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PERSONAL AND CONFIDENTIAL[REDACTED]
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TO: R. J. ZIPFEL

FROM: J. G. LOSCHIAVO J.G.L.

RETENTION OF AMMONIUM PERFLUOROOCTANOATE (C-8)
IN BLOOD OF TEFLON® EMPLOYEES

Using data from the FLAIR* program and from air sampling records, it is estimated that 40% of inhaled C-8 vapor is retained in the blood (see attachment). This estimate is rough since it is based on only four data points. Also, the rate of C-8 absorption varies by individual. Air C-8 levels are also variable.

Data on males only were used due to potential sex differences in C-8 absorption and elimination as observed in rat studies. Data on Fine Powder/Dispersion employees only were used to eliminate the variable of particle size. In areas where a significant portion of airborne C-8 is contained in polymer particles, blood retention should be less than 40% of inhaled C-8. This reduced blood C-8 retention is due to the airborne particle size distribution. Large particles (i.e., particles > 5 microns in diameter) will not likely reach the lung alveolar region. It is in the alveolar region where inhaled gases and vapors are absorbed into the blood. Probably for this reason, TEFLON® FEP Operators have significantly lower blood C-8 levels than Fine Powder/Dispersion Operators.

According to G. L. Kennedy, Haskell Laboratory Toxicologist, not more than 20% of inhaled C-8 accumulates in body tissues besides blood. Rat studies indicate that 10 to 20% of inhaled C-8 is pooled or accumulated by other body tissues.

*FLAIR - Fluoropolymers Laboratory Analysis Information Retrieval.

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Company Sanitized. Does not contain TSCA CBI

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The remaining 40% of inhaled C-8 has 3 potential fates:

- o It is exhaled back out.
- o It is inhaled but not absorbed into the body.
- o It is eliminated by the kidneys or intestines.

The following additional information is needed to determine more accurately the fate of inhaled C-8:

- o More blood C-8 data on males who left TEFLON®.
- o More blood C-8 data on new male TEFLON® employees.
- o More blood C-8 data on new female TEFLON® employees.
- o Data on amount of C-8 excreted over a 24-hour period following exposure.
- o Particle-size distribution of airborne polymer particles containing C-8.
- o Perform a Haskell Laboratory study using radiolabelled C-8 to determine where and how much C-8 is stored in the body immediately after exposure.
- o Data on C-8 content in exhaled air during exposure.

Attachment

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CALCULATIONS AND DATA

Blood C-8 accumulation rates in four male Fine Powder/Dispersion Operators with less than 550 days of service are as follows:

0.0093 ppm C-8 in blood/workday
0.0080 ppm C-8 in blood/workday
0.0043 ppm C-8 in blood/workday
0.0022 ppm C-8 in blood/workday

$$\bar{X} = 0.0060$$

Personal air sample results in moles per billion (mpb) C-8 on these Operators during the same period are:

0.03, 0.09, 0.12, 0.12, 0.15, 0.24, 0.24,
0.66, 0.69, 0.73, 0.75, and 1.39

$$\bar{X} = 0.46 \text{ mpb or } 8.2 \text{ ug./m}^3$$

Average male has 5,500 gm. of blood in his body and inhales 10 m³ of air over an 8-hour shift doing light work.⁽¹⁾

At a C-8 concentration of 0.46 mpb (8.1 ug./m³), an average male would inhale 81 ug. of C-8 during an 8-hour shift.

If all C-8 inhaled was retained in the blood, an average male would accumulate C-8 in blood at a rate of:

$$\frac{81 \text{ ug. C-8/workday}}{5.5 \times 10^9 \text{ ug. blood}} \times 10^6 = 0.0147 \frac{\text{ppm C-8 in blood}}{\text{workday}}$$

However, the average daily C-8 accumulation rate we observe in new employees is only 0.0060 ppm C-8 in blood. Therefore, of the total
workday

C-8 inhaled, about $\left(\frac{0.0060}{0.0147} \times 100 = 40\% \right)$ 40% is retained in blood.

(1) Radiological Health Handbook, U.S. Department of Health, Education, and Welfare; Revised Edition, January, 1970, (pp. 215 and 216).