UAN SOURCES TODAY

Michael Orr

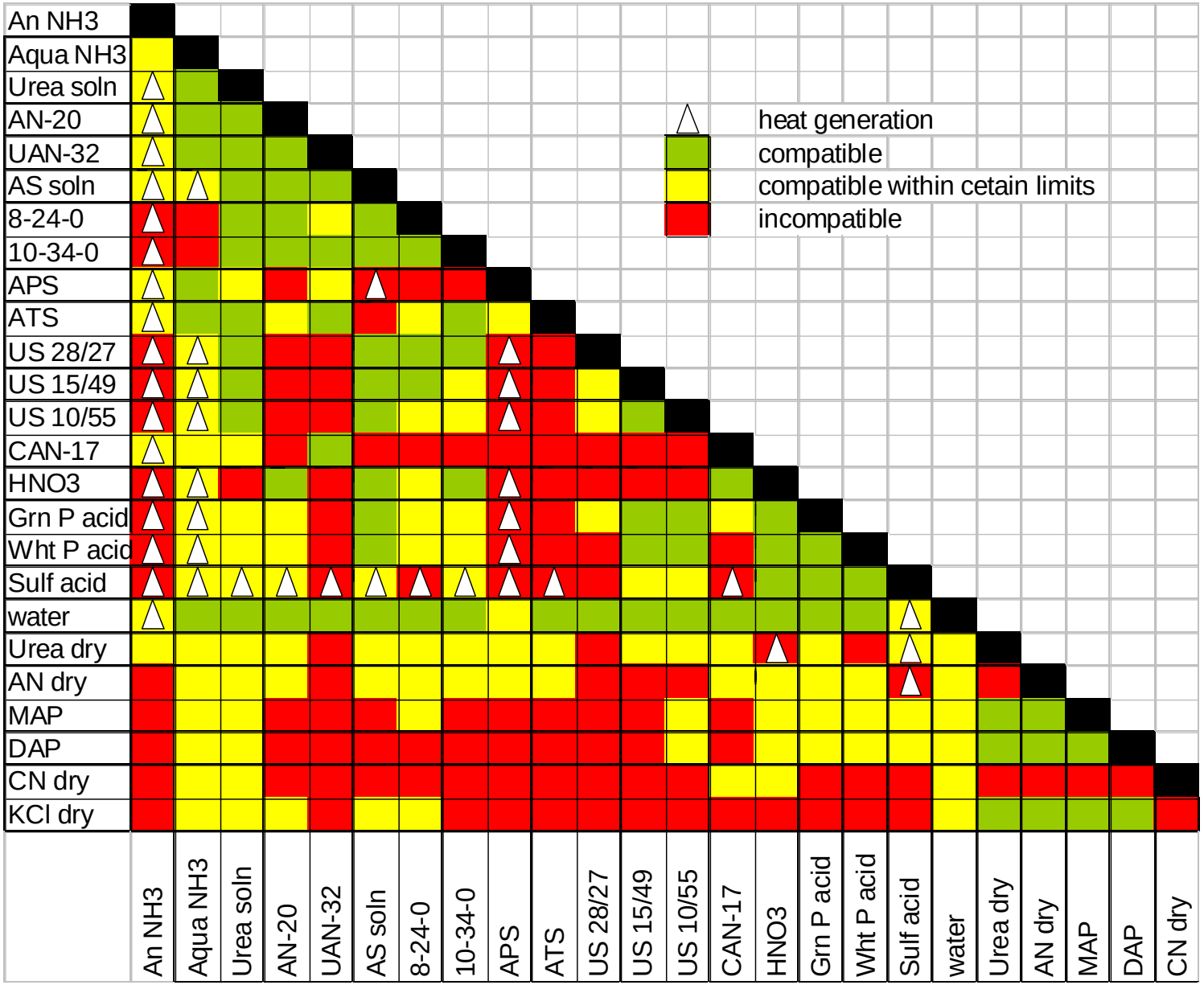
Specialty Process Consulting

Kansas

12-10-2014 Sacramento, CA


VINCITA
33
32
31
30
29
28
27
26
25
24

Unocal Compatibility Chart



UAN PRODUCTION

- AN Liquor + Urea Liquor
- Nitric acid + Ammonia + Urea Liquor
- Melt
- Adjust concentration

