N.W.~~Spiner~~/~~R.T. Brannon~~/R.E. Peele — I mentioned this in our 2/12 meeting on KV Doug Ross
Very interesting B.

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Received Feb 1979

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October 24th, 1978

Occupational Safety & Health Administration
Office of Consumer Affairs
Room N-3635
U.S. Department of Labor
Third Street and Constitution Avenue, N.W.
Washington, D.C. 20210

Re: Docket # H 090

Dear Sirs:

Enclosed is my Post-Hearing Comment. The statements, data and arguments in it should not be interpreted as being those of the New York University Medical Center, as an institution.

Yours truly,

Harry B. Demopoulos, M.D.
Associate Professor
(for identification purposes only)

HBD:nz
Enclosures

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Post Hearing Comments:
A Dispassionate, Scientific Review of the Predominant Causes of the Major Lethal Cancers in People, in the United States

by

Harry B. Demopoulos, M.D.

Regarding the proposed new regulation concerning the identification, classification and regulation of toxic substances posing a potential occupational carcinogenic risk, by OSHA, docket # H 090

The comments, data and arguments herein should not be interpreted as being those of the New York University Medical Center, as an Institution

I. Introduction

I have participated in the recent OSHA Hearings that have focused on the proposed regulations to control carcinogens in the workplace because the studies that were conducted while I was the Director of the fledgling Cancer Center Institute of New Jersey (CINJ) in 1976 are directly relevant to the fears and concerns expressed by OSHA, the labor unions, and selected academicians. This Post-Hearing Comment is made for the same reasons, and on the same basis, i.e., the responsibility to report to the public, the results of studies performed with public funds, that have a bearing on the public welfare.

A great deal of effort was expended at CINJ to probe the bedeviling question of what was causing so much cancer in the state of New Jersey, as indicated by the National Cancer Institute's U.S. Cancer Mortality by County: 1950-1969. In these probes we sought help for the public at large, and for the workers in the enormous chemical/petroleum plants in New Jersey by turning to the best available, objective data for clues as to the major causes of the lethal cancers. The weapons that could bring about a significant reduction in the cancer statistics that had placed New Jersey at the top of the mortality rate were: 1) Prevention and 2) Early Detection. The latter weapon was clear cut in that several leading cancer killers, like breast, colon, and uterine cancer, were amenable to inexpensive screening tests, and numerous studies had demonstrated that early diagnosis, while the primary cancer was still small and asymptomatic, could result in immediate striking decreases in the projected, future death rates. Prevention, however, required the knowledge of who the "real culprits" were in cancer causation; we recognized that if we chased the wrong ones, then the real culprits would continue to get away to add to the toll. When resources are limited, as ours were at CINJ then, and as the nation's are now, there is no margin for error. This search had become clouded in 1976 in New Jersey, with the media carrying almost daily reports provided by various officials that "... it's in the water...", "...it's in the air...", "...it's industry!" Now, in 1978, at the national level, the direction that Prevention efforts should proceed in are similarly enshrouded. The studies conducted at CINJ provide directions for Prevention efforts at a national level and are reviewed herein. Our data resources included the bibliographic references in this document as well as two major works by the National Cancer Institute:

- the NCI's Third National Cancer Survey: Incidence Data (1969-1971), which yields age-corrected cancer data on approximately 10% of the nation's population with sample areas that include: urban areas with heavy chemical industry (Detroit, Pittsburg, Birmingham); urban areas without heavy chemical industry (Atlanta, Dallas, Minneapolis); comparatively rural areas devoid of heavy chemical industry (States of Iowa and Colorado). The data is provided according to sex, race, age, standardized anatomic site of the original primary malignancy, and geographic areas. The data is expressed per 100,000 population and was certified as accurate by high-quality microscopic examinations of the malignancies.

- the NCI's U.S. Cancer Mortality by County: 1950-1969, which provides age-corrected cancer death rates, by sex, race and county, per 100,000 population for the 20 year period, 1950-1969; this data covered every county in the United States; by cross-checking with other federal studies and with encyclopedic references, we were able to compare geographic areas of similar urban density, with and without heavy chemical and petroleum industry.

II. Consideration of Major Variables in Cancer Causation.

Our rationale for conducting these studies was as follows. If the Heavy Chemical and Petroleum Industries do pose a carcinogenic threat to their employees, and worse yet, to the public at large who live in juxtaposed communities, then there should be higher cancer incidence and higher cancer mortality rates in those geographic areas of the United States that have Heavy Chemical/ Petroleum Industries, compared to other areas of the U.S.A. that are similar in urban density and in other major variables. Before embarking on studies that could guide Prevention efforts, we reviewed the major variables in cancer causation.

Other studies, published by noted epidemiologists, including those from the NCI, have substantiated the need to control for the variable of urban density when making comparisons of cancer incidence and cancer mortality. (Hoover, R., Mason, T.J., McKay, F.W., and Fraumeni, J.F. Geographic patterns of cancer mortality in the United States. In: Persons At High Risk. (ed) J.F. Fraumeni, New York, Academic Press, 1975, p. 343). Urban density is as important as age, sex and race in the development of cancer; the percentage differences between urban and rural areas are on the average larger than the differences seen between the sexes and the races. For specific types of cancers the urban-rural differences can be very large, as shown in the accompanying Table I from Hoover's cited paper. The listed ratios can be converted to percent by subtracting 1 from the ratio and then multiplying by 100, e.g., a ratio of 3.08 is 208%, a ratio of 2.96 is 196%, etc. The increases due to urbanization are substantial and as other studies to be cited in this presentation will show, the increases are not due to air pollution from cars and industry (see Section III Cancer and Air Pollution in this document).

Table 2 from Hoover's cited paper, shows the relationship of Socio Economic Status (SES) within a race, and increased cancer risk with higher SES, certain major cancers are increased, e.g., rectum 113%, thyroid 72%, colon 67%, bladder 67%, etc. The generally higher incomes and higher standards of living, particularly for whites, with in urban areas compared to rural, may account for some of the urban-rural differences.

The question now at CINJ was, in view of the fact that New Jersey's population is the most urbanized of any state (nearly 90%), were the rates really high? The surprising answer was no. In fact, areas such as Nassau County, and Westchester County (wealthy, urbanized suburbs of New York City devoid of industry), San Fransisco, and district of Columbia, had higher or equally high cancer mortalit

TABLE 1

Urban-rural ratios of age-adjusted cancer mortality rates[a] among whites in the contiguous United States, according to cancer site and sex, 1950-1969

Male Site	Urban/rural	Female Site	Urban/rural
Esophagus	3.08	Esophagus	2.12
Larynx	2.96	Rectum	2.11
Mouth and throat	2.88	Larynx	1.92
Rectum	2.71	Nasopharynx	1.66
Nasopharynx	2.17	Lung	1.64
Bladder	2.10	Breast	1.61
Colon	1.97	Bladder	1.58
Lung	1.89	Other endocrine glands	1.52
Breast	1.77	Ovary	1.52
All malignant neoplasms	1.56	Colon	1.51
Thyroid gland	1.56	Non-Hodgkin's lymphoma	1.42
Other endocrine glands	1.53	Hodgkin's disease	1.39
Stomach	1.45	Thyroid	1.38
Kidney	1.44	All malignant neoplasms	1.36
Non-Hodgkin's lymphoma	1.39	Stomach	1.35
Other and unspecified	1.38	Pancreas	1.34
Connective tissue	1.35	Mouth and throat	1.29
Pancreas	1.34	Connective tissue	1.28
Biliary passages and liver (primary)	1.34	Brain	1.26
Salivary glands	1.31	Multiple myeloma	1.25
Hodgkin's disease	1.25	Other and unspecified	1.17
Brain	1.21	Leukemia	1.15
Multiple myeloma	1.12	Kidney	1.12
Nasal sinuses	1.10	Salivary glands	1.12
Leukemia	1.07	Nasal sinuses	1.08
Bone	1.05	Biliary passages and liver	1.04
Melanoma of skin	1.01	Corpus uteri	1.00
Prostate	.96	Cervix uteri	1.00
Testis	.96	Eye	.92
Eye	.77	Bone	.89
Other skin	.67	Melanoma of skin	.87
Lip	.57	Other skin	.65
		Lip	.29

[a]Rates were calculated for 100 percent urban and 100 percent rural counties.

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TABLE 2

Social-class ratios of age-adjusted cancer mortality rates[a] among whites in the contiguous United States, according to cancer site and sex, 1950-1969

Male		Female	
Site	Social-class ratio (high/low)	Site	Social-class ratio (high/low)
Rectum	2.13	Rectum	1.67
Thyroid gland	1.72	Breast	1.54
Colon	1.67	Ovary	1.52
Bladder	1.67	Other endocrine glands	1.52
Other endocrine glands	1.59	Non-Hodgkin's lymphoma	1.49
Connective tissue	1.54	Colon	1.45
Kidney	1.49	Connective tissue	1.43
Esophagus	1.49	Multiple myeloma	1.39
Non-Hodgkin's lymphoma	1.37	Hodgkin's disease	1.37
Multiple myeloma	1.35	Brain	1.35
Mouth and throat	1.19	Nasopharynx	1.28
Testis	1.18	Lung	1.27
Breast	1.18	Bladder	1.19
Brain	1.18	All malignant neoplasms	1.18
All malignant neoplasms	1.16	Kidney	1.14
Hodgkin's disease	1.14	Eye	1.12
Leukemia	1.11	Pancreas	1.10
Lung	1.10	Thyroid gland	1.09
Nasopharynx	1.10	Leukemia	1.06
Prostate	1.09	Stomach	1.03
Stomach	1.09	Nasal sinuses	1.01
Larynx	1.02	Esophagus	.97
Pancreas	1.01	Corpus uteri	.94
Melanoma of skin	.98	Biliary passages and liver	.94
Nasal sinuses	.96	Salivary glands	.86
Biliary passages and liver	.88	Other and unspecified	.85
Eye	.87	Melanoma of skin	.85
Other and unspecified	.85	Mouth and throat	.78
Salivary glands	.83	Cervix uteri	.74
Lip	.81	Bone	.69
Bone	.81	Larynx	.67
Other skin	.53	Other skin	.47
		Lip	.32

[a] *See* text for method of choosing high and low social-class counties.

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rates, for white males, per 100,000. The white male cancer rates, incidentally, are most often used for comparisons because they account for the largest numbers of cancers.

