

CALCULATION COVER SHEET

PROJECT CO2 KARSTO	JOB NO. 25474	CALC NO. BECHTEL: 25474-000-M4C-CN-00006 OWNER: 10112936-PB-P-TDO-0006	SHEET 1
SUBJECT: Dosing Rate for Degraded MEA Neutralisation		DISCIPLINE: Process	

CALCULATION STATUS DESIGNATION	PRELIMINARY X	CONFIRMED	SUPERSEDED	VOIDED	
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COMPUTER PROGRAM/TYPE	SCP		MAINFRAME PC		PROGRAM NO.	VERSION/ RELEASE NO.
	YES	NO X <input type="checkbox"/>	YES	NO X <input type="checkbox"/>		

Use of these calculations by persons, without access to pertinent factors and without proper regard for their purpose, could lead to erroneous conclusions. Should it become necessary to use any of these calculations in your work in the future, it is suggested that the calculations be reviewed with authorized Bechtel personnel to ensure that the purposes, assumptions, judgments and limitations are thoroughly understood. Bechtel cannot assume responsibility for the use of these calculations not under our direct control.

Reference Data:

- 1) Oxidative Degradation of Monoethanolamine, Chi, Rochelle, The University of Texas at Austin, 2002
- 2) Amine Degradation, Davis, Sexton, The University of Texas at Austin
- 3) BECHTEL CALC NO. 10112936-PB-P-TDO-0003
- 4) BECHTEL CALC NO. 10112936-PB-P-TDO-0004
- 5) Degradation of MEA Used in CO2 Capture from Flue Gas of a Coal-fired Electric Power Generation Station Strazisar et al. National Energy Technology Laboratory

Design Basis: CO2 Kårstø - Exhibit E0 - Design Basis

Remarks:

This document provides the calculation of the dosing rate required to neutralise the degraded acidic MEA products from the Stripper and Absorber columns.

Comments

0	Issued for Deliverable Milestone Schedule M2	2	2	NH	MJC/DM	ADB / BR	07-Oct-08
REV N	REASON FOR REVISION	TOTAL NO. OF SHEETS	LAST SHEET NO.	BY	CHECKED / APPROVED	REVIEWED / ACCEPTED	DATE

RECORD OF REVISIONS



CALCULATION SHEET

SUBJECT: Dosing rate calculations	CALC. NO.	BECHTEL: 25474-000-M4C-CN-00006	OWNER: 10112936-PB-P-TDO-0006
PROJECT CO2 KARSTO	DATE	07/Oct/08	CHECKED
SUBJECT Dosing Rate Required to Neutralise Degraded MEA			MJC DATE 07/Oct/08
			JOB NO. 25474
			SHEET 2 OF 2 SHEETS

1. Purpose of Calculation:

To estimate the degradation rate of MEA to acids in the process and calculate the required flow rate of soda ash to neutralise the degraded products of MEA
 This calculation does NOT estimate the total waste or MEA consumption of the facility

2. Methodology:

Scientific literature was used to estimate the rate of degradation of MEA.

The rate of degradation of MEA within the process was quantified.

The amount of soda ash required to neutralise the degradation products was calculated.

3. Scientific Literature

3.1 Oxidative Degradation Rate of MEA to Acids

(Reference 1) 0.0000615 kg MEA / litre amine solution at 55 °C and 0.4 loading;
 Dissolved iron acts as catalyst; in stainless steel taken as 1 ppm
 Assumed to be in Absorber packing beds only because aeration conditions apply here

3.2 Thermal Degradation Rate of MEA to Acids

(Reference 2) 24% degradation per 4 weeks at 135 °C based on 35% MEA and 0.4 loading; quadrupled every 15 °C
 0.0007 kg MEA/ hr
 Assumed to be in Stripper column and in other heated components (say 20% V of Stripper column)

4. MEA Degradation in Process

4.1 Oxidative Degradation Rate of MEA (Reference 3)

Loading Ratio		CSA	Packed Bed Height	Liquid hold-up	Liquid in Packing	Vessel Volume	Total Volume	Rate	Degradation
Process	Experiment	m ²	m	%	m ³	m ³	m ³	kg MEA / hr	kg MEA/hr
0.45	0.4	109.5	10	4.5	49.28	N/A	49.28	0.0000615	3.0

4.1 Thermal Degradation Rate of MEA (Reference 4)

Loading Ratio		CSA	Packed Bed Height	Liquid hold-up	Liquid in Packing	Vessel Volume	Total Volume	MEA	Rate	Degraded MEA	Degradation
Process	Experiment	m ²	m	%	m ³	m ³	m ³	Mass Fraction	kg MEA / hr	kg	kg MEA/hr
0.45	0.4	34.9	20	7	48.86	193.2561093	(Take 120%) 290.54	0.35	0.00036	103315.786	37.2

4.2 Total Degradation Rate to Acids

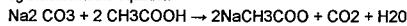
40.2 kg MEA / hr

5. Dosing Rate

5.1 Based on following assumptions:

(reference 5) Acid to neutralise:
 40.2 kg MEA / hr

eg stoichiometric equation



MW MEA	61.08	g/mol	Moles MEA	658.5477328
MW Soda Ash	105.99	g/mol	Moles Soda Ash	329.2738664
			Mass Soda Ash	34.8997371 kg/hr
			Approximate	35 kg/hr