AR226-3468

[redacted]

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
FLUOROSULFACTANT 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.

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.

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

- CHAMBERS WORKS EMPLOYEES DO NOT HAVE ELEVATED LEVELS OF ORGANIC FLUORINE IN THEIR BLOOD AS WAS REPORTED FOR 3M WORKERS.
- 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 TOTAL AND INORGANIC FLUORINE

** [MEDIAN VALUES]

*** EXCEPT 2 VALUES 10.6; 0.78

**** EXCEPT 1 VALUE 0.89 PPM

TABLE I

7/13/81

CONCENTRATION OF PERFLUOROOCTANOATE IN BLOOD (a)

Sample	Date Sampled	GC Analysis Date Analyzed	$[C_8]$, ug F/g b
[redacted]	6/16/81	6/26/81	0.007
	6/16/81	6/26/81	0.011
	6/17/81	6/26/81	n.d.
	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 µgF/g. The detection limit is $\sim$ 0.004 µgF/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 $[C_8] \lesssim$ 0.004 ppm. which cannot be distinguished from reagent background.

8/3/81

TABLE I

CONCENTRATION OF PERFLUOROOCTANOATE IN BLOOD (a)

Sample	Date Sample	GC Analysis Date Analyzed	[C_8], µg F/g b
[redacted]	7/14/81	7/28/81 & 7/29/81	0.014
[redacted]	7/14/81	7/28/81	0.25
[redacted]	7/15/81	7/28/81	0.11
[redacted]	7/22/81	7/28/81	0.015
[redacted]	7/22/81	7/29/81	0.033
[redacted]	7/22/81	7/29/81	n.d.
[redacted]	7/22/81	7/29/81	0.010
[redacted]	7/22/81	7/28/81	0.12
[redacted]	7/22/81	7/28 & 7/29/81	0.015
[redacted]	7/22/81	7/29/81	0.062
[redacted]	7/22/81	7/29/81	< 0.007
[redacted]	7/23/81	7/29/81	0.016
[redacted]	7/23/81	7/29/81	0.14
[redacted]	7/23/81	7/29/81	0.007
[redacted]	7/23/81	7/29/81	0.15
[redacted]	7/23/81	7/30/81	0.032
[redacted]	7/24/81	7/30/81	0.084
[redacted]	7/24/81	7/30/81	0.027
[redacted]	6/23/81	7/28/81	0.10(c)

(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 ± 10% relative standard deviation. The lower limit for quantitation is 0.007 µgF/g. The detection limit is ∿ 0.004 µgF/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] ≤ 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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8/20/81

ANALYTICAL RESULTS AS MICROGRAMS FLUORINE/GRAM BLOOD

Group A	Group B	Group C	Group D*	Group E	Group F
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	0
Samples	15	1	3	8	5	1
Employees	15	1	3	4	5	1

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.

000700

SPECIAL EXAMS

FLUORIDE-IN-URINE SAMPLE FOR MAC

TO VISIT SP.EX. ON DATE:

EMPLOYEE	BASE-LINE URINE	FOLLOW-UP URINE
D	11/8 AM ✓	(2) 11/10 PM ✓
	(3) 11/8 AM ✓	(4) 11/10 PM ✓
	(5) 11/9 AM ✓	(6) 11/11 PM ✓
	(7) 11/10 AM ✓	(8) very little sample 11/12 PM ✓
	11-10 PM ✓	
(9) 36217		11-12 PM ✓

Cost Codes

Cost Codes [redacted]

11/16/76

NAME & NUMBER	FLUORIDATED WATER SUPPLY	FLUORIDATED TOOTH PASTE	DATE & TIME URINE VO BASE-LINE	DATE & TIME URINE VO FINAL SAMPLE
	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 base-line 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

HRS. ON JOB BETWEEN SAMPLES	MILLIGRAMS F per LITER BEFORE	AFTER	PICK-UP
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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ORGANIC FLUORIDES IN BLOOD SAMPLES

