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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Office of Air Quality Planning and Standards
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MEMORANDUM

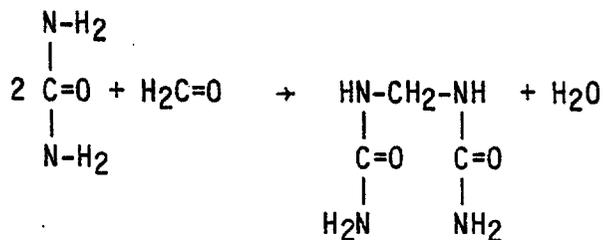
SUBJECT: Measurement of Formaldehyde Emissions from Urea Manufacturing Facilities

FROM: Gary McAlister, Test Support Section
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TO: Eric Noble, Standards Documentation Section
Industrial Studies Branch, ESED (MD-13)

During our testing program to measure particulate emissions from urea plants, we also attempted to measure formaldehyde emissions from those plants that used formaldehyde as a conditioning additive. Since the measurement of formaldehyde emissions was only for background information, no special provisions were made while collecting or analyzing the samples. The water in the impingers used to collect the particulate samples was divided and analyzed for formaldehyde as well as for particulate. The analysis procedure we used was a colorimetric procedure usually identified as the chromatropic acid procedure.

This procedure is specific for formaldehyde and is not significantly affected by other aldehydes or carbonyl compounds. However, based on the information you received from the Fertilizer Institute, I do not believe the method can be used to measure the formaldehyde content of samples from urea facilities. When formaldehyde is added to molten urea, it forms methylenediurea (MDU) according to the following reactions.)



Here, urea is a weak acid reacting with a weak base, formaldehyde, to form MDU and H₂O. In the presence of a strong acid, the MDU could be hydrolyzed to regenerate the urea and the methylene group CH₂, which in the presence of chromatropic acid, would act as formaldehyde. In the chromatropic acid procedure, the chromatropic acid reagent is prepared in a solution of sulfuric acid. (Therefore, I doubt that the chromatropic acid procedure could distinguish between unreacted formaldehyde and MDU.) Unfortunately, most of this information did not become available until recently, some of it having been published in 1982.

This means that all the formaldehyde emission data we gathered at the urea facilities we visited are probably a better measure of the total formaldehyde added to the process than the unreacted formaldehyde emitted.

If there is any future testing of urea facilities for formaldehyde emissions, some procedure other than the chromatropic acid procedure should be used. One possible candidate is high performance liquid chromatography.

cc: Frank Noonan (MD-14)