Philadelphia	221/100,000
St. Louis, Missouri	220/100,000
New York City	215/100,000
Nassau County (an Eastern suburb of New York City)	212/100,000
San Francisco	206/100,000
Chicago	206/100,000
New Jersey	205 100,000
District of Columbia	203/100,000
Westchester County (a Northernsuburb of New York City)	200/100,000
U.S.A. Nationwide	174/100,000

This initial CINJ study demonstrated that serious misimpressions could be made if comparisons were made against invalid controls, wherein a key variable, such as urbanization, is not considered. In Dr. Samuel S. Epstein's book, the Politics of Cancer (Sierra Club Books, San Fransisco, 1978) this type of error is made in his Table 1.10, p. 29, wherein he compares New Jersey, Wyoming and North Carolina. As a result of this comparison he concludes that New Jersey's higher rates are due to the Chemical, Petroleum Industries. Unfortunately, uncontrolled comparisons such as these by Epstein form the basis for much of the book, and for much of the document submitted to OSHA by NIOSH, NCI, and NIEHS, entitled Estimates of the Fraction of Cancer in the United States Related to Occupational Factors. The latter document, quite erroneously, relies heavily on extrapolations from an article published in Ca-A Journal for Clinicians (volume 28, 1978, p.87) by I.J. Selikoff and E.C. Hammond, entitled Asbestos-associated disease in United States shipyards. In this article, comparisons are made between the cancer deaths in asbestos insulation workers, and those expected cancer deaths in the average white male, as obtained from age-specific mortality data from the U.S. National Center for Health Statistics. As seen in Table 1 and Table 3 of this article by Selikoff and Hammond, a comparison with the average U.S. white male suggests that asbestos workers have approximately a 200% greater cancer rate; for example, Table 1, 319 total cancer deaths Expected, versus 994 Observed in the workers. Many, if not most of the asbestos insulation workers were in urban areas, which could, in and of itself, account for much of the 200% apparent increase in cancer rates among the asbestos workers. Further, Selikoff's data does not take into account other factors, besides urban-rural differences, that markedly increase the risk for several forms of cancer. For example, socio-economic status, cigarette smoking, alcohol consumption, and fat ingestion (see References at end of this document). The asbestos insulation workers were high wage earners, a factor that made Selikoff's follow-up relatively easy since there was a low rate of job turn-over; however, this led to increases in socio-economic status. The lack of controlling for cigarette use in the asbestos cancer deaths is seriou since several forms of cancer are caused by smoking. Hammond (Tobac

TABLE 1

Deaths among 17,800 asbestos insulation workers in the United States and Canada January 1, 1967–January 1, 1977

Number of men	17,800
Man-years of observation	166,853

	Expected*	Observed
Total deaths, all causes	1,660.96	2,270
Total cancer, all sites	319.90	994
Lung cancer	105.37	485
Pleural mesothelioma	**	66
Peritoneal mesothelioma	**	109
Cancer of esophagus	7.01	18
Cancer of stomach	14.23	22
Cancer of colon-rectum	37.38	59
All other cancer	154.83	235
Asbestosis	**	162
All other causes	1,351.06	1,114

*Expected deaths are based upon white male age specific mortality data of the U.S. National Center for Health Statistics for 1967-1975 and extrapolation to 1976.

**These are rare causes of death in the general population.

The membership of the International Association of Heat and Frost Insulators and Asbestos Workers, AFL-CIO, CLC, was enrolled on January 1, 1967, and has been observed since.

TABLE 3

Deaths among 17,800 asbestos insulation workers in the United States and Canada January 1, 1967–January 1, 1977: Analysis by duration from onset of employment

	Before 20 years from onset		20 or more years from onset	
Total men	12,583		12,051	
Man-years of observation	89,466		77,389	
	Expected*	Observed	Expected*	Observed
Total deaths, all causes	283.93	324	1,377.01	1,946
Cancer, all sites	42.65	83	277.25	911
Lung cancer	12.03	36	93.34	449
Pleural mesothelioma	**	2	**	64
Peritoneal mesothelioma	**	3	**	106
Cancer of esophagus	0.66	1	5.35	17
Cancer of stomach	1.56	1	12.67	21
Cancer of colon-rectum	4.07	4	33.79	55
Asbestosis	**	8	**	154

*Expected deaths are based upon white male age specific mortality data of the U.S. National Center for Health Statistics for 1967-1975 and extrapolation to 1976.

**These are rare causes of death in the general population.

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In: Persons at High Risk of Cancer. (ed.) J.F. Fraumeni, New York, Academic Press, 1975, p. 151) has shown statistically significant increases in cancer death rates in smokers in the following forms of cancer:

buccal cavity	890%
lung	684%
larynx	509%
esophagus	317%
pancreas	169%
bladder	100%

It is imperative when comparing cancer data for the purposes of strategizing a Prevention program to control for the variables discussed in this section. In using national data, it is often impossib to obtain information on socio-economic status, and the consumption c cigarettes, alcohol and fats. However, urban densities can be readil controlled and can prove valuable, as indicated in the next section.

III. Urban Centers With and Without Chemical/Petroleum Industry

In studying the Third National Cancer Survey: Incidence Data (1969-1971) comparative data was obtained which is summarized in the accompanying Table. The tabular data lists all cancers for all the standardized anatomic sites, as well as for three anatomic sites tha are allegedly more likely to develop malignancy if the person lives in a county with heavy chemical/petroleum industry (see Blot, W.J., Brinton, L.A., Fraumeni, J.F., and Stone, B.J. Cancer mortality in U.S. Counties with petroleum industries. Science 198: p.51, 1977). In Blot's study, a major point was made of the data which suggested that the risk of developing cancers of the lung, nasopharynx and stomach were significantly greater in the 39 petroleum/chemical counties studied. It should be pointed out, incidentally, that Blot's selection of these 39 counties was not based on any attempt to choos a representative sample of the 604 petroleum counties in the U.S. This is freely admitted in Blot's article. Hence, although Blot's study was not meant to be representative, many individuals have made unwarranted extrapolations and have concluded that Blot's study shows that the chemical/petroleum industries in the 604 petroleum counties pose a higher cancer risk to the public, and to the workers. Therefore, these extrapolators of Blot's work continue, there is an urgent need to have far more stringent control over occupational exposures to chemicals. Many of the extrapolations of Blot's work show serious inconsistencies, e.g., there was no increase in lymphomas and leukemias in Blot's, yet, Epstein, in his book, The Politics of Cancer, p. 122, states that benzene causes lymphomas and leukemias, and that the petroleum/chemical industries therefore cause these types of cancers through environmental pollution with beneze

The data in the table show, quite surprisingly, that over-all cancer incidence is lower in those urban areas with industry (average 299/100,000) compared to urban areas without industry (average 31-/ 100,000), and that there is no significant difference in the incidenc of cancers that some individuals believe are more likely to occur in areas with heavy chemical/petroleum industry, i.e., rates for lung, nasopharynx, and stomach are almost identical for the two types of urban areas

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Table 1.

Average Annual Cancer Incidence In Urban Areas, with and without Heavy Chemical/Petroleum Industry (from the Third National Cancer Survey: Incidence Data, 1969-1971, Tables 10c, 11c, 12c, 13c, 14c, 16c, 18c; age-adjusted, white males per 100.000)

	All Cancers	Lung	Naso-pharynx	Stomach
Urban Areas with Heavy Chemical/ Petroleum Industry[1]				
Detroit	303	67	0.8	13.5
Pittsburg	299	67	0.8	14.5
Birmingham	294	83	0.4	7.6
average	299	72	0.7	11.9
Urban Areas without Heavy Chemical/ Petroleum Industry[1]				
Atlanta	304	72	1.1	7.4
San Fransisco[2]	330	68	0.8	14.2
Dallas	321	78	1.0	9.2
Minneapolis	311	57	0.5	13.3
average	314	69	0.8	11.0

Footnotes:

1. Heavy Chemical/Petroleum Industry includes those industries where chemical/petroleum products are produced, or used extensively in manufacture, e.g., automobile industry.

2. San Fransisco's data in the Third National Cancer Survey includes the city of San Fransisco, plus the counties of Alameda, Contra Costa, Marin and San Mateo. A study of the U.S. Cancer Mortality by County reveals that the cancer death rate/100,000, for white males, from 1950-1969 was 212 for San Fransisco, 179 for Alameda, 174 for Contra Costa, 174 for Marin, and 175 for San Mateo. The average U.S. nationwide was 174, indicating that the San Fransisco data in the Third National Cancer Survey is diluted by the inclusion of the low cancer mortality counties. No attempt, however, was made to correct for this in the above Table; the San Fransisco data was used as it appeared in the Third National Cancer Survey.

As a consequence of our CINI studies we concluded that according to the best available data, thereis no correlation betwee high cancer rates and the presence of heavy chemical/petroleum indus It therefore seems unlikely, with the exception of a few very specia instances, that occupational exposures of chemical/petroleum workers or pollution of communities juxtaposed to industrial sites have contributed in a significant way to the development of cancer. The estimate that 1-4% of human cancers are occupationally induced is a generalization that is too high. Perhaps 1-4% are industry-related wherein an occupational exposure, plus more generally used carcinoge such as cigarette smoke or alcohol, bring about additive or synergis effects under unusual circumstances, e.g., extra-ordinary asbestos exposure and cigarette smoke leading to bronchogenic cancer. Such instances are quite rare, when put into perspective. If additive or synergistic effects were generally significant for human carcinogenesis, then we should have been higher cancer rates in those urban areas that have heavy chemica/petroleum industries. Instead, we saw slightly lower rates in such urban, industrialized areas. It should be noted that the seven cities compared (Detroit, Pittsburg, and Birmingham versus Atlanta, San Fransisco, Dallas and Minneapolis) represent 16 million people out of the 21 million total in the Third National Cancer Survey. Hence, the data do not represent some type of exception.

IV. Cancer and Air Pollution

With respect to "...What is it about urbanization that leads to higher cancer rates...?" some people would jump to the conclusion th it is the air pollution in crowded, urban areas. The objective answe to this is, "...not so...", based on NCI data, as well as data from c of the most heavily air-polluted countries in the world, Japan.

