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Dear Unions:

For over 13 years, my team and I have been devoted to identifying a definitive biomarker (blood test) for exposure to the mixtures of TCPs added to aviation engine oils, and also to better understand the toxicology of these engine oil additives. My lab has done all of it on an extremely limited budget to seek the solutions that are so important to enabling you to better protect and advocate for your members, and to improve flight safety. The research team that I lead is in the final stages of this work and is seeking additional funding to pay for supplies, professional staff time (much of which is - and has been - donated), and the fees to use the lab equipment (mass spectrophotometer), all necessary to finalize this work.

Focusing on the biomarker work, to date, my team has identified the mass of the most abundant adduct to the active site peptide of the most promising candidate biomarker blood protein. It is 170 mass units. The second most abundant modification is 186 mass units. These are markers of how the blood changes in a predictable and specific way when it is exposed to the types of TCPs added to aviation engine oils. We identified these protein adducts using highly pure biomarker protein and in vitro modifications with either bioactivated Durad 125 or non-bioactivated Durad 125. We have focused on Durad 125 (rather than any single type ["isomer"] of TCP) because it is the specific blend of TCPs added to BP-Eastman engine oils, which will be almost identical to Syn-o-ad 8484, which is the specific blend of TCPs added to Exxon-Mobil oils (based on information provided). So, Durad 125 is our focus because this is the TCP blend that crews and passengers breathe onboard during a fume event. We have also been studying how Durad 150 oil additives inhibit various enzymes. Durad 150 is the TCP-alternative additive blend currently added to Nyco engine oils, one of which (TN600) is becoming a more popular option with commercial airlines in the US and Europe.

To complete our biomarker work, we need to:

a. Identify the Durad 125-modified protein adduct(s) that we have characterized in the stored blood sample of crewmember(s) who documented exposure to oil fumes;

b. Complete a convenient high throughput protocol for rapidly purifying the target biomarker protein from the blood of exposed individuals. This is necessary to facilitate commercialization of the blood test and is well underway, but needs a bit more work; and

c. Develop specific antibodies for use in high throughput screening procedures; again, this facilitates commercialization of the blood test. Analyses of exposed individuals can be carried out prior to completing this task, but it will be much more convenient and much less expensive per analysis to have a high throughput antibody-based protocol in place. We have done this already with plasma cholinesterase, but will need a special protocol and large quantities of antibodies for the less

abundant cholinesterase. We've already generated a small-scale quantity of antibodies and shown that they will work for rapidly isolating the active site peptide of the biomarker protein.

Much of the labor for the ongoing research has been donated, which has been necessary in order to keep my excellent research team together. The current mass spec analyses have been carried out by a highly-regarded mass spec expert, with his labor being no cost to the effort. We are also fortunate to get the mass spec instrument time at a discount because I am a member of the department. To date, our expert has run hundreds of spectra and, as noted above, has clearly identified the adducts from D125 on the target biomarker protein. He is a very solid scientist and will only run samples from an exposed individual when he is fully satisfied with the sample preparation protocol and mass spec analytical protocol, the latter being in quite good shape already.

I estimate the cost of finalizing the blood test to be approximately $150,000.

Our team would much prefer to have to options to solicit the funds necessary to complete this work from the federal government, especially when you consider that there are about 27,000 flights on US-registered aircraft every day, and the government is supposed to regulate the conditions onboard - crews and passengers should not have to risk breathing oil fumes. It is true that, for some time, some funding was provided for this work through our federal Superfund grant. However, about seven years ago, we were notified that Superfund would no longer support the cabin air research, noting that it is a "worker issue", despite the fact that all of the program administrators as well as the rest of us fly frequently. A couple of years following, they also ended the funding for organophosphate insecticide research. Both of these efforts from our laboratory seem to have disturbed the respective industries – aviation and agriculture. It appears that the federal funding source (National Institute of Environmental Health Sciences) apparently responded to industry pressure to terminate funding for these efforts through the Superfund Basic Research Program.

It is clear that political pressures from industry, coupled with an industry-friendly administration, have cut our options to secure research funding from federal sources. We have taken major financial losses and must work on a shoe string budget, but we cannot continue to work for nothing. The funding issue has become so pressing that we will need to start laying off some or all of the team if funding is not available.

We need your help to keep this research moving and get it done.

I am glad to take the time to answer any questions that you might have, and I have attached instructions for how to make a financial contribution. Thank you for your help to finish this research for the benefit of crewmember and passenger health, as well as flight safety.

Sincerely,

Clement E. Furlong, PhD
Professor of Medicine (Div. Medical Genetics) & Genome Sciences