

FILE NAME: Exxon (EXX)

DATE: 1952 May 23

DOC#: EXX058

DOCUMENT DESCRIPTION: Conference Panel Discussion - Cancer in Industry - Standard Oil Med Research Division

S-78

MRD-J2-52

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CANCER IN INDUSTRY, A PANEL DISCUSSION HELD
FRIDAY AFTERNOON, MAY 28, AT CORNELL
UNIVERSITY MEDICAL COLLEGE.

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CANCER IN INDUSTRY
A PANEL DISCUSSION

MODERATOR: Emerson Day, M.D.
Director, Strang-L'Esperance Cancer
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Saranac Lake, N.Y.

Held on Friday Afternoon, May 23, at
Cornell University Medical College
in connection with the
AMERICAN ACADEMY OF COMPENSATION MEDICINE, INC.
Course on
MEDICAL ASPECTS OF WORKMEN'S COMPENSATION
May 19-23, 1952

MEDICAL RESEARCH DIVISION, ESSO LABORATORIES
STANDARD OIL DEVELOPMENT COMPANY
LINDEN, NEW JERSEY

REMARKS MADE BY R. E. ECKHART, M.D.

DR. DAY, MEMBERS AND GUESTS:

The title of this panel is "Cancer in Industry". That title covers a very wide range, since it includes not only occupational cancers, but also non-occupational cancers in industrial workers. With but one comment, I intend to dismiss the subject of non-occupational cancer in industrial workers and confine my remarks to the subject of occupational cancer. My comment on non-occupational cancer in industrial workers is simply that in an industry with a good medical department and an established program of periodic examinations, an excellent opportunity for early cancer detection presents itself. Many workers are completely asymptomatic at the time of their periodic examinations, yet more than 2/3 of those examined have some physical defect which has required referral back to their own private physicians for treatment or follow-up. Among such defects, naturally, are a few cancers and pre-cancerous lesions.

Much has been written on the subject of occupational cancer within the past 3 to 4 years. Some of this has been fact, and some of it has been pure fancy, so that the student of the subject sometimes has great difficulty knowing just what the situation in regard to this problem really is. It is my intent this afternoon to give you a few facts which will stick with you and may help to solve some of the questions you may have on the subject.

First of all I would like to point out that occupational cancer is not a new disease. It was first described among chimney sweeps in 1771 by Sir Percival Pott. Although the causative agent had not been identified, the clinical observations and correlation with the work history definitely identified this occupation as associated with an occupational cancer hazard. The hazard in this case was associated with contact with the soot of the chimneys, which, you will remember,

was reported in 1907.

(SLIDE 2)

No date from 50-100 cases have been reported, again in plants manufacturing products containing tar. The principle site of involvement was again the upper limbs. A look at the occupations listed in this slide reveals that the majority of cases was found in a specific type of occupation within the plant.

The study of these coal-tar and pitch cancers gained much headway when cancers were produced in experimental animals in 1915.

(SLIDE 3)

It is not my intention to discuss the experimental phases of this subject in great detail since Dr. Smith is much more competent to do this for you. I simply show you this slide to point out that the first experimental cancer was produced in 1915, and, as indicated in the table at the bottom of the slide, that the longer the exposure, the greater incidence of cancer in experimental animals. You will

came either from coal or peat. The contact was a prolonged one, since chimney sweeps were pressed into service at a tender age when they were small enough to pass through the chimneys. Personal hygiene was probably non-existent because these young children lived an indescribably horrible existence of filth, poverty and semi-starvation since if they became too fat they could not squeeze their way through the chimney.

A second occupational cancer was reported from England in 1892. This cancer was associated with exposure to coal tar and pitch.

