

Econamine FG+SM Process: Recent Advances in Emissions Control

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FLUOR[®]

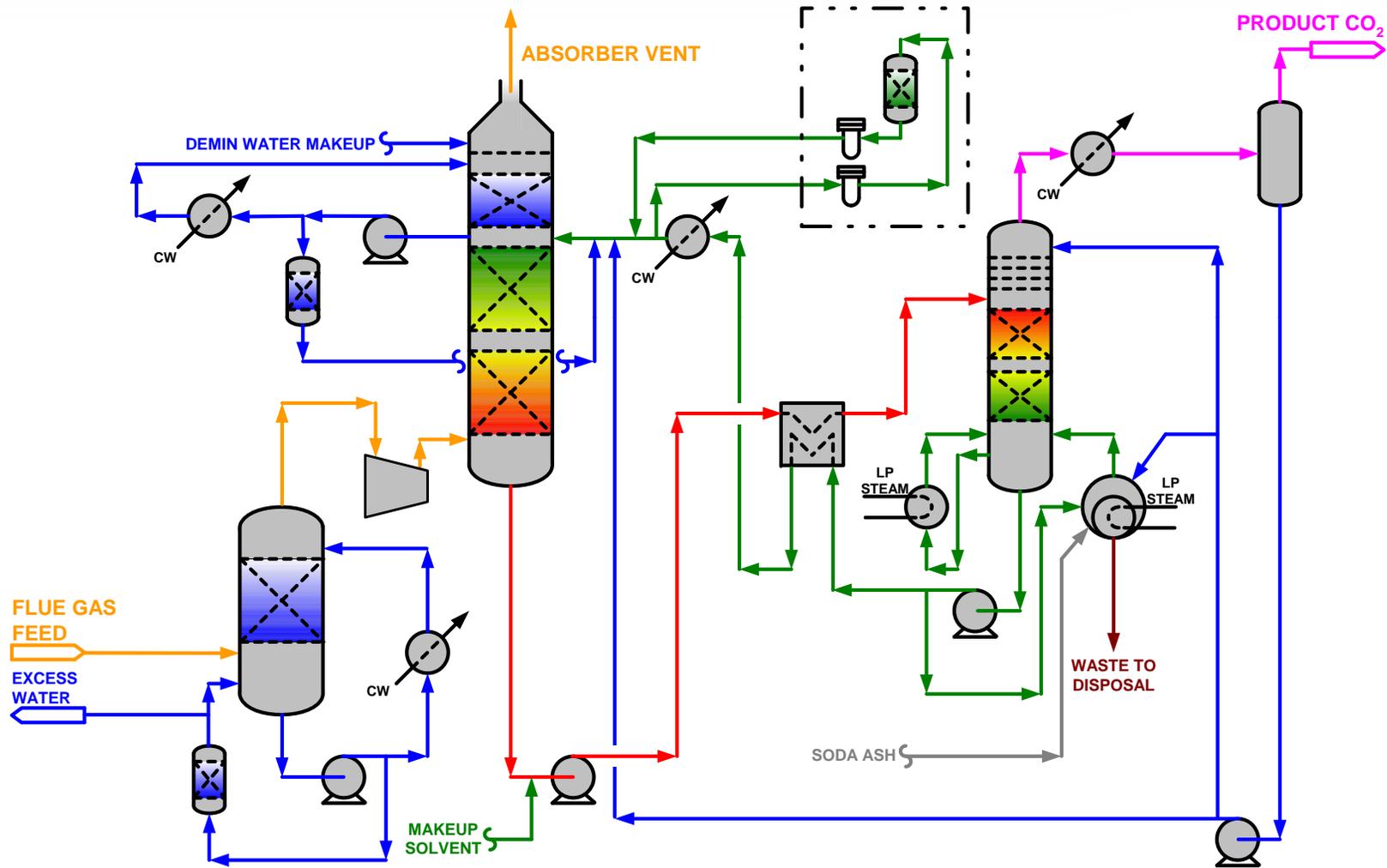
Environmental Impact of Amine Emission
During Post Combustion Capture, Oslo

Econamine FG+SM Technology Background



- ◆ Econamine FG+SM (EFG+) is Fluor's technology which permits large-scale CO₂ capture from flue gases
- ◆ The EFG+ solvent is based on a primary amine