% N salts at Temps

Temp	urea	NH_4NO_3	UAN	NH_4SO_4		NH_4Cl	
32	18.7	19.0	32.6	8.8	10	5.9	15
35	19.2	19.4	33.6				
40	19.9	20.2	34.8				
45	20.6	20.8	35.7				
50	21.3	21.4	36.3	8.8	10.2	6.5	16.6
55	22.1	22.0	36.8				
60	22.8	22.4	37.2				
65	23.5	22.9	37.6				
70	24.2	23.4	37.9	9.1	10.4	7.2	18.2
75	25.0	23.8	38.1				
80	25.8	24.3	38.3				
85	26.5	24.7	38.5	9.3	10.6	7.6	19.3

UAN 28-32%

- RATIOS VARY-INFLUENCE BLENDS
- pH CHANGES DUE TO UREA/NH_3/NO_3
- ADDITION OF OILS/INHIBITORS
- CROSS CONTAMINATION
- WINTER STORAGE INFLUENCE
- BLENDING

ADJUST UAN

- Addition of Urea-summer, winter blend
- Addition of Ammonia to adjust pH
- Addition of one or the other also impacts saltout temperature
- Addition of water to cut concentration impacts saltout
- Inhibitor addition impacts saltout temperatue

pH	Free NH_3
0 - 6.30	0.00
6.31 - 6.85	0.01
6.86 - 7.10	0.02
7.11 - 7.25	0.03
7.26 - 7.35	0.04
7.36 - 7.45	0.05
7.46 - 7.52	0.06
7.53 - 7.57	0.07
7.58 - 7.61	0.08
7.62 - 7.67	0.09
7.68 - 7.72	0.10
7.73 - 7.75	0.11
7.76 - 7.80	0.12
7.81 - 7.83	0.13
7.84 - 7.86	0.14
7.87 - 7.88	0.15
OVER 7.88	TITRATE

Sample Name: UAN 32

Analysis Name	Analysis	Units
Free Ammonia	0.03	%
Ammonium Nitrate	46.52	%
Ammonium Nitrate (N)	16.28	%
Urea	34.32	%
Urea Nitrogen (N)	15.99	%
Total Nitrogen (N)	32.29	%
Biuret	1.0	%
pH	7.53	
Specific Gravity @ Ambient/ 60 deg F	1.3319	

Sample Name: UAN 32

Analysis Name	Analysis	Units
Free Ammonia	0.03	%
Ammonium Nitrate	45.79	%
Ammonium Nitrate (N)	16.03	%
Urea	35.19	%
Urea Nitrogen (N)	16.40	%
Total Nitrogen (N)	32.44	%
pH	7.57	
Specific Gravity @ Ambient/ 60 deg F	1.3308	

CHANGING NITROGEN SUPPLY

- Ammonium nitrate
- Increased importation of UAN
- pH variation in UAN
- AN/Urea ratio
- Supply
- Discoloration

NITRATE/ NO_X

NO WITH ACIDS
SIGNS REDDISH/BROWN GAS
NERVE GAS/DEADLY
NITRATE NOT HIGHLY SOLUBLE WITH POTASSIUM
WILL COMPETE WITH OTHER ANIONS IN SOLUTIONS
KEEP IN MIND WITH UAN SOLUTION MIXING

UAN/10-34-0 blend

Clear Liquid Formulations

Some Keys to Avoiding Salt-out Problems

Salt-out information

- Salt-out results from the formation of insoluble material in a mixed, liquid fertilizer
- It usually occurs between the time the mixture was produced and the time it is actually applied to the field
- In most cased, this decrease in solubility is due to a drop in temperature
- The material which “salts out” may or may not be one of the original ingredients

SOLUBILITIES OF SALTS IN POUNDS PER 1000 POUNDS OF WATER AT DIFFERENT TEMPERATURES

TEMPERATURE	AMMONIUM	UREA	NITROGEN	POTASSIUM
FO	NITRATE		SOLUTION 32-0-0	CHLORIDE
32	1180	670	3900	280
35	1246	698	4552	285
40	1357	745	5639	293
45	1479	793	6725	302
50	1580	840	7812	310
55	1683	898	8900	318
60	1786	956	9987	327

Where to start?

