



Subject: Minutes of Meeting
With H. C. Hodge

August 23, 1978

THOSE PRESENT:

H. C. HODGE	
L. C. KROGH	223-6SE
J. D. LAZERTE	236-1
J. E. LONG	220-2E
J. A. PENDERGRASS	220-2E
R. A. PROKOP	236-3B
F. A. UBEL	220-2E

A meeting was held in Portland, Maine, on July 28, 1978 with Dr. H. C. Hodge to review work to date on fluorochemicals in blood. Background materials had previously been sent to Dr. Hodge on June 26, 1978 by L. C. Krogh.

F. A. Ubel reviewed what 3M employees had been told about fluorochemicals in blood. He also briefly reviewed the epidemiology study in progress and commented on measures being taken to reduce employee exposure to fluorochemicals.

L. C. Krogh pointed out that 3M customers of fluorochemicals have also been notified. In the notification, mention was made that the existence of industrial fluorochemicals in blood was first discovered by Guy and Taves at the University of Rochester.

R. A. Prokop briefly reviewed the process of electrochemical fluorination and outlined the chemistry involved of fluorochemicals which have been found in blood. He agreed to send H. C. Hodge review articles on electrochemical fluorination and on the chemistry of perfluorocarboxylic and perfluorosulfonic acids.

J. D. LaZerte pointed out that perfluorinated inert fluids have also been investigated years ago by an outside investigator. No inert fluids have been detected in blood, however, unusual organically bond fluorine levels have been detected in the liver of rats exposed to FC-43.

FC-43

The Belisle and Hagen method for determining organically bound fluorine in blood was then reviewed. H. C. Hodge pointed out one method of analysis for fluorine in whole blood had been published by Gardiner, Smith and Hodge in the 1950's. Other questions of H. C. Hodge were:

1. What is the level of inorganic fluoride in the St. Paul water supply? What are dietary levels at Decatur?
2. Why is there a discrepancy in the levels of organically bound fluorine between the results of Belisle & Hagen and Singer and Armstrong? Singer and Armstrong found higher levels of organically bound fluorine than Belisle & Hagen in persons not exposed to industrial fluorochemicals. ✓
3. Contradictions exist in Table 2 of the article. Amounts of organically bound fluorine plasma and cells do not correspond with that found in whole blood. Similar contradictions exist in Table 5.
4. Inorganic fluoride levels in the blood of employees from the Tech Service Laboratory in High Point, North Carolina are very low. Is this due to low fluoride in drinking water or could it be related to metabolism of organically bound fluorine? Fcs? ✓
5. Are fluorochemicals metabolized to inorganic fluoride? There may be some evidence of this from fluoride levels in plant employees. ✓

✓ F. A. Ubel commented on recent incomplete results on organic fluorine levels of Decatur employees. The individuals who were sampled are the same ones who were sampled approximately two years ago. Their values have not changed appreciably since that time. He questioned if there is a protein fraction which is variable in different individuals which may be the binding site for fluorochemicals. Electrophoresis studies on blood may help in determining whether or not this is true.

H. C. Hodge questioned whether or not there is a discrepancy between exposure and retention. Excretion values and metabolic transformations should be determined. Persistence is an important issue.

H. C. Hodge also pointed out that Chemolite employees, while high in organically bound fluorine are quite low in inorganic fluoride, and again questioned if organically bound fluorine is metabolized to fluoride ion. Further work should be done to insure that Chemolite workers do not have fluorosis. It is often difficult to interpret by X-ray. Most radiologists will miss signs in X-rays. Paul Bovard (unknown location) is capable of giving a good interpretation. Names of other competent persons can be obtained from Alcoa. X-rays taken of employees should not be purged routinely from X-ray files, but kept indefinitely.

If possible, bone samples should be obtained from Chemolite workers to confirm lack of fluorosis.

F. A. Ubel agreed to do further investigation in the area of fluorosis.

H. C. Hodge also made the following comments concerning the physical examinations of employees:

1. Physical examination results should be compared with controls (F. A. Ubel will try to identify a control group).
2. Of 296 persons examined, 118 had hearing losses. Are these related to fluorochemical exposure?
3. There appears to be indications of liver change from the physical examination results. In terms of indicators of liver disorder, there are a higher percentage at Chemolite than at Decatur and the organically bound fluorine level at Chemolite is correspondingly higher. Additional methods for detecting changes in liver functions should be sought. A possible analogy in liver changes caused by carbon tetrachloride and that caused by fluorochemicals should be investigated.
4. The possibility of alcohol accentuating liver changes from fluorochemicals should be investigated. Alcohol is known to accentuate the liver changes caused by carbon tetrachloride.

It was pointed out by J. A. Pendergrass and F. A. Ubel that indications of liver changes in Chemolite and Decatur employees referred to all chemical workers - not just those working with fluorochemicals. It was also pointed out that the indicators of liver change did not cluster in fluorochemical workers. It was agreed however, that further analysis of data indicating liver changes should be made.

H. C. Hodge made the following comments with respect to animal studies:

1. ✓ Tissue analysis at high levels of fluorochemical dosage would probably represent the most valuable data one will get from such a study.
2. Determination of fluoride ion levels in animals fed fluorochemicals could help determine whether or not fluorochemicals are metabolized to fluoride ion. Consideration might be given to whether or not fluorochemicals can be metabolized to fluoroacetate or similar substances which then interfere with the Krebs cycle in a manner which recently has been suggested by Coons. Kun (Enrich).
3. Analysis for P⁴⁵⁰ (cytochrome Oxidase) could provide further useful information.

✓ A brief discussion of the manner in which fluorochemicals entered the body took place. J. A. Pendergrass showed data on concentration of FC-143 in the packaging area. FC-143 levels have been reduced to 0.2 to 0.4 mg/m³. H. C. Hodge considered these to be an example of good control, but emphasized that we should look for a sensitive biological index of exposure.

H. C. Hodge requested information on physical properties, chemical properties and acute toxicity data on fluorochemicals involved in the blood program. R. A. Prokop will supply this information.

Submitted by:

R. A. Prokop