(SLIDE 1)

Until 1942, over 1400 cases of this type of cancer have been reported in England. The principle site of this cancer was on the upper limbs, and the average exposure was from 20-30 years. It occurred principally in the tar manufacturing industry where high temperature tars were produced. In the United States, the first case

COAL TAR & PITCH CANCERS IN ENGLAND

- | | |
|---|------------------|
| 1. FIRST CASES STUDIED | 1892 |
| 2. NO. CASES REPORTED UP TO 1942 | MORE THAN 1400 |
| 3. TYPE TAR MOST CARCINOGENIC | HIGH TEMPERATURE |
| 4. PRINCIPLE OCCUPATION IN
WHICH CASES OCCUR | MFG. TAR |
| 5. PRINCIPLE SITE OF CANCER | UPPER LIMBS |
| 6. AVERAGE EXPOSURE | 20-30 YEARS |
| 7. MORTALITY | 13.0% |
| 8. INCIDENCE AMONG TAR WORKERS | "VERY HIGH" |
| 9. AGE RANGE FOR MOST CASES | 40-60 |

COAL TAR & PITCH CANCERS IN U.S.
 REVIEW OF 21 CASES OF CANCER COVERING A 10-YR. PERIOD
 STUDIED BY HELLER IN A CLEVELAND PLANT

CASES	SITE OF CANCER	MATERIAL	PROCESS	OCCUPATION
7	HANDS & ARMS	GAS HOUSE PITCH	CARBON MFG.	MOLDER OR MIXER
1	EAR	GAS HOUSE PITCH	CARBON MFG.	MOLDER
1	FACE	GAS HOUSE PITCH	CARBON MFG.	MOLDER
1	LIP	GAS HOUSE PITCH	CARBON MFG.	MOLDER
1	FACE AND HANDS	GAS HOUSE PITCH	CARBON MFG.	MOLDER
1	WRIST	GAS HOUSE PITCH	CARBON MFG.	MIXER
1	HAND	GAS HOUSE PITCH	CARBON MFG.	MOLDER
2	SCROTUM	GAS HOUSE PITCH	CARBON MFG.	MOLDER
3	LIP	COKE OVEN PITCH	CARBON MFG.	MOLDERS & MIXERS
1	SCROTUM	COKE OVEN PITCH	DRY BATTERY MFG.	SEAL MAKER
2	HAND	TAR OIL	LAMPBLACK MFG.	LAMPBLACK MAKERS

1. FIRST CASES REPORTED 1907
2. APPROXIMATE NO. CASES REPORTED 50-100
3. PRINCIPLE OCCUPATION WHERE CASES OCCUR MFG. PRODUCTS CONTAINING TAR UPPER LIMBS
4. PRINCIPLE SITE OF CANCER
5. STUDIES OF PLANTS IN FOLLOWING AREAS NEGATIVE
 N.Y., BOSTON, PITTS., CHICAGO, MILWAUKEE, PHILA.

c.c.-7290

EXPERIMENTAL STUDIES ON CARCINOGENIC
ACTION OF COAL TAR AND PITCH

1. FIRST CANCERS IN EXPERIMENTAL ANIMALS 1915
 - A. LATER STUDIES CONFIRM CARCINOGENIC ACTION
 - B. SIGNIFICANCE - FIRST EXPERIMENTAL CANCER PRODUCED BY KNOWN CHEMICAL
2. ANIMALS IN WHICH CANCER HAS BEEN PRODUCED
MICE RABBITS RATS
3. CARCINOGENIC POTENCY OF COAL TAR PRODUCTS, PITCH
HIGH TEMPERATURE TAR, LOW TEMPERATURE TAR
4. SHORTEST LATENCY PERIOD FOR TAR CANCER IN MICE - 50 DAYS
5. SHORTEST LATENCY PERIOD FOR TAR CANCER IN RABBITS - 47 DAYS
6. SHORTEST LATENCY PERIOD FOR TAR CANCER IN RATS - 400 DAYS
7. EFFECT OF DURATION OF TARRING ON CANCER IN MICE

DURATION OF TARRING	NUMBER OF MICE	NUMBER OF CANCERS
1 MONTH	14	0
2 MONTH	16	3
3 MONTH	13	9
4 MONTH	12	12

6.0.7296

been cancer of this type of cancer reported from the United States, except among men who migrated to the United States after many years of such work in England.

Cancer as a result of exposure to crude paraffin was first reported in the United States in 1910.

(SLIDE 5)

As indicated, about 50 such cases have been reported, principally involving the scrotum, among workers who were involved in the manufacture of paraffin for extended periods of time (10-15 years). A more detailed study of this type of cancer was performed by Miller in 1930 and his findings are summarized in the next slide.