Let us examine California first since it provides excellent data on the question of air pollution. Los Angeles is notorious in the U. and averages over 300 days per year of air quality that is "unhealthful, or hazardous" according to the National Wildlife Federation. Sar Fransisco has about 125 such days per year. Further, in Los Angeles, there is heavy petroleum industry concentrated near the coastline so that the prevailing west to east winds carry the pollutants inland and add them to the stagnant automotive exhaust. San Fransisco is bathed in pure Pacific Ocean breezes. Yet, according to the NCI's U.S. Cancer Mortality by County: 1950-1969, the figures are as follows for white male deaths in Los Angeles and San Fransisco:

All types of Cancers

Los Angeles	175/100,000
San Fransisco (alone)	212/100,000
U.S. Nationwide	174/100,000

Lung

Los Angeles	41/100,000
San Fransisco (alone)	47/100,000
U.S. Nationwide	38/100,000

Nasopharynx

Los Angeles	0.4/100,000
San Fransisco (alone)	0.6/100,000
U.S. Nationwide	0.38/100,000

Stomach

Los Angeles	15/100,000
San Fransisco (alone)	20/100,000
U.A. Natiowide	15/100,000

Again, there is an absence of the "expected" correlation, that air-pollution must cause cancer, especially in a petroleum county.

From Japan, Kunio Aoki and Hiroyuki Shimizu published a paper entitled "Lung Cancer and Air Pollution" in an NCI Monograph, #47, called Epidemiology and Cancer Registries in the Pacific Basin. They showed an absence of a correlation between lung cancer and highly industrialized areas. Further, they showed a gradation in incidence that paralleled the density of population; both rose together.

V. The Predominant Causes of the Major Lethal Cancers

The question then is what urban factors do cause cancer, if it is not industry, and it is not air-pollution? The answer may lie in life-styles and the consequent habits that develop in urban areas with respect to cigarette use, alcoholism, and poor nutritional practises. Cigarettes alone account for virtually all of the lung cancers, and major percentages of cancer of the urinary bladder and pancreas; all told, cigarettes alone acount for 30% of the cancer mortality rate. When cigarette smoking is coupled with alcoholism, an additional 10% of the cancer mortality is explained by the causat[illegible] of cancers of the mouth, larynx and esophagus following the conjoint use of cigarettes and alcohol. Poor nutritional practises, such as excess fat intake, and obesity lead to an estimated additional 40% o[illegible] the cancer death rate by promoting the development of such cancers a[illegible] colon, rectum, breast and others. These life-style aspects of urbani[illegible]zed humans may help explain the significantly higher cancer rates in urban areas. Additional evidence that life-style is involved comes from a study of the Seventh Day Adventists; many of these 500,000 Americans live in places like the Washington, D.C. area and Los

Angeles. They do not smoke, or drink and are vegetarians. Roland Phillips and Jan W. Kuzma found that the over-all cancer rates in 7th Day Adventist males was one half that of the U.S. Nationwide rate for white males. (see Rational and methods for an epidemiologic study of cancer among Seventh Day Adventists, in Epidemiology and Cancer Registries in the Pacific Basin, NCI monograph #47). (See attached references).

VI. The Role of Occupational Exposures

With respect to the idea that occupational exposures cause betwe 20-40% of cancers, as expressed in the recently submitted document, "Estimates of the Fraction of Cancer in the United States Related to Occupational Factors", prepared by individuals from NIOSH, NCI, NIEHS and submitted to OSHA for the hearings on occupational carcinogens, t following should be borne in mind:

- major reliance is placed on Selikoff's data which purports to show that asbestos insulation workers have higher cancer death rates from cancers of the lung and gastro-intestinal tract, compared to the average U.S. white male; this is a serious error in comparisons, since most of the workers were centrated within urban centers. The valid control groups are white males in urban areas, not average U.S. figures.
- extensive extrapolations are made upon data bases that are in themselves very limited, and uncontrolled, e.g., smoking, alcohol and nutritional factors are generally not considered in the original studies that were extrapolated.

The "Estimate" that 20-40% of cancers are occupationally relatec with directly causal agents in the workplace, or additive/synergistic effects is wrong. If the massive extrapolations in this "Estimate" document were valid then we should see more cancer in urban areas that have a great deal of industry. Instead, we do not see this wher we use National Cancer Institute data, e.g., Third National Cancer Survey. (see Section III of this document).

The pervasive question raised by the "Estimate" document is whether potentially carcinogenic industrial substances have escaped into the communities and have caused cancer. The studies in Section III show that this is not the case. However, we went further in view of the continuing public remarks of some individuals that asbestos has not only escaped, but is ubiquitous, particularly in urban areas.

An asbestos-risk study was initiated by CINJ in late 1976 in view of the fact that New Jersey has a major asbestos industry in Manville, N.J. One of the components of this study was to determine the numbers of mesotheliomas seen in large urban medical centers in the Greater New York/New Jersey Area over the ten years, 1967-1976, as one of several bases for future comparisons. Among the largest, most complete contributors to this data pool were the four affiliated hospitals of the New York University Medical Center: Bellevue, University, Manhattan VA, and Booth Memorial. The data from these hospital is particularly interesting in the light of the implications made by

Selikoff and others that the "marker tumors" of asbestos (pleural/peritoneal mesotheliomas) are harbingers of a massive wave of cancers induced by exposures to industrial sources. Supposedly, even a one-time exposure to small quantities of asbestos will pose an increased risk for the future development of not only the "marker tumors", but also bronchogenic and gastro-intestinal tract cancers, in the general public as well as industry workers. If Selikoff's dire predictions have objective, scientific validity, then there should be a clearly evident trend in the appearance of pleural/peritoneal mesotheliomas over the ten years, 1967-1976. The Third National Cancer Survey: Incidence Data catalogued a total of 154 pleural/peritoneal mesotheliomas in the years 1969, 1970, 1971 in the approximate 163,000 cancers included in the survey of all the geographic areas. This is approximately 1 mesothelioma per every 1,000 new cancer cases seen. The Third National Cancer Survey did not provide a breakdown of the distribution of these mesotheliomas according to geographic areas, but the figure of 1/1000 new cancer cases is useful. At the N.Y.U. hospitals an average of 3,000 new cancer cases are seen each year (Squamous and Basal Cell Carcinomas of Skin are not included). The excellence of the anatomic pathology services, coupled with good records and tumor registries provided the numbers of cases summarized in the accompanying Table. There was slightly less than one mesothelioma per 1000 new cancer cases (26 mesotheliomas in ten years, with 30,000 new cancer cases), or 0.86/1000 cancer cases/per year. The NYU figures are of interest for several reasons:

- there is no trend over the years, as would be expected if Selikoff's fears were valid

- the four hospitals provide a significant cross-section of the public from the New York/New Jersey areas, and include balanced percentages of lower, middle and upper income patients

- New York City and New Jersey have had significant asbestos exposure, according to Selikoff, because of the wartime ship-building industry, extensive construction, the use of asbestos in New York City grade-school materials, demolitions, heavy use of automobiles with release of asbestos from the brakes, the clothing industry which sometimes has included asbestos fibers, etc.

Table 2.

Mesothelioma cases at the New York University Medical Center (1967-1976)[1]

	Probable or Compatible	Definite	Total # for the four Hospitals
1967	0	3	3
1968	1	1	2
1969	0	3	3
1970	2	2	4
1971	0	1	1
1972	0	2	2
1973	0	1	1
1974	1	2	3
1975	2	2	4
1976	2	1	3
TOTAL:	8	18	26

[1]Footnote:
New York University Medical Center includes four Hospitals: University, Bellevue, Manhattan Veterans Administration and the Booth Memorial Hospital in Queens.

VIII. Summary

In summary, although we have searched extensively, we have been unable to find any direct, positive correlations between the presence of heavy chemical/petroleum industry and the development of cancer. This is true for the New Jersey and New York areas, as well as for the rest of the country as shown in the Third National Cancer Survey and in the U.S. Cancer Mortality by County: 1950-1969. We also found no increase in the urban areas with heavy chemical/petroleum industry, in selected anatomic sites that are thought to be at greater risk, e.g. lung, nasopharynx, and stomach. These studies, plus the serious flaws in the data base used for extrapolations in the NIOSH/NCI/NIEHS "Estimates" document submitted to OSHA, indicate that in no way can occupational factors account for 20-40% of the cancer mortality in the U.S.A. Dr. Donald Louria, Chairman of the Department of Preventive Medicine and Community Health, in the New Jersey Medical School, studied this question in New Jersey, with New Jersey state funds. His paper, "Cancer in New Jersey: An Overview," was presented at the "Seminar for Physicians: Cancer Risk Identification Within New Jersey and Methods of Cancer Control", May 1-2, 1976. He concludes his paper by stating, "...only about 600 or 4 percent of the deaths can be felt to be related to industrial exposure". Wynder recently ascribed a similar low percentage to industrial exposure (Toward the Prevention of Cancer. Cancer Bulletin 29: p. 186, 1977).

There are many inconsistencies to OSHA's approach to the cancer problem. Some of these inconsistencies have been demonstrate by the studies we conducted at the Cancer Institute of New Jersey wi the aid of an NCI "Planning grant". Other serious inconsistencies that we did not specifically study are pointed out in closing:

- it is widely acknowledged that cancer of the stomach is a rapidly disappearing disease, and the causes for this striking downturn over the past 15-20 years are not known; in any case, this most dramatic event (stomach cancer used to be the leading cancer killer in men) is not in keeping with the implications made from Blot's work (Science 198: p.51, 1977) that petroleum/chemical industries pose an increased risk for the development of certain cancers, like stomach, in the public at large.
- if lung cancers are excluded, the over-all cancer rates have not changed in any statistically significant way in the past 15 years; the lung cancers that we are seeing now were initiated 20-35 years ago, when filter tips were rare, and the great bulk of the smoking was done by males; current trends in the use of greater filtration and more female smokers will not beneficially affect the male lung cancer rates for another 10-15 years. See attached tables, reprinted from Ca - A Journal for Clinicians (volume 28, 1978, pp. 20, 21).