- Salt-out tables (the no brainer approach)
  - Exist for both 32°F and 50°F Salt-out T’s
  - Choose UAN or Urea
  - Choose 0%, 45% or 70% Poly

- Triangular diagrams
  - Each set of raw materials has its own chart
  - Most charts are for 32°F salt-out
  - Most are for either 0% or 70% Poly

Triangular Charts (Cont'd)

- Advantages over tables
  - Show total plant food units possible for a given grade ratio
  - Indicate what material will salt-out first (KCl, NH_4, NO_3, etc.)
- Drawbacks
  - Most are for 32°F only
  - A little harder to read (but not much)

Figure 3.7: System 11-37-0, UAN solution, potassium chloride, water at 32°F.

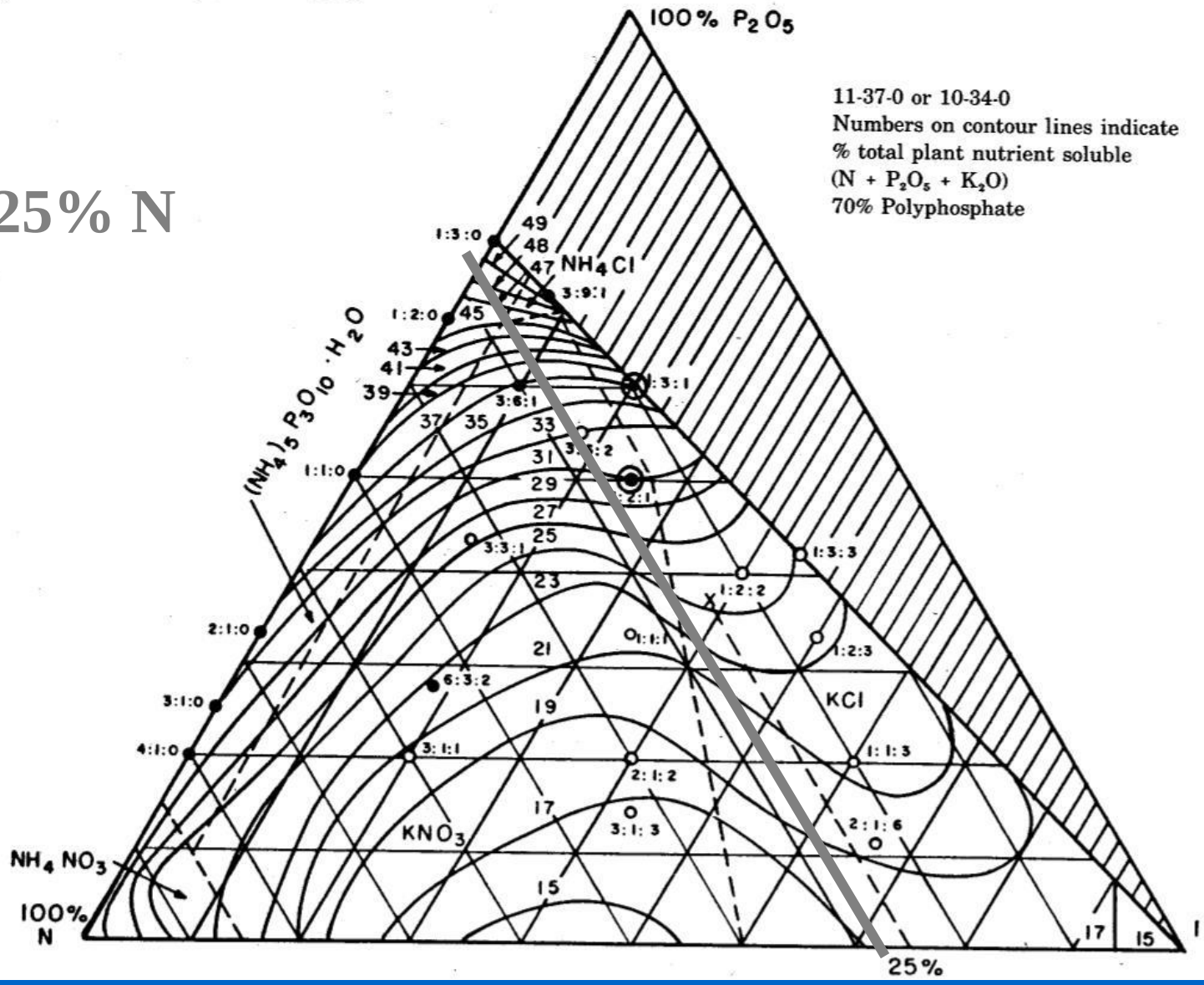


Figure 3.7: System 11-37-0, UAN solution, potassium chloride, water at 32°F.

