

Jan. 26 99 02:02P

DuPont-Chambers Works

609-540-4654

p. 2

CC: B. W. Karrh, M.D.



E. I. DU PONT DE NEMOURS & COMPANY  
INCORPORATED  
WILMINGTON, DELAWARE

EMPLOYEE RELATIONS DEPARTMENT

March 15, 1979

PERSONAL AND CONFIDENTIAL

P. G. GILBY  
CD&P  
B-13265

CHAMBERS WORKS  
FLUOROSULFACANT STUDY  
(Ref. Letter from RDR to PGG, 1/23/79)

In response to our request to the plant for additional information to analyze the data statistically, we received a tabulation of the Dispensary Visits and Disability Wage incidents in the exposed and control groups (Attachment V). These data were broken down by body systems. We were also informed of the number of employees in each group who had abnormal liver function tests.

We performed a "chi-square" test to test the significance of differences between the exposed and control groups. The attached table shows only those differences that were found to be statistically significant.

In the category, "Allergic, Endocrine, and Metabolic" disorders, a significantly higher incidence was found in the exposed group for both Dispensary Visits and Disability Wage incidents. This was attributed in the report to a higher number of diabetics in the exposed group.

The exposed group also showed significantly higher numbers for "mental and psychoneurotic" disorders and for disorders of "skin and cellular tissues."

The control group, on the other hand, had considerably more Disability Wage incidents for circulatory diseases, 25 compared to 5. This difference is highly significant ( $P < 0.001$ ).

Explanations for these differences cannot be found from the available data. It would be helpful to find out what specific diagnosis within these general categories accounted for the differences between the two groups.

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Jan. 26 98 02:02p

DuPont-Chambers Works

609-540-4654

P. 3

- 2 -

Although the number of employees with abnormal liver function tests was notably higher in the exposed group (6 compared to 1), the difference is not statistically significant ( $P < 0.05$ ). Nevertheless, the data do suggest that the exposed group may be at an excess risk of developing liver disease, so continued surveillance would be advisable.

**MEDICAL DIVISION***Sidney Pell*

Sidney Pell  
Manager  
Epidemiology Section

SP:msd  
Attach.

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Jan 28 99 02:03p

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P. 4

ORGANIC FLUORINE IN BLOOD

## GROUP (SAMPLE SIZE)

PPM ORGANIC FLUORINE\*3M DATA

GENERAL POPULATION (106)	0.002 TO 0.13 [0.02] **
PLANT OFFICE WORKER	0.01 TO 0.06
PLANT WORKER - GENERAL	0.13 TO 1.18
PLANT WORKER - LONG	
SERVICE IN F/C AREA	
NEWER PLANT	0.9 TO 9.1
OLDER PLANT	5.9 TO 71

Du Pont Data

WILMINGTON CONTROL GROUP (25)	(23 OF 25) 0 - 0.38 [0.094] ***
CHAMBERS WORKS GROUP (55)	(54 OF 55) 0 - 0.37 **** [0.15]

CONCLUSIONS

- ① CHAMBERS WORKS EMPLOYEES DO NOT HAVE ELEVATED LEVELS OF ORGANIC FLUORINE IN THEIR BLOOD AS WAS REPORTED FOR 3M WORKERS.
- ② THE MEAN VALUE FOR CHAMBERS WORKS EMPLOYEES WAS SLIGHTLY HIGHER THAN THE WILMINGTON CONTROL GROUP [0.15 VERSUS 0.094], BUT ALL VALUES ARE CONSIDERED TO BE "NORMAL" (<1 PPM) EXCEPT ONE VALUE IN THE WILMINGTON CONTROL GROUP (10.6 PPM).
- \* BY DIFFERENCE BETWEEN \*\*\* EXCEPT 2 VALUES 10.6;  
TOTAL AND INORGANIC FLUORINE 0.78
- \*\* [MEDIAN VALUES] \*\*\*\* EXCEPT 1 VALUE 0.89 PPM

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Jan 26 99 02:03p

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608-540-4854

P.5

CONCENTRATION OF PERFLUOROOCTANOATE IN BLOOD (a)

TABLE I

7/31:

<u>Sample</u>		<u>GC Analysis</u>	
<u>PRAL No.</u>	<u>Date Sampled</u>	<u>Date Analyzed</u>	<u>Cal. ug F/g b:</u>
81-2688	6/16/81	6/26/81	0.007
81-2689	6/16/81	6/26/81	0.011
81-2690	6/17/81	6/26/81	n.d.
81-2779	6/23/81	6/26/81	0.096

- (a) Analysis as described in Lab Method ES-567 ("Determination of Perfluorooctanoic Acid in Blood, Gas Chromatographic Method", S. Stafford, 4/3/81), using the packed column GC analysis with perfluoro-n-octanoic acid as calibration standard.
- (b) Although the analysis is specifically for perfluorooctanoate (acid or salts), concentrations are given in ppm fluorine for comparison with the results of total organic fluorine analyses. (ppm F = 0.688 x ppm perfluorooctanoic acid) Estimated uncertainty is  $\pm$  10% relative standard deviation. The lower limit for quantitation is 0.007 ugF/g. The detection limit is  $\sim$  0.004 ugF/g, but concentrations in that range cannot be well quantitated and are reported as < 0.007. None detected (n.d.) is reported for samples with  $[C_8] \leq 0.004$  ppm, which cannot be distinguished from reagent background.