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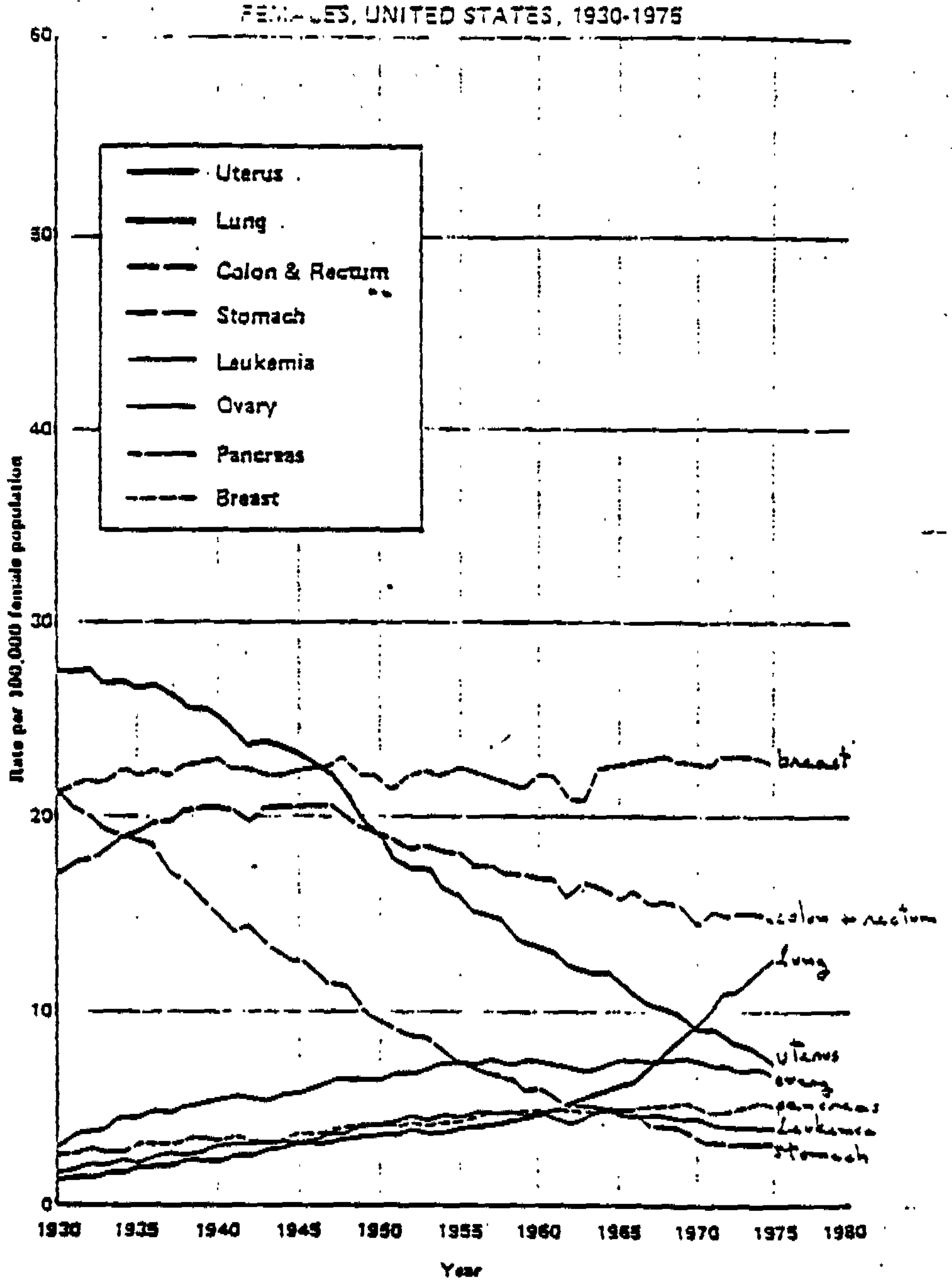
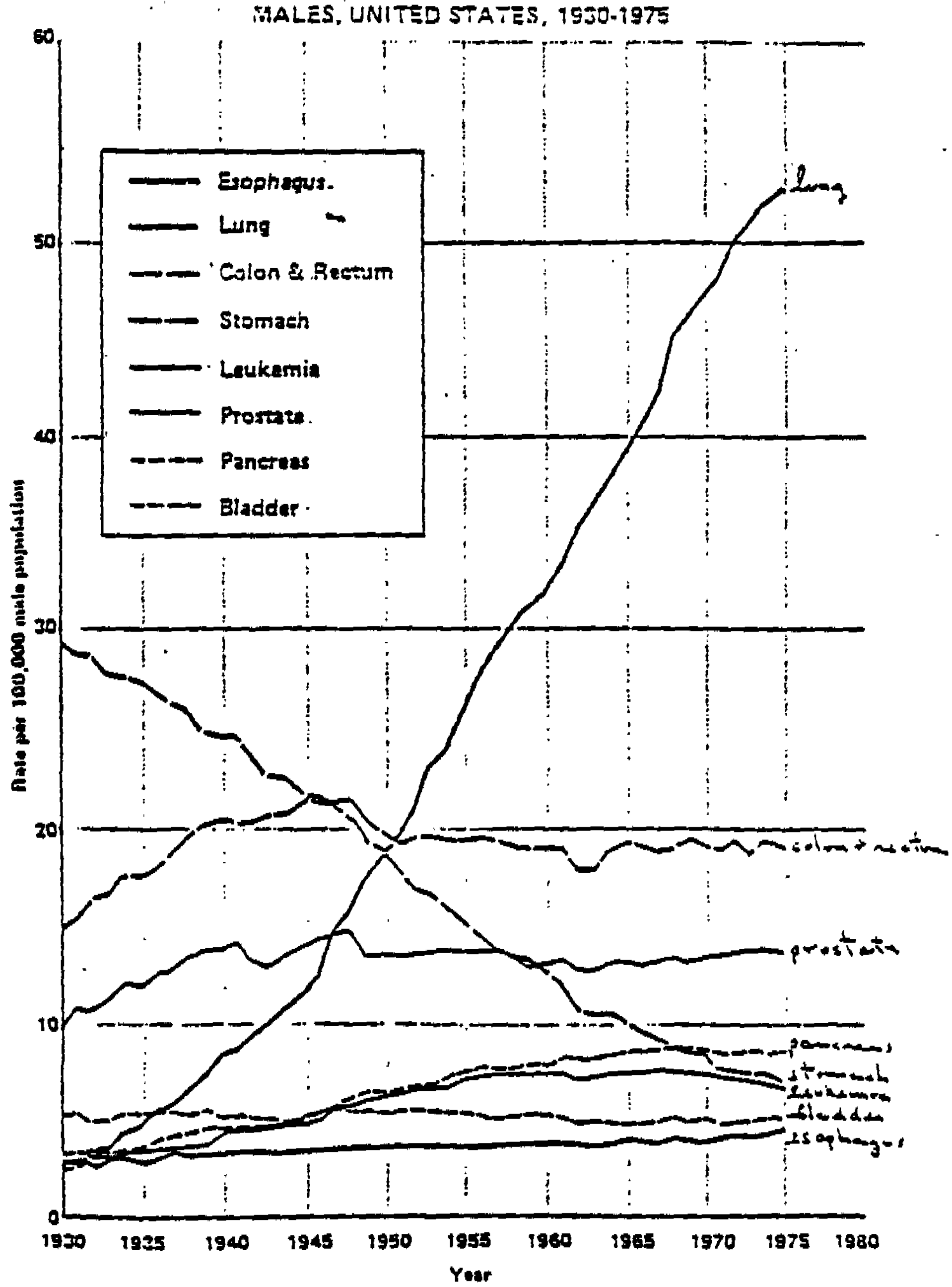
AGE-ADJUSTED CANCER DEATH RATES* FOR SELECTED SITES
FEMALES, UNITED STATES, 1930-1975



Sources: U.S. National Center for Health Statistics and U.S. Bureau of the Census.
* Standardized on the age distribution of the 1940 U.S. Census Population.

AGE-ADJUSTED CANCER DEATH RATES* FOR SELECTED SITES
MALES, UNITED STATES, 1930-1975



Sources: U.S. National Center for Health Statistics and U.S. Bureau of the Census.
*Standardized on the age distribution of the 1940 U.S. Census Population.

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Carcinogens
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A RATIONAL VIEW OF CANCER IN NEW JERSEY

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R. N. WHEELER, JR.

by

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The following document contains simplifications for ease of understanding. As in most aspects of human disease, there are exceptions, and alternate opinions. The following attempts to condense the contemporary, responsible thoughts on the different aspects of cancer.

This Analysis was prepared while Dr. Demopoulos was Director of the Cancer Institute of New Jersey

S U M M A R Y

A RATIONAL VIEW OF CANCER IN NEW JERSEY

This summary outlines the essential points that are explained in the attached documents.

I. Definitions

- o A major distinction is made between mortality and incidence rates. Mortality rates simply represent statistics reported from death certificates and provide insufficient data for any solutions; incidence rates are the numbers of new cases/year and relate to living patients. The status of New Jersey as "the number one cancer state" is based on mortality rates.
- o The difference between industrial and environmental cancer is stressed. Industrial exposures in the "work place" cause a minor number of cancers, and there is an even smaller number attributable to industrial carcinogens that "have escaped into the community" (less than 0.00001% of cancer deaths). Environmental cancer refers to cancers induced by an individual's personal environment which includes cigarette smoking, excess alcohol consumption, ingestion of high fat/low fibre diets, use of nitrate/nitrite containing meats, consumption of foods with artificial colors, and other aspects of life-style; the occupational aspects of the environment are important, but relatively less important.

II. How Cancers Start

- o Normal cells have repair mechanisms to undo the damage caused by chemical and physical agents. However, these repair systems can be overloaded.
- o Cancer-causing agents generally take 20-25 years to produce a cancer. The example of the Hiroshima and Nagasaki survivors is given. This 20-25 year period is known as the "lag phase" in carcinogenesis.
- o Many substances can act together, either in an additive way or synergistically (the sum total of the effect is greater than just additive).

III. The Causes of Human Cancers

- o Specific cancers have been linked with definite agents, but the major lethal cancers, lung and large bowel, are linked to personal habits. Only a small percent of cancers are industry-related.
- o Nitrites/nitrates and artificial colors are cancer causing chemicals (nitrites/nitraces are converted into dangerous nitrosamines when preserved meats are heated), but specific human cancers have not yet been linked to these substances.
- o Life-styles that include obesity, and multiple pregnancies, are associated with a greater risk for cancers of the breast and uterus, respectively.
- o The most dangerous human carcinogens are cigarettes, alcohol, dietary fats, nitrites/nitrates, and artificial food colors. These are the most widely distributed in the communities, and are proven to be responsible for the largest percentage of cancers, estimated as high as 80% (by Dr. Frank Rauscher, the recent Director of the National Cancer Institute, and Dr. Theodore Cooper, the recent Assistant Secretary for Health in HEW).

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IV. Specific Problems in New Jersey

- There is a complex array of medical, social, geological and geographic factors that must enter into any analyses and solutions for New Jersey's cancer problems, e.g., the dense urban population in N.J., inadequate educational and medical leadership in the past, etc. The sensitive area of "the quality of medical care in New Jersey" may explain a portion of the high cancer mortality rates during the period covered by the mortality study.
- New Jersey's unfortunate prominence as the "number one cancer state" is based solely on mortality data from 1950-1969 and does not consider the mobility and shifts in populations from New York City and Philadelphia. These two cities, as well as other non-industrialized urban areas, have death rates as high as those of New Jersey. The density of the urban population of New Jersey confounds any analyses of the data available.

