



1<sup>st</sup> Post Combustion Capture Conference

# Emissions from a post-combustion CO<sub>2</sub> capture plant running on MEA

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Keywords: Amines; emissions; degradation products

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## 1. Introduction

There has recently been an increased awareness of the need to control emissions from post-combustion CO<sub>2</sub> capture plants. Solvent or degradation products emitted in sufficient quantities may present a potential health and environmental issue. While this issue appears to be manageable, there is a need for more accurate data on emissions from capture plants. We also need a better understanding of how solvent degradation translates into emissions.

We do at present have a fairly good overall understanding of solvent degradation in MEA. There are however a number of components formed in small quantities, not all of which have been identified or quantified. In the present work we attempt to summarize what is known about emissions and look at simple models to predict emissions.

## 2. Emissions

The extent to which a compound will be emitted is a function of its concentration in the liquid and a few physical properties. Key among these is the volatility that can be expressed as the Gibbs free energy of solvation or a Henry's law constant. The mass of the molecule may also be a factor.

Experimental data on emissions from CO<sub>2</sub> capture plants are relatively sparse and not always easy to interpret. The emission levels depend on the operation of the plant and measuring the emissions levels of different components is not trivial. The emission levels will also depend on the time the solvent has been in the system and the composition of the exhaust gas entering the system.

In the present work we present some simple models to look at likely emissions from a post-combustion CO<sub>2</sub> capture plant. Degradation products formed in the plant can be classified according to their volatility into; volatile degradation products, non-volatile degradation products and medium volatility degradation products. Non-volatile degradation products are unlikely to be emitted in significant quantities unless there is significant entrainment in the plant. Volatile degradation products can be a potential issue since a large fraction will escape from the absorber column and the water wash is likely to be less efficient in capturing them. Medium volatility degradation products will have a volatility comparable to the solvent itself and be present in concentrations orders of magnitude lower. If these components have health and environmental impact comparable to the solvent themselves, they are unlikely to

present an issue in terms of emissions. Medium volatility degradation products with potential health and environmental impact may however be an issue.

Applying simple models of emissions with what is known about degradation products formed in MEA, we can identify which classes of degradation products that may potentially be an issue. We will draw both on literature data and work done by SINTEF for Aker Clean Carbon on the MTU plant and the Tiller plant.

Many classes of degradation products such as amino acids and organic acids are unlikely to present any issues. Nitrosamines are a class of compounds that are clearly problematic in terms of health and environmental effect, they could present an issue even if they were emitted in small quantities. Among the other degradation products a component such as N-(2-hydroxyethyl)formamide (HEF) may be a significant contributor to overall emissions, since it is relatively volatile and formed in significant quantities.

We have seen in pilot testing that MEA emissions can be kept at levels below 0.5 ppmv utilizing a conventional water wash system. Further reductions is achievable, but will require optimization of water-wash stages and other emission reducing technologies.

Combining knowledge of degradation products formed in the plant with understanding of the emission process we should be able to identify any compounds that may be an issue in emissions, and find appropriate remediating measures.