(SLIDE 6)

It is to be noted that most of the men who developed this type of cancer were involved in the same type of occupation and that their exposure was for long periods of time.

also remember that by using this experimental approach, it was possible to follow the carcinogenicity of various fractions of coal tar and ultimately isolate from it 3,4-benzylene, the first chemically identified carcinogen.

The next occupational cancer was again reported from England among male spinners.

(Slide 4)

The first of these cases was reported in 1910, and until 1942, over 1500 cases were reported. In this occupation the worker is forced to lean over a large spinning machine to adjust the thread, and in so doing received across the front of his pants, a spray of the oil used to lubricate the rapidly rotating spindle. Hence the site of most of these cases was the scrotum. Again the exposure is noted to be of long duration, 10-20 years. Subsequent study indicated that the shale oil used as a lubricant in this operation was much more carcinogenic than the mineral oil lubricant used on similar machines in this country. Hence there have never

OCURRENCE OF SHALE OIL CANCER IN ENGLAND

1. FIRST CASES STUDIED	1910 (?)
2. NO. CASES REPORTED UP TO 1942	"WELL OVER 1500"
3. PRINCIPLE OCCUPATION IN WHICH CASES OCCUR	MULE SPINNING
4. PRINCIPLE SITE OF CANCER	SCROTUM
5. INCIDENCE OF SCROTAL CANCER AMONG MULE SPINNERS	2.5 CASES/ 1000/YEAR
6. AVERAGE EXPOSURE	10-20 YEARS
7. MORTALITY	20%
8. PERCENTAGE OF CASES WHICH ARE NON-SCROTAL	25%

G.C. 7293

SLIDE 4

SUMMARY OF PARAFFIN CANCERS
IN UNITED STATES

1. FIRST CASE REPORTED	1910
2. APPROXIMATE TOTAL NO. CASES REPORTED	50
3. PRINCIPLE OCCUPATION IN WHICH CASES OCCUR	MFG. PARAFFIN
4. PRINCIPLE SITE OF CANCER	SCROTUM
5. AGE RANGE FOR MOST CASES	50-60 YEARS
6. AVERAGE EXPOSURE	10-15 YEARS
7. NEGATIVE EVIDENCE	STUDIES OF 8 REFINERIES IN PA. NEGATIVE

c.c. 7291

PARAFFIN CANCERS IN A U.S. REFINERY (1926-1929)
STUDY OF PARAFFIN DEPT. BY HELLER

YEAR	SITE OF CANCER	OCCUPATION	LENGTH OF EXPOSURE YEARS
1926	ARM	DUMPER IN PARAFFIN PRESS ROOM	10
1927	SCROTUM	DUMPER IN PARAFFIN PRESS ROOM	5
1927	SCROTUM	DUMPER IN PARAFFIN PRESS ROOM	8
1928	SCROTUM	DUMPER IN PARAFFIN PRESS ROOM	13
1928	LEG	DUMPER IN PARAFFIN PRESS ROOM	11
1929	SCROTUM	SUPERINTENDENT OF PARAFFIN DEPT.	29
1929	SCROTUM	TREATER (TANK WASHER) PARAFFIN	33
1. INCIDENCE OF CANCER AMONG EMPLOYEES			23.3%
2. INCIDENCE OF CANCER AMONG DUMPERS 1926 - 1928			55.5%
3. INCIDENCE OF SKIN DISEASES IN REST OF REFINERY			"VERY RARE"

c.c. 7288

Another type of occupational cancer which is well recognized is that associated with the manufacture of certain aniline dyes. I do not intend to dwell on this subject since Dr. McGuigan will undoubtedly discuss this in detail for you. It need only be said that experimental evidence indicates that aniline is not the carcinogenic agent but rather benzidine and beta-naphthylamine.

Another agent associated with cancer, especially of the skin, is sunlight. In work which requires the individual to be out-of doors all day, it may well be considered as an occupational agent. Phillips' studies of 1284 cases of skin cancer in a Texas Hospital clearly illustrate the importance of this.

(Slide 7)

It is to be noted that about 60% of these skin cancers occurred among farmers or ranchers and their wives. The importance of this observation is tremendous in the southern states, where the incidence of skin cancer has been said to be 50 times what it is in the Chicago area. It is also of great importance in the differential diagnosis of occupational cancer because so many southern industrial workers have small personal farms which keep them out in the sun during practically all their hours off the job. Thus the question may arise whether a particular skin cancer is due to sun exposure or to exposure to a carcinogen in industry.