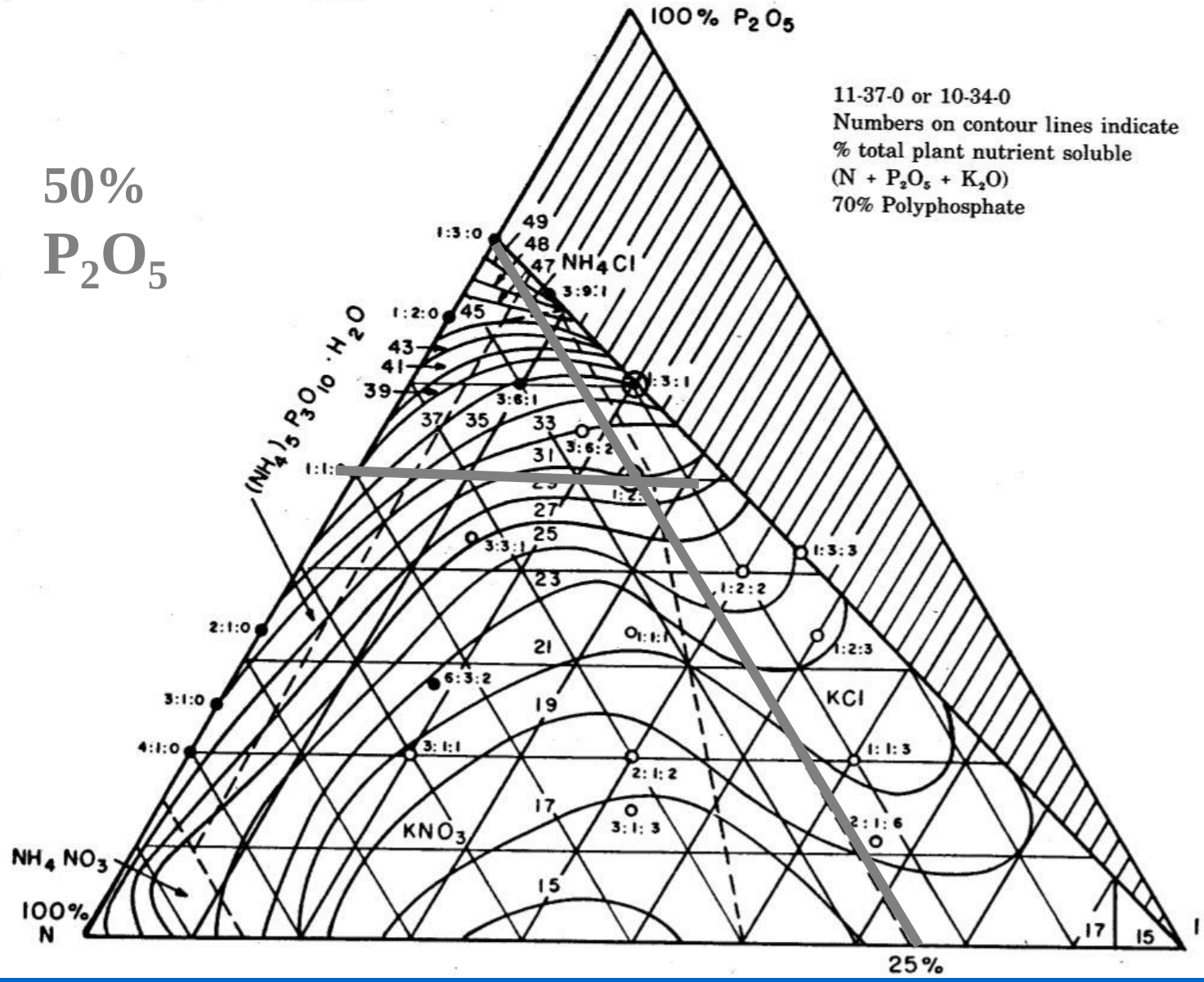
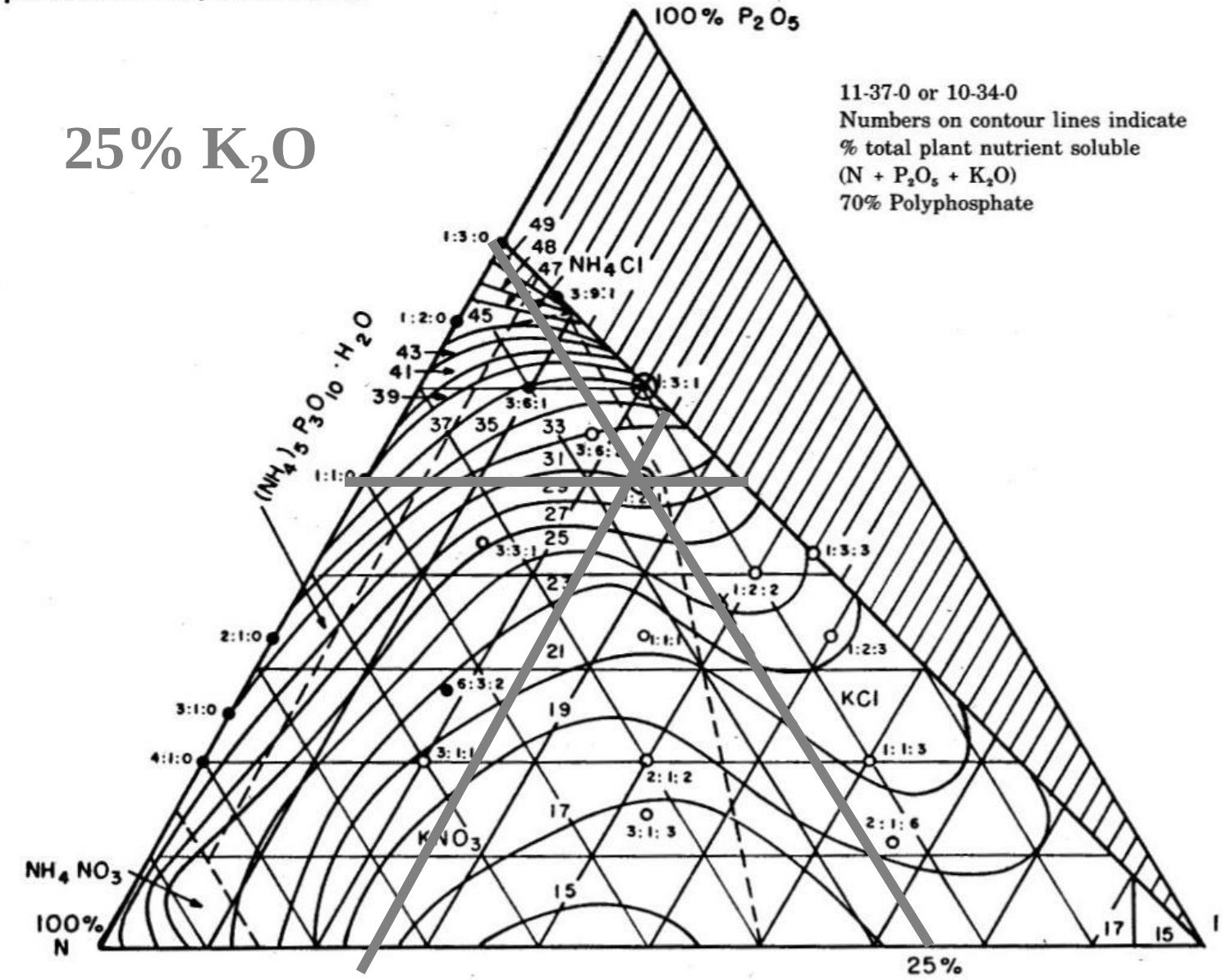


Figure 3.7: System 11-37-0, UAN solution, potassium chloride, water at 32°F.



