



Paris, November 24, 2009

SUBJECT: Potential Toxicity of Jet Engine Oils

Dear Sir,

This letter is the contribution of NYCO S.A. in response to the Advance Notice of Proposed Amendment N°2009-10 dated 28th September 2009.

NYCO S.A. is a French company, manufacturing aviation lubricants and more specifically aviation jet engine oils in its plant in Tournai, Belgium. The company has been active in that field since 1959, with the development of the engine oil for the Dassault “Mirage” fighter. Because of that historical ground in military aviation, NYCO is more known by military forces, with a dominant market share at all European Ministry of Defences. However, the company also market engine oil “Turboncoil 600” who bears validation for popular civil engines such as CFM56, V2500, RB211, AE3007, PT6A, etc...and it is used by about 15 small airlines world-wide.

In 2006, NYCO became aware of the possibility of contamination of bleed air by engine oil vapours, in case of mechanical deterioration of the seals of the APU or propulsion engines, this bleed air being used for the conditioning of cabin air on commercial aircraft. Such an inhalation exposure scenario was never considered by the company, as under ‘normal’ conditions of use of the engine oil, only mechanics working on the engine were to be exposed, and only to cold and liquid engine oil.

Whilst NYCO can not make a statement on the potential impact of those oil vapours on the health of passengers and aircraft crew, because it is impossible to assess the exact quantity of oil being released into the cabin, the public reports of both passengers and crew members exhibiting various health disorders was a concern to NYCO and deserved attention.

As the reports of doctors and university researchers indicated that most of the symptoms were consistent with organo-phosphate intoxication (neurotoxicity), similar to the symptoms of farmers exposed to pesticides, the focus was put on the organo-phosphate anti-wear additive that is present at 2-3% in jet engine oils. Tri-cresyl-phosphate (TCP), is used in all commercial engine oils with the exception of NYCO oils, as NYCO favoured the use of isopropylated triphenylphosphate (TIPP) as an alternative to TCP from the late 70s (TCP became listed by the French Ministry of Health as a chemical causing professional disease in that period). “Turboncoil 600” contains this additive in lieu of TCP.

NYCO then decided to fund a research at the University of Washington, in the laboratory of Pr Furlong, who has a large experience in the field of organo-phosphate because of his prior work on pesticides. The purpose was to evaluate *comparatively* the various organo-phosphates in terms of neurotoxicity in an “in-vitro” test, using human butyrylcholineesterase (BChE), one of the target enzyme of organo-phosphates (OP), and human liver cells. Such a route was chosen because it gives results directly relevant to humans, rather than the usual feeding study of rats, whose relevance to humans is often questioned.

A total of 15 different organo-phosphates were tested, some being commercially available, others being synthesized at the laboratory scale for the purpose of the study, in order to understand what the relation between chemical structure and neurotoxicity (measured by the level of irreversible inhibition of BChE) is.

The conclusions are:

- (1) Commercial TCP (as used in most jet engine oils) presents a non-negligible potential of BChE inhibition in the test, comparatively with TOCP (tri-*ortho*-cresyl-phosphate), a potent neurotoxic, albeit this isomer is not detected in commercial TCP.
- (2) TIPP (anti-wear used in “Turbonycil 600”) does not present a significant improvement over TCP within the repeatability of this test.
- (3) General rules between the chemical structure and BChE inhibition have been found, and specific organo-phosphates inducing a much lower inhibition have been identified.

For example, the following results have been obtained in a comparative experiment at same concentration of organo-phosphate:

Chemical tested	% remaining enzyme activity compared to control (no organo-phosphate)
TOCP (99.5% pure)	0.5%
TCP (commercial grade)	23%
Commercial OP N°1	86%
Model OP N°2 (purified commercial OP N°1)	94%
Model OP N°3	99%

The most interesting candidates OPs have been tested to assess their efficiency as anti-wear additives in engine oil formulations. It was found that some of these low-toxicity additives could be successfully used in engine oils with an adequate adaptation of the formulation, without degrading the overall oil performance (albeit others were rejected on the ground of poor performance).

Consequently, Nyco has filed a patent application concerning these new oil formulations having potentially an overall reduced neurotoxicity by several orders of magnitudes, *comparatively* to oils containing the same concentration of TCP.

One formulation has already been successfully tested against almost all the parameters of the specification MIL-PRF-23699 Class HTS (including T63 engine test). As an additional health benefit, this oil is also free of phenyl-naphthylamine, a molecule used as anti-oxidant that is present in most existing engine oils, and cause of some concerns.

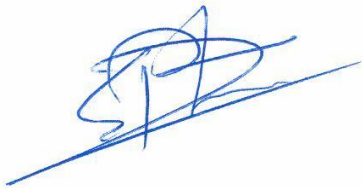
Additional performance testing is needed to demonstrate the compliance of this oil formulation to the standard AS 5780 Gr. HPC, required for an oil to be taken into account for the next stage of validation by OEMs on each propulsion engine and APU type. Additional toxicological testing is also required to confirm the health benefits of the new additives.

Given the high cost associated with the certification of oils on engines as well as the cost of toxicological tests, Nyco would need a clear support from engine OEMs, aircraft manufacturers and airlines to bring the oil to an airworthy status.

Whilst NYCO can not bring new information to EASA on the importance and frequency of cabin air contamination by oil vapours and its impact on health, we consider that it was worth to bring your attention on the possibility of improving the toxicological profile of existing engine oils, as a precautionary measure.

Should you have any question on the subject, I remain available for discussion or meeting at your convenience,

Best regards,



Eric PIVETEAU
General Manager