In 1938 it was reported from Germany that a high incidence of lung cancer had been found among workers in the chromium industry. Little importance was attached to this announcement until 1948 when Machle & Gregorius reported a similar increased incidence of lung cancer in chromate workers. It now seems without question that some place in the chromium producing industry such a hazard exists, although to date it has not been well identified. Apparently it is some kind of a specific exposure because it has not yet been associated with the chrome plating industry.

CANCER OF THE SKIN IN TEXAS
(PHILLIPS)

	NO. OF CASES	PERCENT
FARMER-RANCHER	532	41.4
HOUSEWIFE	229	17.8
BUSINESS	144	
PROFESSIONS	60	
LABORER	37	
CARPENTER	20	
OIL INDUSTRY	11	0.9
RAILWAY INDUSTRY	30	
STUDENT	4	
SOLDIER	3	
OCCUPATION UNKNOWN	214	
TOTAL	1,284	

Finally I would simply like to mention that in those workers who develop asbestosis, there is also an increased incidence of pulmonary cancer. Exposure to asbestos dust alone, without the appearance of asbestosis does not seem to be associated with the increased incidence of lung cancer. I need only mention radiation exposures, as evidenced by skin cancers in radiologists and bone sarcomas in radium dial painters to recall the carcinogenic hazards associated with these occupations.

I would like now to show you a summary slide of some of the more well recognized occupational cancers.

(SLIDE 8)

The significance of this slide lies in the much greater number of cases reported from other countries, principally England, than reported from the United States. With the exception of shale oil, where the exposure does not occur in the United States, this difference has been attributed to two factors: 1) the greater personal cleanliness and improved working conditions of the majority of American workers, and 2) the lack of a central reporting agency for cancer in the United States, but its presence in England. In England, all cancer cases are reported to the Chief Inspector of Mines and Factories, who periodically analyzes the data so collected and correlates it with the occupational history of the individual. No such reporting system exists in the United States and hence it is believed by many experts in this field, that many occupational cancers are missed. There is one other point that this slide emphasizes. The data given cover approximately a 20 year period. Thus the number of cases of occupational cancer represents but a small fraction of the total number of cases of cancer which occur each year. This figure has been estimated as about one-tenth of one percent. You can thus see that the overall problem in terms of the total cancer picture is a relatively insignificant one. Nonetheless, for any one industry, the problem can become a significant one.

- 13 -

C.G. 8866-A

OCCUPATIONAL CANCER

	U.S.	OTHER COUNTRIES	TOTAL
PARAFFIN WAX AND OIL	>62	193	>255
SHALE OIL	0	>1500	>1500
COAL TAR	33	>1568	>1601
ANILINE DYE	100	450	550

SLIDE 8

found a mortality of 0.78 per thousand per year, while figures computed by the census for the population at large indicated a mortality of 0.93 per thousand per year, which is quite comparable to figures published by an insurance company for the general population. In any statistical studies it is important to realize that the incidence increases markedly with increasing age as indicated by the bottom three bars. Not satisfied with Gaster's figures, we repeated his studies, using incidence instead of mortality figures in six large refineries. These figures are shown on the next slide.

(SLIDE 10)

The first column indicates the expected incidence of cancer in all ages of the General population, while the next column indicates the expected incidence in the General population in the age range 45-54. The next six columns represent cancer incidence in six separate refineries for the years 1937 - 1948 inclusive.

indicated by over 1600 cases of coal tar cancer, representing about 80 cases a year. Eighty cases of occupational cancer a year would represent a significant problem to a single industry, and hence the interest of industry in this problem. For me say also, that regardless of its statistical importance, cancer is an important problem to the individual who has cancer.