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Jan. 26 99 02:03P

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609-540-4654

P.6

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TABLE I

CONCENTRATION OF PERFLUOROOCTANOATE IN BLOOD (a)

Sample PRAL No.	Date Sample	CC Analysis Date Analyzed [C <sub>8</sub> ] ug F/g b:
81-3076	7/14/81	7/28/81 & 7/29/81 0.014
81-3077	7/14/81	7/28/81 0.25 —
81-3078	7/15/81	7/28/81 0.11 —
81-3185	7/22/81	7/28/81 0.015
81-3186	7/22/81	7/29/81 0.033
81-3187	7/22/81	7/29/81 n.d.
81-3188	7/22/81	7/29/81 0.010
81-3189	7/22/81	7/28/81 0.12 —
81-3190	7/22/81	7/28 & 7/29/81 0.015
81-3191	7/22/81	7/29/81 0.062
81-3192	7/22/81	7/29/81 < 0.007
81-3193	7/23/81	7/29/81 0.016
81-3194	7/23/81	7/29/81 0.14 —
81-3195	7/23/81	7/29/81 0.007
81-3196	7/23/81	7/29/81 0.15 —
81-3197	7/23/81	7/30/81 0.032
81-3198	7/24/81	7/30/81 0.086
81-3199	7/24/81	7/30/81 0.027
81-2779	6/23/81	7/28/81 0.10 <sup>(c)</sup> —

- (a) Analysis as described in Lab Method ES-567 ("Determination of Perfluorooctanoic Acid in Blood, Gas Chromatographic Method", S. Stafford, 4/3/81), using the packed column GC Analysis with perfluoro-n-octanoic acid as calibration standard.
- (b) Although the analysis is specifically for perfluorooctanoate (acid or salts), concentrations are given in ppm fluorine for comparison with the results of total organic fluorine analyses. (ppm F = 0.688 x ppm perfluorooctanoic acid) Estimated uncertainty is  $\pm$  10% relative standard deviation. The lower limit for quantitation is 0.007  $\mu$ gF/g. The detection limit is  $\sim$  0.004  $\mu$ gF/g, but concentrations in that range cannot be well quantitated and are reported as < 0.007. None detected (n.d.) is reported for samples with [C<sub>8</sub>] < 0.004 ppm, which cannot be distinguished from reagent background.
- (c) Previously analyzed sample, re-analyzed for comparison with repeat sample 81-3189; result of the initial analysis on 81-2779 was 0.096, reported 7/13/81.

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P000010177

Jan. 26 99 02:03p

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P. 7

111  
81-181ANALYTICAL RESULTS AS MICROGRAMS FLUORINE/GRAM BLOOD

<u>Group A</u>	<u>Group B</u>	<u>Group C</u>	<u>Group D*</u>	<u>Group E</u>	<u>Group F</u>
0.032	0.059	0.013	{ 0.013	0.020	N.D.**
.015		.016	{ .015	N.D.**	
.033		N.D.**	{ .007	<.007**	
.014			{ .007	<.007**	
.062			{ .011	.010	
.077			{ .016		
.140			{ .096		
.025			{ .120		
.084					
.150					
.110					
.039					
.027					
.250					
.150					
Range	0.014-.25	-	0-.016	0.007-.12	0-.020
Mean	0.0805	0.0590	0.0097	0.0356	0.0088
Samples	15	1	3	8	5
Employees	15	1	3	4	5
Overall:	Range 0-.25	Mean 0.049	Samples 33	Employees 29	

\* Pre-work and post-work specimens were taken from 4 employees in Group D (Pre). Time lapse between samples was 2-5 weeks. (Post)

\*\* None detected. Zero concentration used in computing means.

\*\*\* The lower limit for quantitation is 0.007 and lower values are reported simply as <0.007; however, the 0.007 value was used in calculating means.

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Jan 26 99 02:04P

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P.8

SPECIAL EXAMSFLUORIDE-IN-URINE SAMPLE FOR MACTO VISIT SP.EX. ON DATE:

BASE-LINE

FOLLOW-UP

EMPLOYEE

URINE

11/8 AM ✓

URINE

11/10 PM ✓

(3) 11/8 AM ✓

(9) 11/10 PM ✓

(5) 11/9 AM ✓

(6) 11/11 AM ✓

(7) 11/10 AM ✓

(8) very little sample  
11/12 PM ✓

11-10 PM ✓

11-12 PM ✓

(9) 36217

Cost Codes

1st Code

(a) For FM = 5233.

(b) For EC = 3200.

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Jan 26 99 02:04p

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609-540-4654

p. 9

11/6/76

<u>NAME &amp; NUMBER</u>	<u>FLUORIDATED</u>		<u>DATE &amp; TIME URINE VO</u>	
	<u>WATER</u>	<u>TOOTH</u>	<u>BASE-</u>	<u>FINAL</u>
	<u>SUPPLY</u>	<u>PASTE</u>	<u>LINE</u>	<u>SAMPLE</u>
	yes	no	11/8 AM	11/10 PM
	yes	no	11/8 AM	11/10 PM
	yes	yes	11/9 AM	11/11 PM
	yes	yes	11/10 AM	11/12 PM
	yes	yes	11/10 PM	11/12 PM

The baseline urine sample was voided after worker had been away from worksite potential exposure to fluorides for at least 48 hours.

The final urine sample was voided after worker had been subjected to worksite potential exposure for a minimum of 48 hours - clock time.

### RESULTS

<u>BETWEEN SAMPLES</u>	<u>HRS. ON JOB</u>	<u>MILLIGRAMS F per LITER</u>		
		<u>BEFORE</u>	<u>AFTER</u>	<u>PICK-UP</u>
22		4.8	5.9	1.1
22		3.2	2.8	0
23		3.6	4.0	0.4
23		3.9	6.6	2.7
15		6.1	4.2	0

NIOSH RECOMMENDATION (Criteria Document, 4-8-76) = The postwork specimen shall not exceed .7.0 and shall not exceed the pre-work specimen by a pick-up greater than 3.0 milligrams F per liter of urine

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