Monsanto

FROM: F.R. Johannsen - A2SC

DATE: August 22, 1975

cc: G. J. Levinskas - A2SC
G. Bratsch - B3NA

SUBJECT: Epidemiological Considerations of the Dept. 246 Cohort

REFERENCE:

TO:

George Roush *
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As stated in an Epidemiology status report of July 31, 1975 (FRJ/GR), the service records of those persons previously and presently employed in Department 246 - AROCLOR of the Krummrich Plant have been reviewed. Utilizing the data obtained from this review, statistical analyses have been performed on this cohort of employees. The results of these studies can be found in the attached addendum. Several conclusions and recommendations will be presented below. They have been derived, in part, from the results obtained in the statistical analyses but are also based on accepted epidemiological principles.

Comparisons were made on the following crude mortality rates developed for the St. Louis City and the Dept. 246 populations:

a. all causes
b. malignant neoplasms
c. digestive system cancer, including liver cancer
d. respiratory system cancer

In each of the first three comparisons, the Dept. 246 population exhibited a lower or equivalent mortality rate versus mortality rates of similar diseases developed for the St. Louis City population. However, the rate of deaths due to respiratory cancer found in the #246 population (total of 4 mortalities attributable to respiratory cancer) was significantly higher than the rate for respiratory cancer deaths calculated for the St. Louis City population. To further define the validity of this significant difference, a 2 x 2 table analysis was performed. Breaking each of the two populations (STL City and Dept. 246) into subgroups (mortalities attributable and not attributable to respiratory cancer), a determination of the risk of dying from respiratory cancer was calculated for each population. A subsequent comparison revealed significant differences between the risk calculated for each population, thus substantiating the earlier analysis.

Looking at this data from a purely statistical viewpoint, it

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must be clearly realized that the population (Dept. 246 - mortalities) evaluated in this study is extremely small, containing a total of 24 mortalities over a 25-year period. To conduct a life-table analysis (LTA) which would require further subdivision into age-specific, cause-specific categories would greatly increase the chances of statistical error, resulting in a false conclusion. The highly significant differences in the rate of mortalities due to respiratory cancer among our two populations is a prime example. The number of deaths related to this cause in a population of the size derived for Dept. 246 is expected to fall between 2.4-3 cases, based on national rates and on the St. Louis City rate developed here. Thus, if the #246 population had contained only 3 such cases, the rates would have been statistically non-significant. Yet the addition of but 1 more case yielded a very high degree of significance. For this reason, statistical comparisons of rates developed on populations with less than 5 cases are generally not made. It is therefore concluded that the LTA would not be a useful tool to further determine the health status of this small cohort.

Observation of data from an epidemiological viewpoint yielded the following conclusions:

a) there does not appear to be a correlation between cause-of-death and duration of exposure in the Dept. 246 cohort,

b) the average age-at-death of the Dept. 246 cohort is similar to that calculated for the entire Krummrich Plant population,

c) while the rate of respiratory cancer deaths in the Dept. 246 cohort was found to be significantly higher than that of a control population (St. Louis City) by gross statistical manipulation, the number of observed cases in the Dept. 246 cohort is not considered to be unusual for a population of its size over a 25-year period (an opinion shared by Dr. Wm. Gaffey, Manager, Epidemiology - Tabershaw-Cooper, Associates).

The present analysis of the data obtained from this cohort does not support a statistically valid adverse effect attributable to occupational exposure in Dept. 246. Further, it is felt that a subsequent analysis of the same data by an outside contractor would produce a similar conclusion.

Since there is some advantage to having an outside concern voice a professional opinion that our data is not supportive of the presence of adverse effects due to PCB exposure, it is recommended that an experienced epidemiologist be contracted to further evaluate this data.

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Att.

Addendum

I. Epidemiological Information Concerning Dept. 246 - Krummrich Plant

a) No. employed ≥ 6 mo. in Dept. 246 between years 1950 - 1974	137
b) No. of man-years of life in cohort between years 1950 - 1974	2,457
c) No. of mortalities observed in cohort, all causes	24
d) No. of mortalities observed in cohort, respiratory cancer	4
e) No. of mortalities observed in cohort, digestive system cancer	0
f) Range of duration in Dept. 246 of the four respiratory cancer cases	1½ - 2 3/4 yr.
g) Age (and year) at death of each of the four respiratory cancer cases	a) 70 - 1963 b) 59 - 1968 c) 69 - 1963 d) 56 - 1968
h) Average age at death of cohort (1950-1974) with ≥ 6 mo. length of service in Dept. 246	57.2 yr.

II. Rate and Probability-of-Risk Determinations

A. Population Definitions

1. Dept. 246 = Adult males employed in the Aroclor department at the Krummrich Plant for ≥ 6 mo. duration between the years of 1950 - 1974.

2. STL = Adult (≥ 20 years old) males residing in St. Louis City during the years 1952 - 1972.

B. Population Statistics

1. Population (man-years existence in cohort)

a. #246 - 2,456
b. STL - 6,807,506

2. Mortalities, all causes

a. #246 - 24
b. STL - 103,274

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3. Mortalities, malignant neoplasms

   a. #246 - 6
   b. STL - 18,191

4. Mortalities, respiratory cancer

   a. #246 - 4
   b. STL - 5,287

5. Mortalities, digestive system cancer

   a. #246 - 0
   b. STL - 6,207

C. Crude Mortality Rate Determination by Classification in the Dept. 246 - AROCLOR and St. Louis City Populations

Mortality Classification	Rates per 100,000 #246	Rates per 100,000 STL	Standard Mortality Ratio(SMR) #246	Standard Mortality Ratio(SMR) STL
All causes *	9.77	15.17	64*	100
Malignant neoplasms	244.29	267.21	91	100
Respiratory cancer	162.86	77.66	209**	100
Digestive system cancer	0.00	91.17	0**	100

* per 1,000
** significant at the 5% level
*** significant at the 1% level

D. Determination of Risk of Respiratory Cancer in STL versus #246 Populations

	Mortality #246	Population STL	
no respiratory cancer	a= 20	c= 97,987	M_1= 98,007
with respiratory cancer	b= 4	d= 5,287	M_2= 5,291
	N_1= 24	N_2=103,274	N= 103,298

$$X^2 = \frac{(1ad-bc1-\frac{N}{2})^2 N}{N_1 N_2 M_1 M_2}$$

$$= \frac{(120.5,287-4.97,9871-\frac{103,298}{2})^2 \cdot 103,298}{24.103,274.98,007.5,291}$$

$$= \frac{1.18 \times 10^{16}}{1.28 \times 10^{15}}$$

$X^2 = 9.2$ **

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degree of freedom = 1
** significant at the 1% level
conclusion: each population has a significantly different rate of disease incidence