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**Subject:** Preliminary Report on Bearing Constituents

**Date:** 8/1/2014

**To:** Emerson Climate

**From:** Plastics Services Network

The principle component in all of the potential bearing replacements is polytetrafluoroethylene (PTFE), which is Teflon. It was originally invented by DuPont in 1938 and has extensive worldwide applications. Its production is in over a dozen small facilities located around the globe and has not recently been in short supply. The only red-flag with PTFE is perfluorooctanoic acid (PFOA) is used as the surfactant with PTFE. This molecule helps make PTFE processable into nonstick cookware and it remains with the polymer in small amounts. At 500°F it can volatilize and enter into the local air. There have been cases where this has resulted in the death of several domesticated birds. It has also been reported to cause flu-like symptoms in humans. There were no lingering effects with the exposure to humans. Substitutes for PFOA have been found and are incorporated in European PTFE products.

There are instances where perfluoroalkoxy (PFA) or perfluoro methyl alkoxy (MFA) are copolymerized with tetrafluoroethylene (TFE) to make a melt processable copolymer. These chemicals in their pure form can represent small hazards, but when polymerized they are inert and stable. Their decomposition products would be similar to PTFE and their longevity in the environment is considerable, perhaps in excess of 100 years. These melt processable copolymers are used in many applications such as medical implants, tubes and pipes.

The rest of the components in the materials are metal oxides or ceramics. Molybdenum disulfide is a refined, natural occurring product which acts as a lubricant; it is not known to have any deleterious effects on humans or the environment. The next listed compound is calcium fluoride, which is fluorspar, a natural occurring compound which can be decomposed into its calcium and fluoride in an oxidizing environment. It has no known carcinogenic effects. The next compounds are aluminum oxide and iron oxide, these are benign ceramic materials found in the environment. Finally, zinc sulfide, which is a skin irritant, but is not known to have any other synergistic effects with the human body or the environment.

There is also mention of carbon fibers. These act as a lubricant and are not considered to be reactive. They have no detrimental effects to the environment and no known reactions with the human body.

This is a cursory overview of these materials, if more information is required, please be specific and I will be glad to accommodate your requests.

Paul Koch