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Building K-1, Room 3B35
January 15, 1979

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Subject: Analysis of PCB's for PCDF's

Dear Dr. Selikoff,

The attached copy of my latest letter to Jim McKinney presents answers to some of the concerns you addressed in your letter of December 19. As best I can determine, what actually happened down there was that the PCB samples got passed down the chain of command to a technician who determined the molecular weights of a large number of constituents, got out one of those mass spectrometry tables that list several dozen reasonably common chemicals corresponding to each molecular weight value, made some selections that he thought plausible, and passed his report back up the chain. McKinney, without realizing that the chemical identifications were purely suggestive rather than definite, got quite excited over their chemical, environmental, and medical implications, and wrote some extensive essays on the subject which he was understandably reluctant to swallow completely after learning of the absence of supporting data. As best we can make out from the fairly extensive pile of raw data and internal reports he sent us, however, the only definite conclusions that can be drawn at this time are these:

1. The "used transformer oil" sample analysed has the gross composition of a 1953-63 era transformer dielectric, which was a blend of commercial grade trichlorobenzene, tetrachlorobenzene, and Aroclor 1260 with a little tetraphenyl tin as a stabilizer.

2. The sample contained trace levels of a considerable number of other materials, probably mostly hydrocarbons, phthalates, plasticizers, etc., along with a family of $C_{12}H_{10-x}Cl_xO$ species which could represent either polychlorinated diphenylethers, polychlorinated biphenols, or perhaps something else completely. The

is not yet any analytical evidence to support the totally unprecedented chlorine redistribution, oxidative coupling of chlorobenzenes, or low temperature PCB oxidation which was hypothesized.

3. The sample did not contain significant levels of terphenyls or quaterphenyls (which were major constituents of Yusho PCB), nor more than trace levels of dibenzofurans. (The analytical interference by $C_{12}H_{10}-xCl_xO$ species really doesn't look like a serious problem unless one is willing to postulate that every single isomeric dibenzofuran gives a GC peak that falls directly on top of one of the $C_{12}H_{10}-xCl_xO$ peaks.) You are quite right, however, in pointing out that we cannot exclude the possible presence of a few ppm PCDF, such as have been reported for the French and German PCB's. Until we have definite quantitative PCDF analyses, we won't know for sure what the actual level of PCDF hazard amounts to.

So where do we go from here? At present, I am confronting rapidly growing internal disenchantment with the idea that there are any simple, low cost solutions to problems of PCB/PCDF analysis. GE has now been burned three times by sloppy work in this area: first by the young analyst at Woodson-Tennant who dry-labbed his fish data in order to meet a reporting deadline during the NYS hearings in 1975; second, by the guy at DuPont who sat on the used transformer oil sample during most of 1977 without ever getting his PCDF analytical method worked out; and third, by the internal communication problems and confusion at NIEHS in 1978. It is evident that the accomplishment of an analysis for PCDF's in either capacitor-grade PCB (primarily trichlorobiphenyls) or in used transformer dielectric fluid (a more complicated blend) which is accurate, defensible, and publishable, and hence capable of answering more questions than it raises, will require considerable care and effort. Accordingly, we have decided not to send any more samples of PCB dielectric fluids outside the company until we can be assured that suitable levels of care and effort can be expended on them. At the same time, we are actively exploring the possibilities of doing the analyses internally. As I indicated in my letter to McKinney, we now have the high resolution mass spec equipment needed to do unambiguous qualitative analyses. Thus, the only remaining technical problem is to devise procedures, possibly involving perchlorination,

Irving J. Selikoff

-3-

January 15, 1979

that will allow us to quantitate the levels of all such species as phenols, biphenols, diphenyl ethers, dibenzofurans, terphenyls, quaterphenyls, etc. in a statistically significant group of industrial PCB specimens.

In addition, I would hope that a few laboratory PCB specimens could be examined. These are generally stored in glass containers, and hence subject to photochemical oxidation to PCDF's, which the industrial specimens are not. (The PCDF's themselves are believed to be photochemically unstable in the presence of water, and hence don't form under environmental conditions; but they might be formed in dry PCB on a laboratory shelf.) Hopefully, this would elucidate the problem posed by the frequent reports of highly variable PCDF-like bioeffects coming from biological testing of PCB's. There is one report by Ax and Hansen showing that even specimens that were supposed to be pure, individual PCB isomers, as well as most of the Aroclor specimens examined, actually contained PCDF's at the ppm level. However, I am aware of no other investigator of PCB bioeffects, other than Vos, who ever did a PCDF analysis on the PCB specimens that he fed his animals. As you may recall, Jim Allen, who reported a level of Aroclor 1248 toxicity in monkeys that increased nearly 100-fold during the years that he was studying the problem, got rather severely chided on this point from the floor at the 1975 PCB conference. In short, your statement, "Finally, since the biological effects of PCB's have generally been investigated without such admixtures, we need as much information as possible to sort out interactions," may seriously understate the real problem, which is that we do not actually know what PCB's do in the absence of such admixtures.

At any rate, that's where we seem to be today. I'll keep you posted on further progress.

Sincerely,



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GENP 010334