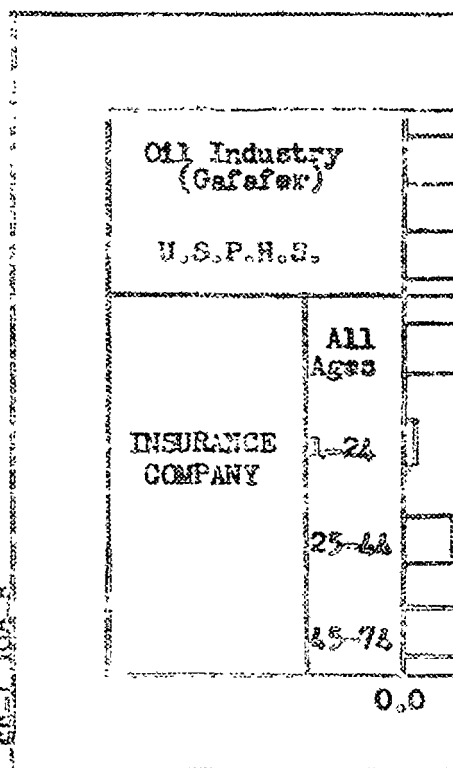
Because of this, we became interested in the problem of occupational cancer among our own employees. Occupational cancer, after all, is one of the few cancers which is preventable, but before it can be prevented, it is necessary to know, first, whether you have a problem, and, second, where that problem exists.

(SLIDE 9)

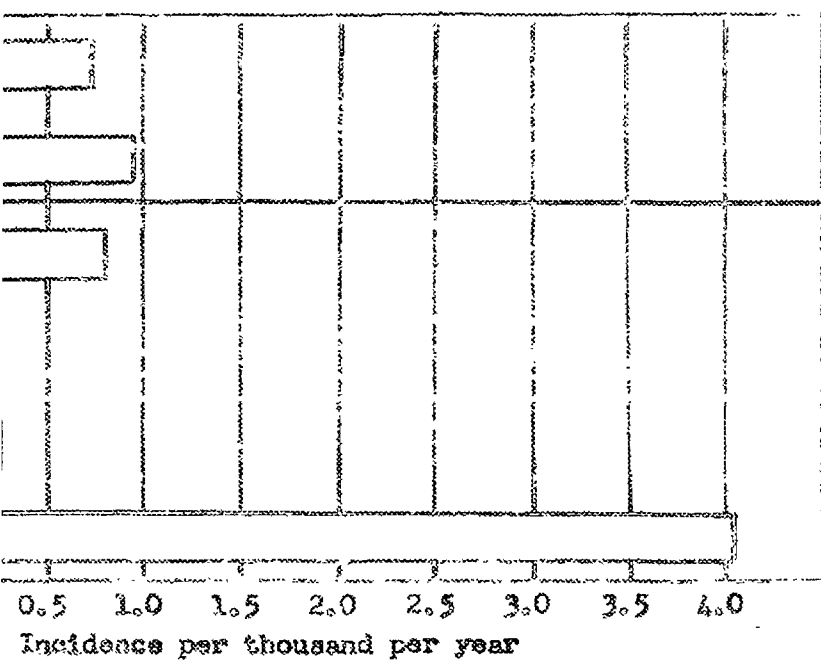
When we studied the available figures on mortality of cancer. Gaffner of the U.S. Public Health Service in 1938 made a study of cancer mortality in the oil industry. His figures indicated that there was no occupational cancer hazard in this industry.