V. New Jersey Industry and Cancer

- New Jersey had a 17% greater death rate, for white males, and a 14% greater death rate, for white females, compared to the rest of the country. This is the basis of New Jersey's infamy.
- Other urban centers, even with light industry, share New Jersey's death rates, e.g., New York City, its Northern Westchester suburb, its Eastern Nassau suburb, and San Francisco. The state of New Jersey, when compared to other states, ranks number one. If, however, only populations are compared and state boundaries are ignored, then New Jersey's rates are equal to the rates of urban areas in other parts of the country. The problem lies however in the fact that even the rural areas of New Jersey have "urban rates"; this is the heart of the problem and requires further study. The answer may be as simple as the fact that many New Jersey rural dwellers, who died in 1950-1969, may have been city inhabitants from New York and Philadelphia at some time in the past and carried their damaged cells with them when they moved.
- The types of cancers that are typically "industry-related" do not account for New Jersey's excess 2,000 cancer deaths each year. All types of cancer deaths are increased, and in some cases there is a negative correlation (benzene causes lymphomas and leukemias, and benzene is a prominent industrial pollutant - yet, the mortality rates from lymphomas and leukemias are <u>not</u> above the national average).
- Separate studies by Drs. Louria and Demopoulos have suggested that only 600 of the 14,000 deaths in New Jersey might be "industry-related".

VI. The List of Carcinogens in S-3035, Section 6

- The list includes a mix of substances; some are no longer in use, some are not carcinogens, some are strong and others are weak carcinogens. Apparently, at the present time, all are being handled with adequate precautions.
- Asbestos and vinyl chloride are weak carcinogens.
- Research is required to determine permissible exposure levels as has been done with the most powerful carcinogenic agent, x-rays.

A RATIONAL VIEW OF CANCER IN NEW JERSEY

New Jersey has unfortunately achieved infamy because statistics from a National Cancer Institute study reveals that New Jersey had the highest mortality rate, per 100,000 general population, in America in the period 1950-1969. This means one of two things: a) if you developed cancer and lived in New Jersey at that time, you were more likely to die of it because your cancer has been detected at a more advanced stage than in other states, and/or the complicated treatment that was needed was not as available as in other parts of the country; b) the risk of developing a lethal form of cancer was greater in New Jersey than in other states. It is not possible to determine which of these two reasons, or what combination is the truth because reliable incidence data does not exist throughout New Jersey. The data that is available is mortality data, which only shows how many people die each year from cancer. The mortality data, although very inadequate, has triggered massive controversies regarding:

- industry-related cancer
- environmental cancer
- the personal environment
- life-styles and cancer
- inadequate health resources
- toxic substances
- dietary factors
- banning of so-called carcinogens
- politics
- early detection
- financial aspects of cancer
- possible solutions

Cancer is the most complicated disease process, compared to the other major killers such as heart disease, strokes and accidents. There are over a hundred different forms of cancer, and they start in different organs of the body, in different types of individuals, and under poorly understood circumstances. No other disease process is so intricately interwoven with the very fabric of society; as though to emphasize their perplexing, intricate nature, cancer cells remain very similar to the patient's normal cells, thereby frustrating most attempts to "weed" them out.

In order to put cancer into perspective, so that possible solutions can be evaluated, the major complex aspects must be understood.

1. DEFINITIONS

Cancer - a malignant growth, composed of solid masses of disorganized cells that are ever-growing, and are capable of spreading to organs far from the original site, e.g., breast cancer starts as a lump, and some of its component cells will microscopically invade the blood stream which will carry them to the lungs, bones, liver, and brain.

Metastasis - the term used to refer to the spread of cancer cells from its site of origin, to other organs.

Early Detection - the process of detecting the cancerous mass while it is still small and therefore less likely to have metastasized.

Radical Surgery - the principal weapon in use today for treating cancer; the surgeon cuts widely around the cancerous mass hoping that none of the cancer cells have microscopically metastasized; the surgeon and other cancer experts generally have no way of knowing whether an individual case has already spread microscopically; however, the smaller the original cancer mass, the less likely it is to have spread.

Mortality Rate - the number of people dying as a result of cancer each year; it is generally given as the number of cancer deaths per 100,000 general population. In America, the average figure is about 170/100,000.

Incidence Rate - the number of new cases that are diagnosed each year, again given per 100,000; in America the average figure is about 340/100,000; about one-half of this number will eventually die of their disease, but over a period of 2-8 years; the other half of the newly diagnosed cancer cases will live out a normal life expectancy and die of some other cause.

Industry-Related Cancer - a cancer whose cause can be, at least in part, traced back to a distinct exposure to a chemical or sometimes a physical agent that was present in the "work-place"; this generally encompasses employees and, more rarely, members of their families who are exposed to the employees "contaminated" work clothes.

Environmental Cancer - refers to most cancers, possibly 80%; however, the term "environment" is all-encompassing and relates mostly to the personal environment that results from life-styles, habits, and dietary factors; occupational exposures, and industry-related events comprise a minor component of "environmental cancer".

Carcinogen - an agent, chemical or physical, that is capable of initiating irreparable damage to a cell, such that the cell may be untimately transformed into a cancer cell.

Co-Carcinogen - a chemical which by itself is incapable of causing cancer, but in combination with small doses of carcinogens (doses too small to cause cancer) will cause the development of cancers.

Epidemiology - the science of studying what disease occurs in which types of people, and under what circumstances - it constitutes medical detective work.

II. HOW CANCERS START

Cancer cells are no longer "self-controlled", the way normal cells are. Of the many trillions of cells in our bodies, many of them divide and multiply in order to replace "worn out" cells. Most remarkable is that the normal replacements are exactly like the worn-out ones. Cancers start as a result of some cells losing their normal control mechanisms. This happens as a result of damaging the genetic material and the delicate membranes of a cell beyond repair. It is important to realize that from conception, i.e., when a sperm and egg cell have united to form a unique individual, that single cell and all of its subsequent dividing cells are constantly barraged by damaging agents such as viruses, chemicals, and ionizing radiation. In the overwhelming majority of damaging insults, our cells repair themselves. When repair is inadequate, we see the development of birth defects, cancer, or death. The genetic material of the nucleus, the DNA, has incredible repair machinery, and the membranes of a cell, in spite of their extraordinary delicacy and complexity, are undergoing incessant replacement, 24 hours a day, 365 days a year. In short, evolution has given us resilient cells so that our bodies can take a certain amount of damage. However, the repair systems can be overloaded and some damaging agents can specifically attack the repair systems.

It is clear that there are certain tolerance limits, and if exceeded, the results may be birth defects, cancer or cell death.

Most cancers are the result of a complex sequence of damaging events that have not been repaired. However, the damage need not be expressed; there is a need to have other factors which will "bring out" the cancerous damage. In some instances, it may take 20-25 years to "bring out" the cancerous damage. This is referred to as the "lag phase" and is best exemplified by the survivors of the atomic blasts at Hiroshima and Nagasaki. These large amounts of radiation caused irreparable damage to cells, but the cancerous nature of the damage was not expressed as a lump of uncontrolled cells until 20-25 years later. In these and a few other instances, there are exposures to a single damaging agent and clear cut blame can be affixed to that agent.

In the overwhelming majority of cancers, there are multiple agents which interact and cause cumulative damage. While there are many hundreds of damaging agents, there are only a few different types of parts in a cell; hence, the same type of cell part may be damaged by several different substances. We can therefore see additive effects, and sometimes synergism, wherein the result is more than just additive.

III. THE CAUSES OF HUMAN CANCERS

The causes of many cancers are known and are listed below. The numbers in parentheses represent the percent of total cancer deaths caused by that particular type of cancer.

Type of Cancer	(% of Deaths)	Causes
o lung cancer	(20%)	cigarette smoking*
o mouth cancer	(2%)	cigarette smoking* plus excess alcoholism** plus inadequate mouth care
o larynx cancer ("voice box")	(1%)	cigarette smoking* plus excess alcoholism**
o esophagus cancer ("food tube")	(5%)	cigarette smoking* plus excess alcoholism**
o colon and rectal	(16%)	high dietary fat plus low dietary fibre
o liver cancer (ordinary type)	(0.5%)	excess alcoholism**
o urinary bladder cancer	(5%)	unrestricted use of certain chemicals used in dye production
o mesothelioma	(0.001%)	unrestricted use of asbestos
o hemangiosarcoma (a special type of liver cancer)	(0.001%)	unrestricted use of vinyl chloride

From the preceding list, it is clear that we know what causes over 50% of cancer deaths. There are several major cancer types whose causes are not known and account for a total of 30% of the deaths; these are cancers of the breast, ovaries, pancreas, and prostate. In some of these cancers, we know a spectrum of associated findings that add up to a greater risk, as in cancer of the breast, but this does not mean that a causal factor(s) that can be controlled has been discovered.

In addition to the above known causes of cancer, the following substances have been identified as potent carcinogens that are consumed in significant quantities (milligrams/day) by the majority of Americans; these substances have not yet been linked as causative factors to a specific type of cancer, as in the case of cigarette smoking and lung cancer, but they are nonetheless

* generally more than one pack/day

** generally more than three ounces of distilled liquor/day, or more than sixteen ounces of wine/day suspected of causing several different types of cancers. They may act as co-carcinogens, or act synergistically.