Simplified Econamine FG+ SM Flowsheet



Molecular Modeling Studies

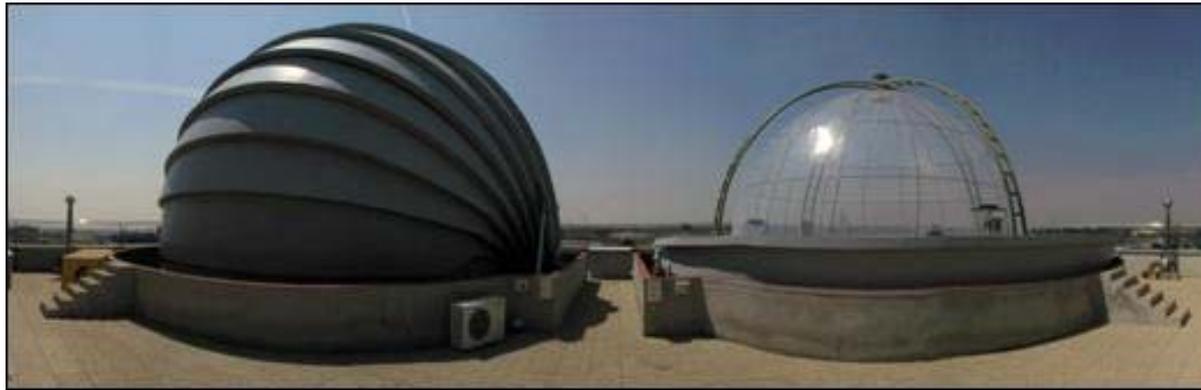


- ◆ Over the past two years there has been an increased level of concern regarding amine emissions.
- ◆ A molecular modeling study done in Norway has hypothesized that amines react with atmospheric NO_x in the presence of ultra-violet (uV) light (sunlight) to form nitrosamines
- ◆ The theoretical study assumed 5 ppmv of amine in the spent fluegas
- ◆ Nitrosamines are considered harmful to the environment.

Atmospheric Chemistry Test



- ◆ The Centro de Estudios Ambientales del Mediterráneo (CEAM), Valencia, Spain is a EU funded Atmospheric Chemistry Studies Center
- ◆ Atmospheric chemistry testing with amines is being conducted



- ◆ The results of the tests are yet to be announced!

Advanced Emission Control System



- ◆ The molecular modeling effort has caused a substantial discussion in the CCS community.
- ◆ In some countries, there is public anxiety
- ◆ For amine based technologies, the best path forwards is to reduce the emission of solvents to the atmosphere
- ◆ Fluor's strategic plan is to demonstrate new plant designs to reduce amine emissions by one order of magnitude

Solvent Emissions from EFG+ plants



- ◆ In general, Fluor's goal has been to minimize stack amine emissions from EFG+ plants.
- ◆ At the Bellingham plant, rigorous testing of solvent emissions in the fluegas vent was conducted
- ◆ The solvent concentration in the absorber vent was less than 1 ppm (v/v)
- ◆ Systems with lower emissions can be designed with a minor increase of OPEX

Further Improvements to Reduce Amine Emissions



- ◆ Fluor has developed an advanced scrubbing system, where the solvent concentration in the vent is greatly reduced to around 0.1 to 0.2 ppm (v/v)
- ◆ In 2011, the process and equipment to reduce amine emissions will be tested in demonstration plant in Germany
- ◆ The fluegas is derived from a coal fired power plant
- ◆ The demonstration plant is a result of cooperation between E.ON and Fluor Corporation
- ◆ A detailed test plan has been prepared

Target Emissions Levels



- ◆ More efficient scrubbing systems consume more power and/or reagents
- ◆ There is a need to design systems that scrub fluegas down to an “adequate” level and to not an arbitrarily low value
- ◆ Depending on the environmental impact, the degree of scrubbing (amine concentration) could vary depending on the amine used
- ◆ There is a need for the authorities to set target levels for amine emissions. Vendors can endeavor to design systems to meet the target

Reclaimer Waste



- ◆ Most amine based CO₂ capture processes require solvent reclaiming
- ◆ Depending on the fluegas constituents and the solvent's resistance to degradation a varying amount of reclaimer waste would be produced
- ◆ In its current generation technology, Fluor has significantly reduced reclaimer waste production
- ◆ Fluor is now focusing on developing methods for reclaimer waste disposal

Questions



Any Questions?