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MEMORANDUM

Date: 6/7/2019

To: Dr. Lam Leung, Chemours

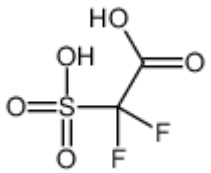
CC: Mike Aucoin, AECOM

From: Eric Redman, Director of Technical Services

Subject: LC/MS/MS Method Performance for DFSA

This technical memorandum addresses questions regarding observed variability in the determination of DFSA (difluorosulfoacetic acid) by Eurofins TestAmerica's current LC/MS/MS methodology, known as the 'Table 3+' analytical method.

DFSA is a very small molecule by LC/MS/MS standards, consisting of singe C1 fluorocarbon bonded to two acidic moieties (carboxylic and sulfonic):



The size, structure, and highly polar nature of this molecule create a variety of technical challenges for LC/MS analysis. Due to the size and structure of DFSA there are relatively few characteristic mass fragments or mass transitions that can be used to identify DFSA in the LC/MS/MS methodology, and the identification elements that exist are not unique to DFSA. DFSA is therefore prone to a large range of chemical interferences that can adversely impact the performance of the analytical method.

The small and highly polar nature of DFSA also means that it is not easily retained under the usual LC/MS/MS chromatographic conditions. Poor retention in turn means that DFSA cannot be chromatographically separated or resolved from physical or chemical interferences, and is therefore more susceptible to adverse impacts from these co-eluting interferences. These can be manifest as discreet interferences that mimic the MS/MS response of DFSA and either obscure its presence (false negatives) or impart a positive bias (false positives). Additionally, non-discreet or bulk interferences such as dissolved solids, high ionic content, and naturally occurring organic and ionic compounds (humic acid or NOM) can create severe ion suppression and enhancement effects in the LC/MS/MS analysis. DFSA is further prone to variable impacts from ionic substances (including pH differences) due to its unusual di-acidic character.

The combination of multiple DFSA properties that can adversely impact analytical performance means that current 'Table 3+' analytical procedures will generate variable and potentially unreliable results for DFSA in samples. Analytical performance for DFSA has been demonstrated to be reliable in the absence of matrix interferences, but a growing body of empirical evidence including sample duplicate and matrix spike results indicates that matrix effects have a significant adverse impact in field samples.