NAME	P.R. NO.	ZONE	ORGANIC FLUORIDE PPM	COMMENTS
GRANULAR OPERATORS				
Polymerization				
[redacted]	501	6	0.47	8/60-6/71, 12/72 to present
[redacted]	3520	6	2.33	Exposure since 1968, granular polymerization since 2/74.
[redacted]	598	6F	0.52	Special job. Relief on granular polymerization about 1 day/week 2/69 to present.
[redacted]	3097	6	3.54	F.P. P.O. 8/62 to 3/69, FEP polymerization 8/69 to 7/70, polymerization 12/71 to present
[redacted]	380	6	5.61	12/72 to present, others jobs since 5/55
[redacted]	3120	6	3.91	9/71 to present.
[redacted]	3417	6	6.84	FP, P.O. 9/65 to 12/72, polymerization 9/73 to present
[redacted]	3278	6	2.23	3/76 to present.
Finishing				
[redacted]	3720	4	2.06	Disp. P.O. 9/71 to 7/72, details to polymerization 5/76 to present.
[redacted]	4335	4	0.69	Detailed to polymerization 65 days in past 5 months.
[redacted]	4278	4	0.72	Detailed to granular polymerization 8 of last 10 weeks as of 9/13/79.
FINE POWDER/DISPERSION OPERATOR				
Polymerization				
[redacted]	4214	6	4.39	F.P. Dryers and Disp. P.O. 9/76 to 4/79, Polymerization 4/79 to present.
[redacted]	1484	6(22:17)	21.22	Service operator jobs 6/56 to 6/60, polymerization since 2/63.

( ) Previous blood samples taken in June.

Redacted - Privacy

NAME	P.R. NO.	ZONE	ORGANIC FLUORIDE PPM	COMMENTS
Polymerization (Cont.)				
[redacted]	3352	6	0.17	8/76 to present.
	953	6	(9.53) 8.25	4/62 to present, others job previous 6 years.
	3522	6	1.52	F.P. P.O. and Dryer 6/66 to 3/72, polymerization 2/74 to present.
	1482	6F	0.59	3/63 to present, except monomer operator 10/77-4/79.
	426	6	20.81	1960 to present.
	1508	6F	$\bar{x} = 9.63$ (10.56) 8.70	11/75 to present.
	943	6	$\bar{x} = 14.4$ (15.02) 13.75	4/62 to present. Service operator jobs previous 4 years.
	3564	6	1.60	11/75 to present.
	3994	6	3.55	3/76 to 8/78 F.P. dryer, polymerization 8/78 to present.
	1951	6	5.90	5/65 to present, service operator jobs additional 5 years.
	4146	6	0.38	3/79 to present.
	3485	6	6.91	4/77 to present, FEP service operator 2/75 to 4/77
	3854	6	16.89	F.P. dryer 10/75 to 4/77, polymerization 8/78 to present.
	3568	6	0.98	F.P. dryer and P.O. 2/75-5/76, some granular polymerization. F.P./disp. polymerization 4/79 to present.
	3987	6	3.81	Service operator jobs 9/72-11/77. Polymerization 11/77 to present.
	3424	6	3.23	8/76 to present

( ) Previous blood samples taken in June.

