

# NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering  
Materials Laboratory Division  
Washington, D.C. 20594



January 23, 2018

MATERIALS LABORATORY FACTUAL REPORT

Report No. 17-054

## A. ACCIDENT INFORMATION

Place : San Juan, Puerto Rico  
Date : August 17, 2016  
Vehicle : RO/RO Passenger Vessel *Caribbean Fantasy*  
NTSB No. : DCA16FM053  
Investigator : Adam Tucker, IIC MS-10  
Luke Wisniewski, MS-10

## B. COMPONENTS EXAMINED

Unknown material removed from carbon dioxide cylinders (part of the fire suppression system)

## C. DETAILS OF THE EXAMINATION

During the on-scene investigation of this accident, an off-white, opaque material with a waxy and viscous consistency was found on the outer surfaces of several pressurized carbon dioxide (CO<sub>2</sub>) cylinders and associated fittings of the CO<sub>2</sub> fixed fire suppression system. To ensure proper actuation, the pressurized gas cylinders and associated fittings (valves, piping and tubing) are to be kept clean and free of contamination.

A sample of the unknown material was examined using a Fourier Transform Infrared (FTIR) spectrometer with a diamond attenuated total reflectance (ATR) accessory in accordance to American Society for Testing Materials E1252-98: *Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis and American Society for Testing Materials*.

The spectrum contained spectral peaks that corresponded to particular functional groups found within molecular structure of the unknown material. The presence of a broad peak at ~3336 cm<sup>-1</sup> corresponds to an oxygen-hydrogen bond and a nitrogen-hydrogen (N-H) bond. These functional groups could be present either singularly or in combination. The presence of a doublet peak at ~2916 cm<sup>-1</sup>, and ~2848 cm<sup>-1</sup> corresponds to carbon-hydrogen stretching bonds. A broad, weak single peak at ~1713 cm<sup>-1</sup> is indicative of a carbon-oxygen (C=O) double bond. A weak single peak at ~1462 cm<sup>-1</sup> is indicative of a carbon-hydrogen (C-H) bending bond. A weak peak at ~719 cm<sup>-1</sup> is also indicative of a carbon-hydrogen (CH<sub>3</sub>) bending bond functional group.

The spectrum from the unknown material suggested that the material was a straight chained aliphatic hydrocarbon with the possible presence of carboxy and amine functional groups. A spectral library search found several materials with similar spectral patterns but no strong or exact matches. The similar materials tended to be amine-based and carboxy-based anti-corrosion product, surfactants and emulsifiers. Based on the spectral interpretation and spectral library search results, the unknown material was likely some type of paraffin-based carboxy/amine-based anti-corrosion product.

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