

From: [McAtee Nancy](#)
To: [Stein Stephen](#)
Cc: [Budinski Michael](#)
Subject: Email report-WPR20LA234 (Deposit on fuel fittings)
Date: Tuesday, April 20, 2021 1:28:01 PM

Stephen,

The fuel fittings from the accident aircraft were submitted to the Materials Laboratory for examination. A sample of the unknown reddish granular material was removed from the fittings. The unknown material was examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to ASTM E1252-98 (American Society for Testing Materials E1252-98: *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis*). The spectrometer was used to collect and process infrared wavelength absorbance spectra of the unknown material.

The spectrum for the material contained the following combination of spectral peaks corresponding to particular functional groups found within the molecular structure of the material. The presence of a broad, medium doublet peak $\sim 3300\text{ cm}^{-1}$ is indicative of a nitrogen-hydrogen (N-H) (primary) stretching bond. The presence of a triplet peak at $\sim 2965\text{ cm}^{-1}$, $\sim 2930\text{ cm}^{-1}$ and $\sim 2880\text{ cm}^{-1}$ is indicative of a carbon-hydrogen (C-H) (alkane) stretching bond. A weak peak at $\sim 1710\text{ cm}^{-1}$ is indicative of a carbon-oxygen (C=O) (carbonyl) double bond. A strong single peak at $\sim 1550\text{ cm}^{-1}$ is indicative of nitrogen-hydrogen (N-H) bending bond. Peaks at $\sim 1410\text{ cm}^{-1}$ is indicative of a carbon-hydrogen(2) (C-H₂) bending bond. A peak at $\sim 1370\text{ cm}^{-1}$ is indicative of a carbon-hydrogen(3) (C-H₃) bending bond. A small peak at $\sim 1160\text{ cm}^{-1}$ is indicative of a carbon-nitrogen (C-N) stretching bond. A peak at $\sim 1070\text{ cm}^{-1}$ is indicative of a carbon-oxygen (C-O) bond. A peak at $\sim 720\text{ cm}^{-1}$ is indicative of a carbon-hydrogen(2) (C-H₂) bending bond as well as a nitrogen-hydrogen(2) (N-H₂) bending bond. The spectrum was consistent with an amine and possibly the weak presence of a carboxy/carbonyl material.

A spectral library search was performed on the unknown spectrum. The spectral search did not find a strong match to a single material, but the unknown had many similarities to several surfactant materials and anti-corrosion products. Based on the lack of a single match, the material was likely a mixture of materials. Based on the library search similarities, the unknown material is likely a mixture of fuel additives such as detergents and water dispersants (surfactants), anti-corrosion additives (which are often amines), and other carbonyl and/or amine-based additives. No spectral peaks consistent with the base fuel were found in the spectrum indicating that the deposit was residue left after the evaporation of the base fuel. The exact type of fuel could not be determined.

If you have any questions or comments, let me know.

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