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To: file
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Analysis of C-8 in blood, status of interlab comparison

Introduction
In december 1997 Dordrecht Works has taken blood samples of the Teflon E-shift workers to be analyzed for C-8 content. For reasons of cost effectiveness and convenience the samples were brought to Shell VGW-lab in Pernis, but a duplicate of every other sample was also sent to National Medical Services lab, who is performing C-8 in blood analyses for Parkersburg for many years.

Summary
The differences between the two labs were unacceptably high: especially in the high numbers Shell VGW gave a result 2 - 3 times higher than NMS. We have been communicating with both labs, and Shell has done a lot of tests to see what could be the reason of the differences.
At this time Shell reports results similar to NMS, with the exception of one sample, where there is a factor 10 difference. We have agreed to resample the person who gave this blood and have it analyzed by both labs. NMS will also investigate the data on their file, to see if anything strange was the matter with this particular sample. It was agreed that this one resample is free of charge.

Discussion
One important difference is that NMS prepares the sample by freeze drying, followed by esterification, while Shell VGW has no ready access to a freeze dryer, so they use an extraction method. The extraction solvent is evaporated, and the sample is esterified and injected on a GC-MS system.
The first extraction was with hexane, but this gave a recovery of only 10 - 15 %. Addition of hexane to acidified old blood gave lumps and looked unreliable, although with fresh acidified blood there was no visual problem. Extraction with ethyl acetate gave a clear extract both with old and fresh blood, and a recovery of 50 %.

We came to some other interesting conclusions which may interest others who are working in this field [redacted]

1. They started with the use of C-10 as an internal standard, but changed to C-9 when they heard that C-10 contains C-8 as an impurity. However, during the investigation it turned out that most blood samples also contained C-9 before adding internal standard. We confirmed that Dordrecht Teflon workers have been exposed to C-9. This caused a significant error in the analysis.
NMS uses C-10 as an internal standard, at such a low level that C-8 impurity is insignificant.

2. Bloodsamples also contain small amounts of C-10. This must be because C-10 is an impurity in C-8, so if workers are exposed to C-8, they are also exposed to C-10.
So this gives an error if C-10 is used as an internal standard at low levels, and the workers have high levels of C-8..

3. Extraction recovery of C-9 is 70 % vs C-8 50 %. This means that you cannot extract more than once, for the ratio C-8/C-9 will change with every extraction step.
A similar phenomenon is expected for C-10.