Question – if the temperature falls below 32°F, what material will precipitate?

- If you have a Potash/UAN Mixture
- Answer – $KNO_{3/}$

  The area inside the dashed lines defines what material will precipitate

Intertek Caleb Brett

160 James Drive East
St. Rose, LA
Tel: +1.504.602.2100 / Fax +1.504.457.2156
Email: noagriculture@intertek.com

Interlek Caleb Brett Ref. #: US621- 12085

CERTIFICATE OF QUALITY

(ISSUED AT THE DISCHARGE PORT)

An Inspector from our New Orleans, LA branch sampled the herein described shipment prior to discharge from the vessel. The sample was analyzed at the Intertek, New Orleans laboratory with results as follows:

VESSEL :	***M/T SITEAM NEPTUN***
DESCRIPTION OF GOODS :	UREA AMMONIUM NITRATE 32 % N
TERMINAL :	BURNSIDE ANCHORAGE
EX VESSEL'S TANK :	1P, 1S, 3P, 3S, 5P, 5S, 6P, 6S, 8P, 8S, 9P & 9S
DISCHARGED TO BARGES(S) No. :	KIRBY 30310T, KIRBY 27304, KIRBY 29001, KIRBY 29306, KIRBY 28001T, KIRBY 18500B, KIRBY 29003, KIRBY 30500B, KIRBY 30020, KIRBY 20504, KIRBY 27000, KIRBY 28000B
SHIPMENT TONNAGE:	**32,627.329 METRIC TONS**
DISCHARGE DATE (S) :	AUGUST 2-4, 2014

SPECIFICATIONS:	TEST METHOD	SPECIFICATIONS	RESULTS
Appearance:	Visual	Transparent, slightly dyed liquid	Transparent slightly dyed liquid
Total Nitrogen Content, %	AOAC 993.13	32.0 MIN	32.42
Mass Ratio Urea / Ammonium Nitrate	CALCULATION	0.74-0.80	0.81
Alkalinity in terms of free Ammonia %	TFI 11.A.7	0.30 MAX	0.03
Density @ 15 deg. C G/CM3 (*)	ASTM D4052	None Specified	1.32866
Density @ 15 deg. C G/CM3 in Air	By conversion	-	1.32775
Density @ 40 deg. C G/CM3	ASTM D4052	1.288-1.326	1.31123
Nitrogen in the form of Ammonia & Nitrate, %	T.F.I. 11.A.6	None Specified	15.58
Nitrogen in the form of Urea, %	T.F.I. 11.A.4 / By Difference	None Specified	16.84
Fraction of Total Mass of Inhibitor, ppm	LWI.027.L	None Specified	<0.001
Solidification Temp, Deg. C	LWI.024.L	-2 MAX	-2

Upon arrival at the discharge port on 8/2/2014, samples were drawn from all above-mentioned Vessel tanks and a composite sample was prepared. This analysis conducted on the Vessel composite sample prior to discharge, represents the quality of the total cargo on board and not for individual parcels (if any) subsequently discharged.

For and on behalf of
Intertek Agricultural Services

Signed and dated in: St. Rose, LA
on: August 6, 2014

Niki Hebert, Operations Manager

INSPECTORATE

ANALYSIS CERTIFICATE

R111796

This is to certify that Inspectorate Estonia AS., at the request of "[redacted]", performed inspection of ships tanks of the under mentioned vessel:

Commodity	UREA AMMONIUM NITRATE SOLUTION (UAN) 32% BULK
Loaded into the	M/T "BOW FORTUNE"
Place of loading	SILLAMAE, ESTONIA
Time of loading	JULY 7th –9th 2014
Loaded quantity as per B/L no.1 dated 09/July/2014	29 156.591 MT
Destination	1-2 SB CORPUS CHRISTY, TX U.S.A.

