

## **THE ROLE OF INTERMEDIATE AMINES IN BOILER WATER CONDENSATE CONTROL CASE 3**

The need for condensate corrosion control is well established within the boiler water treatment field. Dissolved carbon dioxide in condensate results in low pH, which causes corrosion.

For years the addition of volatile neutralizing amines has been successfully used to prevent such corrosion. The selection of the proper amine to neutralize CO<sub>2</sub> varies from one boiler system to the next.

In many systems an amine with intermediate properties can be a singular solution to problems. One amine which offers a number of advantages is Arkema DMAE (Dimethylaminoethanol).

An examination of physical properties in the accompanying table shows DMAE physical characteristics to be intermediate to morpholine and cyclohexylamine in key areas.

DMAE vaporization characteristics can give more protection than either cyclohexylamine or morpholine. Condensate systems operating at high temperatures will get better protection with DMAE than cyclohexylamine. DMAE will increase protection offered by morpholine in longer runs of low pressure steam.

These same vaporization characteristics will limit DMAE losses in periodic blow down. Morpholine and AMP-95 maintain higher percentages of active material in the liquid phase which is lost during blow down discharging. In addition the high deaerator losses experienced by cyclohexylamine because of high volatility will not occur with DMAE.

Further examination of the physical properties in the table shows that DMAE is intermediate in base strength, when compared to morpholine and cyclohexylamine. The pH of 10.1 calculated for a 10<sup>-3</sup> N (90 ppm) solution of DMAE in distilled water demonstrates that adequate protection can be maintained at low excesses of DMAE over CO<sub>2</sub>.

In the neutralization of CO<sub>2</sub> the reaction products of each amine must also be considered. Under normal operating conditions the reaction products of DMAE and CO<sub>2</sub> will not plug lines. AMP-95, cyclohexylamine and morpholine, on the other hand, have been known to form troublesome solids that can plug lines.

(Over)

PROPERTIES OF SELECTED NEUTRALIZING

	DMAE	Morpholine	AMP-95	Cyclohexyl-amine
Molecular Wt. (calc)	89.1	87.1	89.1	99.2
Boiling Pt. (?C)	133	129	165	134
Freezing Pt. (?F)	-74	+2.3	+30	+23
azeotrope at 760 mmHg		None	None	
Boiling Pt. (?F)	210			206
% Amine in vapor	14			44
Vapor/Liquid Distribution at 1 atmosphere-pH 10	1.1	0.45	0.17	4.4
Basicity (Kbx 10 <sup>6</sup> )	13	2.4	66	410
pH of 10 <sup>-3</sup> N solution (calc)	10.1	9.8	10.2	10.7
Solid Carbonate Formation	No	Yes	Yes	Yes
Flash Pt. (?F)	104	95	182	88

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