UREA SOLUTION PRODUCTION

It is important to understand the properties of dry Urea when added to water. The reaction is endothermic. This is a negative heat reaction. When added to water the liquid becomes cold. Once the liquid becomes very cold the dissolution stops. To drive the dissolution to completion it is necessary to have vigorous agitation, more liquid to dissolve into or heat. This is usually in the form of hot water or steam.

PRODUCT NOTES:

UREA: Urea (46-0-0) is a prilled, light weight product. It can be used to make Urea solutions up to 47.82% by weight, a grade of 22-0-0 Nitrogen solution. The following is a chart is various Urea solutions.

UREA – WATER SOLUTIONS

RADE	% UREA	Ton Formula Urea *	Water	Specific Gravity	LBS/GALS	SALT OUT TEMP	MINIMUM HOT WATER TEMP.
14-0-0	30.43	610	1390	1.087	9.06	10°F	58°F
15-0-0	32.60	652	1348	1.092	9.10	14°F	67°F
16-0-0	34.78	696	1304	1.098	9.15	18°F	76°F
17-0-0	36.96	740	1260	1.105	9.20	23°F	88°F
18-0-0	39.13	783	1217	1.110	9.25	28°F	99°F
19-0-0	41.30	826	1174	1.117	9.31	33°F	110°F
20-0-0	43.47	870	1130	1.123	9.36	39°F	124°F
21-0-0	45.46	910	1090	1.129	9.41	45°F	137°F
22-0-0	47.82	957	1043	1.136	9.47	52°F	153°F
23-0-0	50.00	1000	1000	1.147	9.57	57°F	167°F

From experience 23-0-0 can be produced with 160 Degree F Water. Temps shown in the table are calculations based on BTU exchange

The cooling of the liquid by the Urea must be offset with hot water. To calculate the heat required to do so is as follows. Urea has a negative heat of 110 BTU's per pound. Multiply the pounds per ton of Urea in the solution X 11 BTU's. This is the amount of negative BTU's of the Urea by the BTU's of the water. This plus the Salt Out Temperature of the solution equals the minimum hot water temperature required. Most ambient water temperatures are above the 22-0-0 solution S.O.T. of 52 degrees Fahrenheit. If the degrees of heat needed are added to the ambient water temperature it is usually sufficient to dissolve the Urea quickly.

Example:
22-0-0 Urea Solution

		N	P	K
	ANALYSIS	**22**	**0**	**0**
MATERIAL	**POUNDS**	**440**	**0**	**0**
Water	**1043**			
Urea	**957**	**440**		
Total	**2,000**	**440**	**0**	**0**

Heat to dissolve the Urea: Example calculation

957 Pounds X -110 BTU / Pound Urea = 105,270 BTU / Ton
105,270 BTU ÷ (1043 Pounds Water x 1 BTU/F°) = 101° the water will cool. 101° + cold water temp (or S.O.T.) = Temperature of water to mixer. 101° + 52° = 153° F. Water at 153° F should be adequate for total dissolution of the Urea.

50% UREA SOLUTION TEMPERATURE CALCULATION

50% Urea solution has a S.O.T. (Salt Out Temperature) of 57 Deg. F.
Typical Calculation: 50% Solution, 1,000 Pounds Water
1,000 Pounds Urea
2,000 Pounds Total

Urea = -110 BTU per pound (-110 x 1,000 pounds = 110,000 negative BTU's

The Minimum Hot Water Temperature to Achieve Total Dissolution of the Urea.

110,000 BTU ÷ (1,000 Pounds Water x 1 BTU/ºF) = 110º F the Water will Cool
Salt Out = 57º F
110º F + S.O.T. 57º F = 167º F Minimum Hot Water Temperature to Dissolve the 1,000 Pounds of Urea

Desired Finish Product Temperature 80ºF

110º F the Water will Cool + 80º F Desired = 190º F Production Water Temperature.

CaNO3, KNO3, KTS, CaTS, Amm. Sulfate, Urea, Etc.