- o nitrites/nitrates - are converted to dangerous nitrosamines when preserved meats, such as frankfurters, ham, etc., are heated
- o artificial food colors - some colors that are widely used in a multitude of foods and beverages are powerful carcinogens

Some aspects of particular lifestyles are associated with a greater risk for developing cancer and include:

o obesity	associated with breast, colon and rectal cancer
o multiple pregnancies coupled with inadequate gynecologic care	associated with cancer of the uterine cervix
o repetitive sun exposure	causes cancer of the skin

Added to all of the above are many other agents that are carcinogenic, but they are either weak, sparsely distributed, or not well delineated. This includes:

o hormones used to relieve symptoms of the menopause	associated with cancer of the endometrium
o pharmacologic drugs used to treat high blood pressure	associated with cancers of the breast and colon
o high benzene levels	capable of causing leukemias
o varied organic compounds in the work place	thought capable of causing cancers of the skin, stomach, liver, lungs and urinary bladder

The conclusion that should be reached at this point is that everyone is exposed to some combination of carcinogenic substances every day and the most significant ones are uncontrolled. Many agents are carcinogenic and there is a desparate need to study and define which of these agents should be brought under more restrictive control. Logic would direct immediate attention, at this time, to those carcinogens that cause the greatest number of cancer deaths, and are also widely used. This would result in a list, in order of importance, as follows:

- o cigarettes
- o alcohol
- o dietary fat and fibre
- o nitrites/nitrates
- o artificial food colors

IV. SPECIFIC PROBLEMS IN NEW JERSEY

The State of New Jersey is characterized statistically in a number of areas that have a relevance to the high cancer mortality rates, and which may also be involved in the solutions:

- Most densely urbanized population
- Lowest average land elevation with respect to sea-level
- Highest unemployment rates
- Reliance on local water sources of household consumption, in contradistinction to other states where water sources are not derived from the water table or rivers found in the concentrated urban areas.
- Ranks 46th among the states in money spent for higher education per capita.
- Until recent years lacked any credible medical schools; the two existing ones are developmental and reportedly rank 85th and 87th out of the approximate 100 American Schools according to the average scores of the students on the National Medical Board Examinations.
- 75% of the interns and residents in the hospitals are foreign medical school graduates; this is the highest in the country; in New York, the second highest, the figure is 50%, while in California, this number is 5%; the reliance on foreigners is directly traceable to the absence of a large enough pool of graduating medical students who have a desire to undertake or continue their training in New Jersey hospitals.

The intermingling of medical, social, geographic, and geological factors listed above, provide clues for analyzing New Jersey's complex cancer problems, and the thought that is required for the solutions. There is no simple approach, and to highlight this, a critical examination of the New Jersey cancer data is in order.

The National Cancer Institute, under a program directed by Dr. Fraumeni, conducted a nationwide county-by-county study of cancer death rates per 100,000 general population. This was done by transcribing what was written on the death certificates. The medical records of the patients were not examined. The death rates from 1950-1969 were catalogued from death certificates, and were classified by anatomic site, and sex. Hence, the number of deaths from cancer of the mouth, or of the stomach, in males or females, in Atlantic County, or Essex County, and other such numbers became available. These numbers are interesting, and, in general, there is no county in New Jersey that could be considered "safe" according to these data.

The 1950-1969 mortality study was not designed by Dr. Fraumeni to provide information for definitive solutions. To employ this type of data for directing conclusive solutions is a frank misuse. The study was conducted to provide an overview of the scope of the cancer problem in the nation and nothing more. The reasons that the Fraumeni data of 1950-1969 cannot be used to direct any solutions stem from the lack of medical records data such as:

- Size of cancer and extent of disease when the patient was first admitted and diagnosed in the hospital. These two factors, size and extent of disease at time of diagnosis, are the principal determinants of the patient's prognosis as to life or death; if the cancer is large, chances are very high that the cancer cells have already metastasized.

- No treatment data is available to judge adequacy of therapy, and of long term, dedicated follow-up.
- No patient histories with respect to dangerous habits, nature of the diet, previous places of residence, occupation, income and educational level.

If the Fraumeni data were to be used for a direct attack on the cancer problem, without any further extensive studies, several false leads would be pursued based simply on mobility and shifting of the population, especially in the years from 1950-1969. Miami, Florida has cancer death rates equal to those of New Jersey. With a moment's careful thought, the reason becomes obvious - many Miami residents are retired Northeasterners who have come from crowded urban settings. It is critical to remember that a 20-25 year lag period is required to develop a cancer from the numerous environmental exposures (including cigarettes and alcohol).

Further examination of the N.C.I. mortality studies reveals the following death rates of other urbanized areas and their suburbs.

o New York City	213/100,000
o Westchester County (a Northern suburb of New York City)	200/100,000
o Nassau County (an Eastern suburb of New York City)	212/100,000
o Philadelphia	221/100,000
o Chicago	206/100,000
o St. Louis City, Missouri	220/100,000
o San Francisco	206/100,000

Since New Jersey received former dwellers of New York City and Philadelphia during the post-war years of suburban expansion, circumstances in these two cities may ultimately be responsible. Westchester and Nassau Counties may be high in mortality rates for the same reason that New Jersey is, i.e., the city dwellers led life-styles that predisposed to cancer and when the population shift out of the cities occurred, these individuals carried their irreparably damaged DNA and altered cell parts with them. If many of these individuals were in the lag phase (20-25 years), this could explain, at least in part, the findings. This is a similar explanation for the high rates in Miami, Florida.

There are many other confounding factors that preclude conclusions, and these are as follows:

- While the population was shifting into the suburbs, including into New Jersey, industry also continued to grow in the state.
- In the 1930's-1940's (the period of time when people were being exposed in order to develop their cancers and live 20-25 years later in 1950-1969), industry and government were largely ignorant of chemical carcinogens, hence fewer safeguards may have been used in this period.

V. NEW JERSEY INDUSTRY AND CANCER

The county-by-county death statistics of 1950-1969 are divided by anatomic site and by sex. The overall death rates for white males was the highest in the country, but this was not the case for females or non-whites. This can lead to a great deal of speculation, but the data is insufficient for reaching a solution.

The Fraumeni numbers indicate that the national average death rate from cancer was 174/100,000 (for white males), while in New Jersey, it was 205/100,000, a 17% increase. In females, the national average was 130 and, in New Jersey, 148/100,000, about a 14% increase. These are the increases that have precipitated the current controversy. The increases are significant and were consistent through the 19 years (1950-1969) of the study. More detailed numbers are presented in appendix A.

Adding to this data are the estimates of the American Cancer Society, regarding New Jersey incidences and mortalities. These are given in appendix B.

The conclusions pertaining to New Jersey are as follows:

1. General Findings on New Jersey:
   Proportionally, New Jersey's figure on cancer mortality is greater than that of any other state in America. Nearly all of New Jersey falls into the highest decile in the U.S. (top 10%) for white males and for white females (Appendix A).

2. Cancer categories in which the mortality, proportional to population, is higher in New Jersey than in any other state:
   - Rectal cancer (males and females combined)
     The rating of New Jersey as having the worst concentration of mortality from rectal cancer is based largely on the extremely high death rates among both men and women in northern New Jersey, the Trenton-Princeton area included. This would not be classified as an industry-related cancer by cancer specialists.
   - Bladder cancer (males only - women not significantly different from the rest of the United States) A proportion of these are industry-related.
   - Cancer of the ovary - The mortality figures among the women of New Jersey's northwest corner — Sussex and Warren Counties — ranks with the worst in the country. Mortality figures are nearly as high among women in Bergen, Morris, and Passaic Counties. This causes the mortality figures for women in northern New Jersey in this cancer classification to be worse than for any other single concentrated area in the nation. This would not be classified as an industry-related cancer.

3. Cancer categories in which the mortality rates for the state of New Jersey rank approximately with the worst statewide records in the nation:

   - Cancer of the large intestine (males and females combined)
     New Jersey ranks with Rhode Island as the worst in the nation. This is not regarded as industry-related.

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- o Cancer of the Trachea, Bronchus, and Lung - Mortality figures among New Jersey males rank as the highest in the U.S., along with the mortality among males in Louisiana and Florida. A small proportion of these are industry-related.
- o Breast Cancer among females - The record in this category is worst in New York, with New Jersey, Rhode Island and Massachusetts just behind. This is not classified as industry-related.

4. Cancer categories in which mortality for portions of New Jersey ranks with the worst areas in the nation.
   - o Cancer of the Esophagus (males only) - Northern New Jersey, Connecticut, New York City, Long Island, and the Greater Philadelphia Area of Pennsylvania, combined, comprise the worst single area in the U.S. for mortality figures in this category. The rate for females in northern New Jersey is above the national average. This is generally caused by a combination of cigarette smoking and excessive alcoholism. In addition, women with rare benign esophageal problems are predisposed to cancer of this organ. It is not generally regarded as being industry-related.
   - o Cancer of the Larynx (males only) - The highest concentrations of mortality from this type of cancer are in northern New Jersey, New York City, Long Island, the Greater Philadelphia Area and the Pittsburgh area. A small proportion of these are industry-related, but generally are caused by a combination of cigarette smoking and excessive alcoholism.

If an attempt is made to correlate the types of cancers that are known to be "industry-related" (i.e., industrial substances contribute together with other factors to the development of cancer), with the types of cancers occurring in New Jersey, it would be expected that most of the excess cancer deaths in New Jersey would fall into the "industry-related" types - this is not the case.

There are about 14,000 deaths each year in New Jersey, and about 26,000 new cases each year (from appendix B, estimates for 1974). If New Jersey had average U.S. rates, these numbers would be 12,000 and 22,000, respectively. The excess 2,000 deaths each year and the excess 4,000 new cases each year should fall into the classical "industry-related" categories which include a small portion of cancers of the:

- o Urinary bladder
- o Respiratory system
- o Liver
- o Skin
- o Lymph organs and bone marrow (lymphomas and leukemias)

Instead, the "excess" 2,000 deaths are spread across all of the anatomic sites in the N.C.I. mortality study (lip, salivary glands, nasopharynx, mouth, esophagus, stomach, large intestine, rectum, liver, pancreas, upper and lower respiratory tracts, breast, uterine cervix, body of uterus, ovaries, prostate, testis, kidneys, urinary bladder, skin, eye, brain, endocrines, bones, and connective tissues). Further, there are some negative correlations, e.g. benzene is reportedly an industrial pollutant in New Jersey and supposedly is the highest in the nation, yet the cancer that should be caused by benzene, such as lymphomas and leukemias, occur at the lower national rates.

o Lymphomas	N.J.	(White males)	4.93
	U.S.	(White males)	4.89
o Leukemias	N.J.	(White males)	8.74
	U.S.	(White males)	8.81

Analyses performed by Dr. Donald Louria, Chairman of the Department of Preventive Medicine and Community Health, New Jersey Medical School, Newark, and presented under the title of "Cancer in New Jersey: An Overview" at the "Seminar for Physicians: Cancer Risk Identification within New Jersey, and Methods of Cancer Control", May 12, 1976, in Cherry Hill, found that only 600 of the 14,000 cancer deaths in New Jersey might by industry-related. A different analytic study conducted by Dr. Harry B. Demopoulos, former Director of the Cancer Institute of New Jersey, also revealed the same types of numbers, i.e., no more than 600 of the 14,000 cancer deaths could be industry-related, among th deaths reported in 1950-1969; this report was given by Dr. Demopoulos to the "Skevin Committee" in testimony on November 5, 1976.