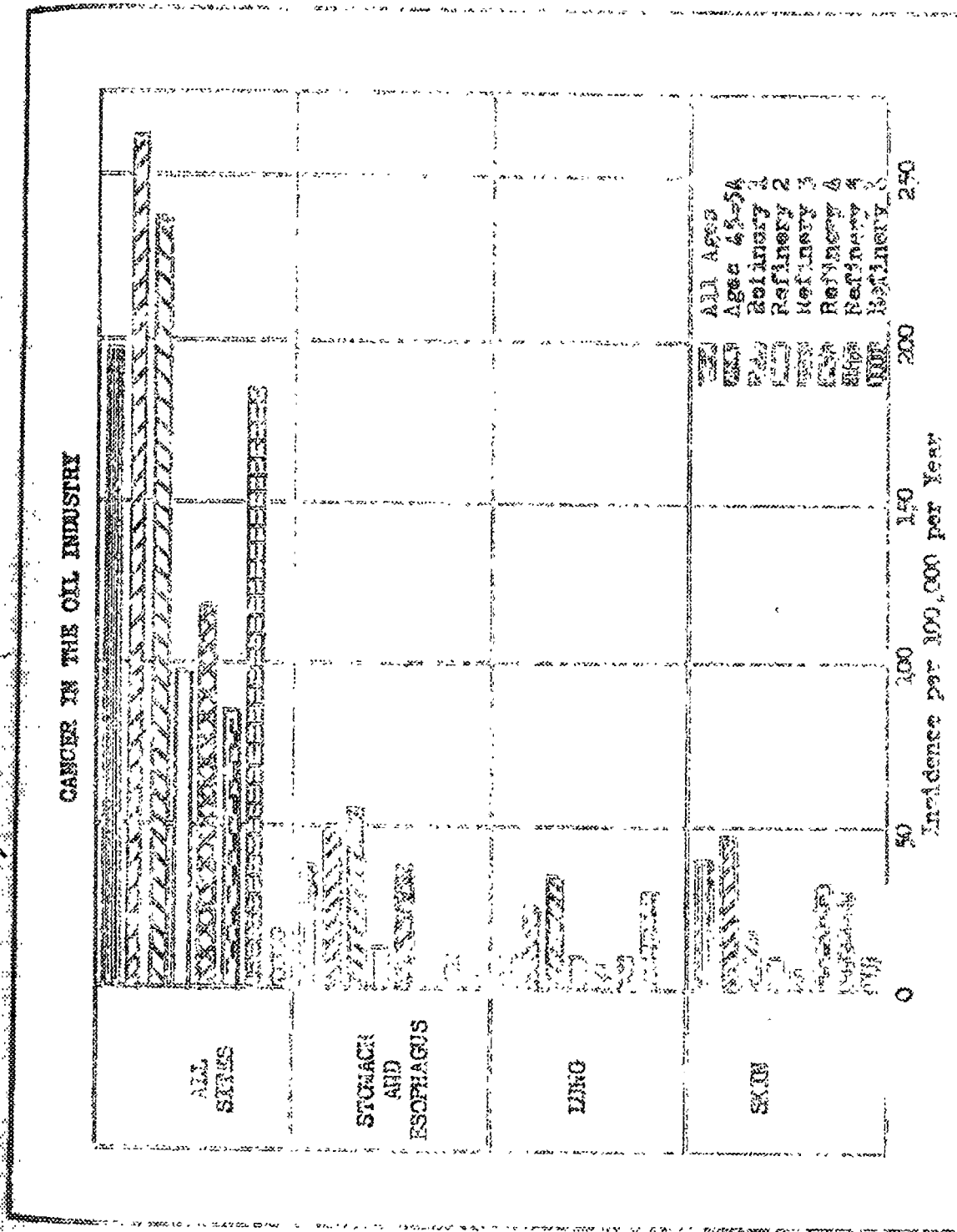
15

SLIDE 9



MORTALITY FROM CANCER





my purpose in showing this slide is simply to indicate how misleading a study of this type can be. Let us, for instance take the case of the refinery represented by the third bar. It can be seen that the incidence of cancer of all sites is not alarming when compared with the general population. Similarly the incidence of stomach, lung and skin cancer would be no cause for concern when compared with the incidence for these sites in the general population. I would particularly like to call your attention to the figures for skin cancer. It is seen that the incidence among workers in the refinery is almost half that in the general population; but now let us examine these figures more closely.

(SLIDE 11)

Here the incidence of skin cancer in the general population in the age ranges 45-54 and 55-64 is given in the first two bars. In the next bar the incidence of skin cancer among all employees in the refinery is given. However, in reviewing these cases it was found that about 1/3 of them appeared on the skin of the scrotum. Because of the previous literature references to occupational scrotal cancer, our index of suspicion was aroused and detailed studies were undertaken. These studies indicated that all these men worked in one small area of the refinery for more than 10 years, and what's more they all worked at the same job for more than ten years. On this basis, then, it is seen that a very significant increase in the incidence of skin cancer in this selected group of workers exists, and that, therefore, a definite occupational cancer exists. As a result of such studies it was possible to pinpoint the hazard and to introduce the necessary precautions to eliminate it.

This then leads to the \$64 question, namely, "How does one arrive at the diagnosis of occupational cancer?" The answer is a difficult, but not an insurmountable one. First of all the location of the cancer must be determined. All