0-1 4
1-5 5
5-10 4
10-15 1
15-20 1
>20 1

Redacted - Privacy

NAME	P.R. NO.	ZONE	ORGANIC FLUORIDE PPM	COMMENTS
Service Operator				
[redacted]	3613	4	4.97	F.P. dryer and P.O. 6/66 to 12/69, Polymerization 10/77 to 10/78.
[redacted]	4390	4	1.98	F.P. Dryer since 11/78.
[redacted]	4153	4	4.84	F.P. Dryer and Disp. P.O. 9/76 to present.
[redacted]	1591	4F	2.24	Service Operator jobs 5/57 to present.
[redacted]	4300	4	1.03	
[redacted]	4111	4	2.92	12/78 to present F.P. Dryer, detailed to polymerization.
[redacted]	4452	4	0.50	3/79 to present all 3 jobs.
[redacted]	4216	4	1.04	
[redacted]	4331	4	1.80	F.P. packout.
[redacted]	1498	4	2.97	F.P. Dryer 12 years, F.P. P.O 8 years, other 3 years.
[redacted]	3490	4	3.89	12/72 to present F.P. Dryer and P.O.
[redacted]	4266	4	2.30	1/79 to present Disp. and Polymerization.
[redacted]	4299	4	1.78	F.P. packout.
[redacted]	4202	4	1.81	F.P. P.O. 11/76 to present, Details to polymerization.
MONOMER OPERATORS				
[redacted]	370	7	0.35	
[redacted]	432	7	0.39	
[redacted]	932	7	0.08	
[redacted]	858	6E	0.54	
[redacted]	1447	7	0.17	
[redacted]	625	7	0.37	
[redacted]	864	7	0.52	

Redacted - Privacy

NAME	P.R. NO.	ZONE	ORGANIC FLUORIDE PPM	COMMENTS
FEP OPERATORS				
Polymerization				
[redacted]	1743	6	(1.36) 0.99	1976 to present. Additional exposure in homopolymers
	707	6F	1.72	1976 to present. Additional exposure in homopolymers
	3223	6	2.71	Disp. 1964-1971; polymerization 1976 to present.
	1920	6	0.91	1976 to present.
	1510	6	2.10	1976 to present.
	1572	6	4.64	Disp. 10/60-11/63; polymerization 1976 to present.
	1978	6	3.70	1976 to present. Additional exposure to homopolymers
	1761	6	(3.61) 1.99	1976 to present.
	1928	6	1.95	1976 to present.
	1619	6	1.47	1976 to present.
	1744	6	4.96	1976 to present. Additional exposure in homopolymers.
	1426	6	4.52	10/77 to present. Additional exposure in homopolymers.
	889	6	4.14	12/76 to present. Additional exposure in homopolymers.
Dispersion				
[redacted]	4329	4	1.31	6/78 to present.
RESEARCH				
Research Chemists				
[redacted]	W/S		0.43	
	W/S		0.45	

( ) Previous blood samples taken in June.

Redacted - Privacy

NAME	P.R. NO.	ZONE	ORGANIC FLUORIDE PPM	COMMENTS
Semiworks Laboratorians				
[redacted]	870	6	0.44	5/70 to present.
	3793	6	1.50	8/77 to present. Finishing operator 9/68 to 11/69, service operator 5/72 to 12/72, homopoly service operator 12/72 to 7/74, 8/75 to 11/7
	3904	6F	0.24	4/77 to present.
	911	6	0.70	2/75 to present.
	560	6 (0.46)	0.26	4/77 to present.
	3133	6	0.30	7/69 to 10/72, 5/79 to present.
	3690	6F	0.24	8/77 to present. Service operator 2/75 to 9/75.
	1592	6 (0.72)	0.59	10/72 to present. Teflon exposure 9/59-4/62, service operator 3/63-2/6
MONOMER OPERATORS WITH LAST FINE POWDER/DISP. POLYMERIZATION EXPOSURE				
[redacted]	939	7	6.66	Polymerization 1/62 to 10/78 Monomer operator 11 months.
	3044	7	5.29	Exposure 5/62 to 5/77. Monomer operator 28 months.
	1633	7	5.64	Exposure 9/62 to 11/77. Monomer operator 22 months.
			$\bar{X}$ = 5.86	
FOREMAN VOLUNTEER				
[redacted]	W/S		0.69	Various jobs with C-8 10/56 to 3/63. Monomer operator 3/63 to 2/69. Foreman 2/69 to present.

Total 12

0 - 1 8
1 - 5 1
5 - 10 3
10 - 15
15 - 20

( ) Previous blood samples taken in June.

JFDoughty:mps
10/10/79

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