These two independent analyses therefore indicate that 4.3% of the total cancer deaths in New Jersey could be "industry-related". These percentages are important and yet it is essential to realize that these analyses are based on insufficient data and represent the highest possible number of "industry-related" exposures. This does not mean that industrial pollutants were solely responsible. If an analysis is attempted of how many cancer deaths were caused solely by industrial pollutants, the data is found to be totally inadequate and very soft estimates yield fractions of 1%.

While the cited studies and analyses refer to past events, there is meager data since 1969. The American Cancer Society estimates do not provide sufficient information to answer the obvious question - are cancer mortality rates and incidences in New Jersey the same, better, or worse than for the period 1950-1969? Current, but inadequate, "samples" from hospitals that have excellent Tumor Registries indicate that their cancer case workload has increased by 50% in the past 5 years, and that the average age of the cancer patient is younger by 5-6 years. This type of data is fragmentary and may reflect changes in referral patterns to some hospitals, or it may indicate a worsening of the New Jersey cancer problems. Clear cut answers require far more data.

VI. THE LIST OF CARCINOGENESIS IN BILL NO. S-3035, SECTION 6

The list includes a mix of substances

- Some are no longer in use, e.g., 4 Aminodiphenyl
- Some are not carcinogenic, e.g., alpha naphthylamine - its carcinogenicity was proven to be due to contamination of alpha naphthylamine
- Some are very potent carcinogens, e.g., benzidine
- Some are rather weak carcinogens, e.g., asbestos and vinyl chloride
- All are currently handled with precautions that lead to low exposures of workers such that cancers will not develop.

Asbestos and vinyl chloride are termed weak carcinogens on the basis of careful analyses of the cancers that they cause. Excessive concerns over asbestos as a carcinogen has been prompted by cases such as that of a 14 year old boy who developed mesothelioma; he apparently was exposed to this when he was helping his father to smooth down the joints of the newly replaced plaster board walls in their home. Asbestos was in the joint material, not in the plaster board. There was no other known asbestos exposure, and the father did not otherwise work with it. Cases such as this are exceedingly rare and form an inadequate data base. Mesothelioma does occur in nature, without asbestos exposure, and it cannot be ascertained whether this 14 year old boy would have been a "Natural" victim, or whether the asbestos was indeed causal. Far more numbers are needed for statistically valid studies in such unusual cases.

The relative weaknesses of asbestos and vinyl chloride are borne out by the fact that workers who were exposed to very large, uncontrolled levels developed relatively few cancers as a result. This is in contrast to a powerful carcinogen such as 3,4-dimethyl 4-aminodiphenyl, wherein 15-20% of exposed workers developed urinary bladder cancer in a short lag phase (7-8 years). When the amounts of asbestos, vinyl chloride, and 4-aminodiphenyl are compared, versus the numbers of cancers developed, then asbestos and vinyl chloride are weak carcinogens.

The idea of a <u>comprehensive ban</u> on all carcinogens would lead to the restriction of many activities and substances. Radiation, by x-rays, is the most powerful carcinogenic agent. There are methods for converting physical carcinogens into chemical equivalents, and when this is done, x-rays are quite potent. When the Manhattan Project (building the A-Bomb during World War II) was in full swing, the Department of Pathology at Rochester University was given the job of determining the ill-effects of radiation. There were some individuals who were so impressed by the pathologic changes that they decreed a "Zero-exposure". When subsequent, rational studies were done, it was found that small doses of radiation could be tolerated, even though the effects were cumulative over a life time. This type of exacting research has made it possible to use x-rays for medical use, nuclear plants for energy, etc. The same type of information must be obtained for chemicals.

APPENDIX A

NATIONAL CANCER
INSTITUTE

MORTALITY STUDY

1950 - 1969

EXHIBIT 1 - New Jersey Cancer Mortality 1950-1969

EXHIBIT 2 - New Jersey Cancer Mortality 1950-1969, by County

EXHIBIT 3 - States With Highest Cancer Mortality, 1950-1969

EXHIBIT 4 - All Malignant Neoplasms 1950-1969, by State

APPENDIX A- EXHIBIT 1

CANCER MORTALITY 1950-1969

All Malignant Neoplasms

(All cancer categories) causing mortality
(Male, Female Combined)

	Number[1]	Annual Rate (per 100,000 pop. whites only)
Total deaths, United States	2,572,035 - M	174.04 - M
	2,253,282 - F	130.10 - F
Total deaths, New Jersey	106,900 - M	205.01 - M
	93,379 - F	147.92 - F

Highest Rates by New Jersey Counties:

Hudson	14,049 - M	231.8 - M
	11,004 - F	153.5 - F
Middlesex	6,556 - M	220.8 - M
	5,251 - F	149.2 - F
Essex	16,975 - M	215.1 - M
	15,258 - F	154.5 - F

Highest Number by New Jersey counties:

Essex	16,975 - M	215.1 - M
	15,258 - F	154.5 - F
Hudson	14,049 - M	231.8 - M
	11,004 - F	153.5 - F
Bergen	12,863 - M	202.1 - M
	11,894 - F	148.1 - F

1. This number is the total deaths from 1950-1969

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ALL MALIGNANT NEOPLA .S (all cancer categories, causing mortality

New Jersey, by counties

	White				Non-white			
	Male		Female		Male		Female	
	Total	Rate	Total	Rate	Total	Rate	Total	Rate
Atlantic	3,213	195.3	2,897	145.2	598	220.1	484	150.8
Bergen	12,863	202.1	11,894	148.1	373	281.4	344	192.2
Burlington	2,692	188.5	2,395	139.9	196	216.3	138	141.0
Camden	6,329	204.7	5,647	148.4	586	228.0	520	177.1
Cape May	1,264	194.7	1,037	142.9	72	184.2	78	176.8
Cumberland	1,683	181.4	1,551	140.0	150	155.8	141	144.2
Essex	16,975	215.1	15,258	154.5	2,385	219.2	2,155	154.6
Gloucester	1,935	191.1	1,674	141.8	182	183.1	142	146.0
Hudson	14,049	231.8	11,004	153.5	645	289.7	571	197.3
Hunterdon	1,025	175.7	926	143.3	17	297.1	19	303.2
Mercer	4,639	205.4	3,973	145.2	422	203.5	351	150.1
Middlesex	6,556	220.8	5,251	149.2	282	279.0	223	208.2
Monmouth	5,754	199.0	5,340	147.6	515	225.4	360	135.3
Morris	3,851	179.2	3,606	135.5	109	248.6	98	170.1
Ocean	2,577	185.5	2,028	137.2	69	265.3	64	231.6
Passaic	7,981	209.5	6,631	147.8	355	271.5	302	182.7
Salem	848	185.9	731	146.6	147	232.0	97	161.5
Somerset	2,151	182.8	1,820	135.7	74	226.9	66	228.5
Sussex	923	180.8	797	140.5	18	913.3	12	465.4
Union	8,311	203.4	7,757	151.6	620	252.2	534	166.3
Warren	1,281	189.3	1,162	147.7	15	274.2	10	187.7
New Jersey	106,900	205.01	93,379	147.92	7,830	230.33	6,709	163.41

Rates indicated are annual per 100,000 population
Total deaths, for the period, 1950-1969, are given.

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STATE	WHITE MALE NUMBER	WHITE MALE RATE	NONWHITE MALE NUMBER	NONWHITE MALE RATE	WHITE FEMALE NUMBER	WHITE FEMALE RATE	NONWHITE FEMALE NUMBER	NONWHITE FEMALE RATE
ALABAMA	29066	152.44	10156	140.24	25643	113.88	10915	127.17
ARIZONA	14782	156.19	1062	128.83	11301	110.48	811	111.76
ARKANSAS	22197	144.14	4915	132.13	17726	108.03	4660	121.99
CALIFORNIA	216761	171.39	15086	170.77	195171	128.09	10785	124.10
COLORADO	21816	144.19	620	169.99	20219	117.29	462	116.37
CONNECTICUT	44501	195.68	1439	231.75	38333	138.64	1047	139.39
DELAWARE	5691	179.75	1100	235.97	5171	134.42	774	162.57
DISTRICT OF COLUMBIA	7915	203.75	6790	264.55	8123	141.73	5445	166.05
FLORIDA	76859	163.58	10683	179.78	56475	110.54	8959	133.14
GEORGIA	33499	153.77	11546	152.23	30383	111.27	12652	130.90
IDAHO	8546	139.02	103	123.67	6647	110.15	73	109.27
ILLINOIS	162672	182.81	15012	216.77	142394	137.78	13040	160.98
INDIANA	67635	164.24	4139	210.85	62111	130.60	3408	157.97
IOWA	46897	156.60	516	213.55	42106	124.14	380	151.28
KANSAS	30949	143.89	1644	189.14	28094	115.08	1286	141 [illegible]
KENTUCKY	38813	146.39	4220	199.50	36016	121.61	3500	154.[illegible]
LOUISIANA	32662	190.39	14576	193.68	24611	118.98	12466	143.77
MAINE	17793	178.53	47	154.11	16135	140.46	48	161.70
MARYLAND	39157	192.43	8099	224.84	35366	138.66	6080	154.73
MASSACHUSETTS	95772	192.23	1971	215.92	90506	139.47	1480	141.86
MICHIGAN	113318	182.42	9800	210.58	92946	135.63	7830	151.26
MINNESOTA	54422	158.24	539	176.18	47219	127.05	380	128.98
MISSISSIPPI	18050	156.40	9046	136.74	15030	113.03	10146	129.44
MISSOURI	70822	164.55	7394	213.58	63213	125.58	5882	159.07
MONTANA	10201	153.07	227	140.69	7453	119.28	207	157.24
NEBRASKA	23955	157.48	576	219.93	20736	123.75	482	175.99
NEVADA	4050	167.39	179	136.61	2654	118.79	180	148.97
NEW HAMPSHIRE	11944	189.19	17	130.20	10655	140.20	16	110.02
NEW JERSEY	106900	205.01	7036	230.33	93379	147.92	6709	163.41
NEW MEXICO	7689	136.30	398	95.50	6915	115.10	352	96.48
NEW YORK	307997	199.24	21572	227.69	273316	148.01	18920	152.80
NORTH CAROLINA	36533	140.11	10564	147.17	33864	106.97	10701	124.39
NORTH DAKOTA	9039	144.34	97	143.57	7084	119.45	110	165.14
OHIO	146265	178.41	12523	226.35	130411	136.25	9762	159 70
OKLAHOMA	34295	155.95	2936	144.80	28878	116.03	2904	13[illegible]
OREGON	28314	155.12	471	158.47	23148	119.27	307	122.48
PENNSYLVANIA	189018	183.08	15066	236.89	170851	140.26	11528	157.10
RHODE ISLAND	16434	203.17	342	236.56	14770	143.37	212	133.64
SOUTH CAROLINA	16754	154.96	7135	145.59	15295	111.59	7647	123.97
SOUTH DAKOTA	10513	149.86	252	137.79	8384	119.98	302	184.07
TENNESSEE	38356	146.28	7374	163.79	35763	115.95	7796	142.51
TEXAS	107557	158.51	15021	167.53	90072	113.34	13452	128.45
UTAH	8369	133.14	198	152.86	7233	102.06	101	108.96
VERMONT	6981	173.02	18	207.22	6551	136.41	11	119.06
VIRGINIA	38218	157.53	11503	189.62	35279	119.12	9254	138.94
WASHINGTON	45015	164.20	1347	169.72	36251	123.43	773	129.39
WEST VIRGINIA	26025	154.62	1771	191.28	22241	123.75	1373	149.77
WISCONSIN	65376	166.23	876	191.54	56898	132.35	707	140.97
WYOMING	3953	138.93	64	123.16	2962	109.09	52	130.08
UNITED STATES	2572035	174.04	264103	184.28	2253292	130.10	226561	139.18

