *Environmental Health* in October, 2006 (see [www.ehjournal.net](http://www.ehjournal.net))

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### A Few Lessons from History

"Environmental carcinogenesis is the newest and one of the most ominous of the endproducts of our industrial environment. Though its full scope and extent are still unknown..., enough is known to make it obvious that extrinsic carcinogens present a very immediate and pressing problem in public and individual health."

-- Wilhelm Hueper, senior scientist  
U.S. National Cancer Institute  
*Environmental Cancer*, 1948

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### The Precautionary Principle

"If the lessons from the tobacco control experience are applied in other areas, even greater gains can be made in cancer prevention."

-- Canadian Cancer Statistics 2005

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The Need to Act on What We Know

"It is time to start pursuing alternative paths. From the right to know and the duty to inquire flows the obligation to act."

-- Sandra Steingraber  
*Living Downstream*, 1997

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Richard W. Clapp, D.Sc.  
Genevieve K. Howe, MPH  
Molly M. Jacobs, MPH

September 2005  
And 2007 Update  
With E. Loechler

[www.sustainableproduction.org](http://www.sustainableproduction.org)  
[www.healthandenvironment.org](http://www.healthandenvironment.org)

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**A Way Forward**

- Blue-green alliances
- Beyond REACH
- Alternatives research and green chemistry
- Making peace with the planet as the guiding principle

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