APPENDIX B

AMERICAN CANCER
SOCIETY

MORTALITY AND INCIDENCE ESTIMATES

1974

Estimated Cancer Deaths for All Sites, Plus Major Sites, by State — 1974

State	All Sites: Number of Deaths	All Sites: Death Rate per 100,000 Population	Major Sites: Breast	Colon-Rectum	Lung	Oral	Uterus	Prostate	Stomach	Pancreas	Leu-kemia
Alabama	5,400	155	425	550	1,200	125	250	325	175	325	200
Alaska	200	62	15	20	50	5	10	10	10	10	10
Arizona	2,600	134	225	300	650	70	50	150	100	150	125
Arkansas	3,500	175	225	400	850	75	100	250	125	200	200
California	33,200	153	3,200	4,200	7,300	750	1,000	1,400	1,400	1,800	1,400
Colorado	2,900	122	275	400	500	60	70	175	100	175	150
Connecticut	5,400	167	500	800	1,000	175	125	250	250	275	250
Delaware	900	152	70	125	225	25	20	30	30	50	30
Dist. of Columbia	1,600	199	175	200	325	60	60	80	60	80	40
Florida	14,600	197	1,200	1,900	3,500	350	400	800	600	700	500
Georgia	6,300	130	550	550	1,500	150	275	375	250	350	275
Hawaii	900	110	60	90	150	30	20	30	90	70	50
Idaho	1,100	150	90	125	175	20	25	80	40	70	70
Illinois	19,900	172	1,900	2,800	4,100	450	700	1,000	850	1,100	900
Indiana	8,600	158	800	1,300	1,800	175	325	450	250	450	350
Iowa	5,200	182	500	850	950	100	125	350	175	250	275
Kansas	4,000	175	375	550	750	90	125	275	100	225	200
Kentucky	5,400	165	425	700	1,200	150	200	300	150	325	275
Louisiana	5,900	156	475	600	1,500	150	200	325	250	300	250
Maine	2,200	212	175	300	425	40	60	125	90	100	80
Maryland	6,400	150	600	850	1,600	175	200	300	200	325	200
Massachusetts	11,200	189	1,200	1,700	2,200	300	300	475	525	600	400
Michigan	14,500	155	1,400	1,900	3,100	300	425	750	525	700	550
Minnesota	6,500	163	600	950	1,100	125	125	450	300	375	275
Mississippi	3,600	162	275	400	750	70	125	250	150	225	200
Missouri	8,900	184	800	1,200	2,100	175	275	550	275	475	400
Montana	1,300	185	100	150	200	25	30	70	50	80	60
Nebraska	2,800	185	250	425	475	60	70	175	100	175	150
Nevada	750	133	60	80	200	15	20	25	10	50	30
New Hampshire	1,500	189	150	250	325	30	50	80	40	80	70
New Jersey	14,000	184	1,400	2,200	3,000	300	400	550	650	700	500
New Mexico	1,200	115	100	125	200	20	30	50	50	70	50
New York	37,700	200	4,000	5,800	7,400	800	1,000	1,500	1,700	2,000	1,400
North Carolina	6,900	132	600	700	1,400	175	300	375	225	375	350
North Dakota	1,100	181	90	150	175	15	25	70	60	70	50
Ohio	19,000	172	1,800	2,700	4,100	425	650	900	700	900	750
Oklahoma	4,500	170	350	550	950	80	125	300	150	275	200
Oregon	3,700	166	325	500	850	80	100	200	125	200	200
Pennsylvania	23,500	197	2,300	3,600	4,600	500	750	1,100	950	1,200	950
Rhode Island	2,000	204	200	350	400	60	50	80	100	90	60
South Carolina	3,500	132	300	375	750	80	150	200	100	200	150
South Dakota	1,200	182	80	175	200	20	40	100	50	90	80
Tennessee	6,300	155	550	750	1,400	150	225	375	200	350	275
Texas	17,100	144	1,400	1,800	4,000	375	600	800	650	950	900
Utah	1,100	97	100	150	175	20	30	80	50	60	60
Vermont	850	182	70	150	175	20	30	50	30	50	40
Virginia	6,800	139	650	800	1,500	175	250	375	225	375	275
Washington	5,600	154	500	700	1,300	125	150	300	225	325	275
West Virginia	3,400	201	250	400	850	70	125	200	125	200	125
Wisconsin	7,800	169	800	1,200	1,300	175	200	450	350	400	325
Wyoming	500	149	40	60	75	10	10	40	15	30	20
United States	355,000	167	33,000	48,000	75,000	8,000	11,000	18,000	14,000	19,000	15,000

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APPENDIX B - EXHIBIT 2

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Estimated New Cancer Cases for All Sites, Plus Major Sites, by State — 1974

State	All Sites* Number of Cases	Major Sites Breast	Colon-Rectum	Lung	Oral	Uterus (Invasive)	Prostate	Stomach	Pancreas	Leu-kemia
Alabama	10,000	1,100	1,100	1,300	350	1,000	950	300	350	300
Alaska	300	50	50	60	15	20	30	15	10	20
Arizona	4,800	600	600	700	150	350	450	150	150	150
Arkansas	6,400	600	800	1,000	200	500	750	200	200	300
California	61,000	8,700	8,700	8,100	2,300	3,900	4,200	2,300	1,900	2,000
Colorado	5,400	750	800	550	150	350	550	150	200	200
Connecticut	10,000	1,400	1,700	1,100	500	550	750	400	300	350
Delaware	1,700	200	300	250	70	100	90	50	50	40
Dist. of Columbia	3,100	500	400	350	200	250	250	90	80	60
Florida	27,000	3,300	3,900	3,900	1,100	1,600	2,400	1,000	750	700
Georgia	12,000	1,500	1,400	1,700	450	1,100	1,100	400	350	400
Hawaii	1,700	150	200	200	50	80	60	150	70	70
Idaho	2,100	250	250	200	50	100	250	70	70	100
Illinois	37,000	5,200	5,800	4,500	1,400	2,700	3,000	1,400	1,200	1,200
Indiana	16,000	2,200	2,700	2,000	500	1,300	1,400	400	450	500
Iowa	9,500	1,400	1,800	1,000	300	650	1,100	300	250	400
Kansas	7,300	1,000	1,100	800	300	650	800	150	250	300
Kentucky	10,000	1,200	1,400	1,300	450	900	900	250	350	400
Louisiana	11,000	1,300	1,200	1,700	450	850	950	400	300	350
Maine	3,600	500	600	450	125	250	400	150	100	100
Maryland	12,000	1,600	1,800	1,800	500	900	900	350	350	300
Massachusetts	21,000	3,300	3,500	2,400	900	1,200	1,400	850	600	550
Michigan	27,000	3,800	3,900	3,400	900	1,800	2,300	850	750	750
Minnesota	12,000	1,600	2,000	1,200	400	600	1,300	500	400	400
Mississippi	6,600	750	800	800	200	700	750	250	250	300
Missouri	16,000	2,200	2,500	2,300	500	1,200	1,700	450	500	550
Montana	2,000	250	300	250	70	150	200	80	80	80
Nebraska	5,300	700	900	550	150	300	500	150	200	200
Nevada	1,300	150	150	250	50	60	80	15	50	40
New Hampshire	2,800	400	500	350	90	200	250	70	60	100
New Jersey	26,000	3,800	4,500	3,300	900	1,600	1,700	1,100	750	700
New Mexico	2,200	250	250	250	60	150	150	80	70	70
New York	70,000	10,800	12,000	8,200	2,500	4,300	4,500	2,800	2,100	2,000
North Carolina	13,000	1,600	1,400	1,600	500	1,200	1,100	350	400	500
North Dakota	2,000	250	300	200	50	80	200	100	70	70
Ohio	35,000	4,900	5,600	4,500	1,300	2,500	2,700	1,200	950	1,000
Oklahoma	8,200	950	1,100	1,100	250	600	900	250	300	300
Oregon	6,800	900	1,000	950	250	500	600	200	200	300
Pennsylvania	43,000	6,300	7,400	5,100	1,500	2,800	3,300	1,600	1,300	1,300
Rhode Island	3,700	550	700	450	200	200	300	150	90	80
South Carolina	6,300	800	750	850	250	700	600	150	200	200
South Dakota	2,200	250	350	250	50	150	300	80	90	100
Tennessee	12,000	1,500	1,600	1,500	450	1,000	1,100	300	350	400
Texas	31,000	3,800	3,700	4,400	1,100	2,300	2,400	1,100	1,000	1,200
Utah	2,100	300	300	200	50	200	250	80	60	80
Vermont	1,600	200	300	200	60	100	150	50	50	60
Virginia	13,000	1,800	1,700	1,700	500	1,100	1,100	350	400	400
Washington	10,000	1,400	1,500	1,400	400	700	900	350	350	400
West Virginia	6,200	700	800	900	200	600	600	200	200	150
Wisconsin	14,000	2,200	2,500	1,400	500	850	1,300	600	400	450
Wyoming	800	100	100	90	20	60	90	20	30	30
United States	655,000	90,000	99,000	83,000	24,000	46,000	54,000	23,000	20,000	21,000

*Does not include carcinoma-in-situ of the uterine cervix or superficial skin cancers. These estimates are offered as a rough guide and should not be regarded as definitive. They are calculated according to the distribution of estimated 1974 cancer deaths by state. Especially note that year to year