RESULTS OF CHEMICAL ANALYSIS

Sampling and chemical analysis based on composite sample taken from vessel's tanks after loading was performed according to the requirements and the following results were obtained:

Tests	Methods	Units	Specifications	Results
Appearance	VISUAL	Result	The Tingle Pigment Clear Liquid	TCLP
Total Nitrogen Content	AOAC 993.13	%mass	min 32.0	32.02
Urea/Ammonium Nitrate	CALCULATED	%mass	0.74-0.80	0.79
Alkalinity in terms of free Ammonia	ADCH0564 (BORDEN)	%mass	0.02-0.30	0.083
Crystallization temperature, °C	ASTM D 2500 (mod.)	°C	Not higher than -2C	-14
Content of Inhibitor (CORBLOK 9140 or identical)	ACRON in-house method	%mass	0.01 min	0.011
Density of liquid @40°C,	ASTM D 4052 (mod)	g/cm3	1.298-1.326	.3214

Dated: 09th July, 2014
For and on behalf of
INSPECTORATE R.

Inspectorate Estonia AS
[illegible]

Registered in Estonia no. [illegible]
[illegible]

[illegible]

INSPECTORATE
A Bureau Veritas Group Company

CERTIFICATE OF QUALITY

J089146

This is to certify that, at the request of Messrs. [redacted], we have performed the quality inspection of the under-mentioned goods:

Description of goods:	**UAN SOLUTION, MINIMUM 32% NITROGEN**
Vessel:	**MT FAIRCHEM COLT**
Port of loading:	**CONSTANZA, ROMANIA**
Date of loading:	**08TH – 10TH OF NOVEMBER, 2012**
Port of discharge:	**1-3 PORT(S) USEC (PHILA-JAX RGE) OR 1 SP USG RANGE INCL. MISS. RIVER (NOT NORTH OF D'VILLE), USA**
Quantity as per B/L No. 1 dated 10.11.2012	**18,450.000 MT**

RESULTS OF INSPECTION

We hereby certify that we took samples from ship's tanks after loading of **UAN SOLUTION, MINIMUM 32% NITROGEN** and, based on analysis of the ship's composite sample, report the following findings:

Parameters	Specifications	Methods	Results
Total Nitrogen	32 % min	EC 2003/2003 method 2.6.2	32.09 %
Amidic Nitrogen	16.0 % +/- 1.1	SR ISO 5661:1995 SR EN ISO 12185:2002	15.99 %
Nitrate Nitrogen	16.0 % +/- 1.1	EC 2003/2003 method 2.1 / 2.2.3.	16.10 %
Corrosion inhibitor (SK FERT UAN)	?80 ppm max	SNM - SLUISKIL	160 ppm
Crystallization point	< or = 0°C	SR EN ISO 1392:1994	0°C
Pressure at 40° C	0	Manometer tube U with water	29
Free Ammonia	0.1% max	SR ISO 1593:1999	0,04 %
Specific weight at 20°C	1.320 g/cm³ min	ISO 758:1976 SR EN ISO 12185:2002	1,3261 g/cm³
Aspect	Clear liquid	Visual	Clear liquid

Dated: 10th of November, 2012
For and on behalf of
INSPECTORATE (SUISSE) S.A.

F40491

Intertek

5841 Freeman Avenue, Suite A
Signal Hill, CA 90755, USA
Tel: +1.562.494.4999 / Fax: +1.562.494.4498
Email: [illegible]@intertek.com

Intertek Ref. #: US520-00001918

CERTIFICATE OF QUALITY

(ISSUED AT THE DISCHARGE PORT)

An inspector from our Wilmington, NC branch sampled the herein described shipment prior to discharge from the vessel. The sample was analyzed at the Intertek, New Orleans laboratory with results as follows:

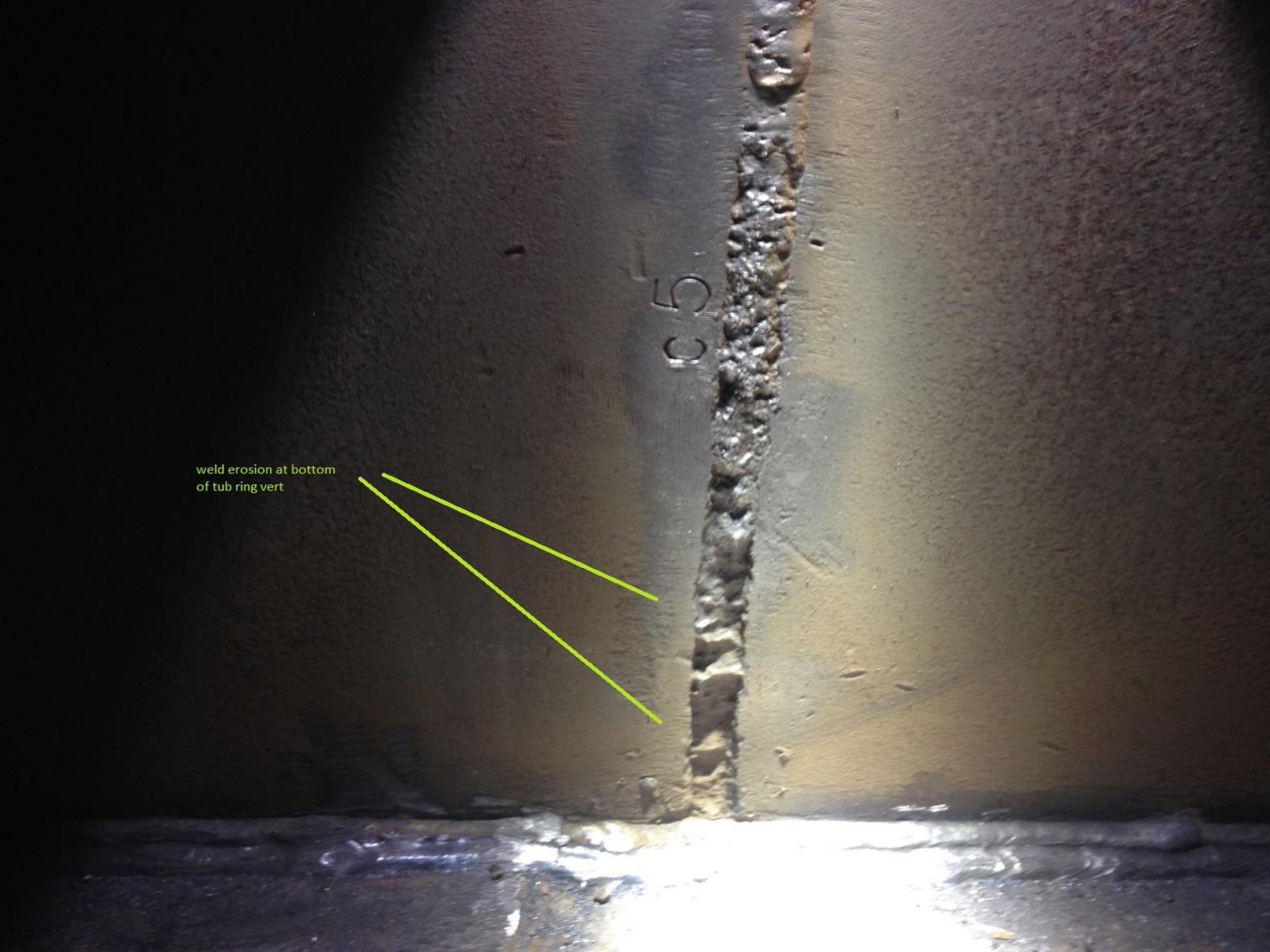
VESSEL : *M/T "FAIRCHEM COLT"*
DESCRIPTION OF GOODS : UAN SOLUTION 32 PCT NITROGEN IN BULK
TERMINAL : [redacted] - WILMINGTON, NC
EX VESSEL'S TANK : 1P, 1S, 2P, 2S, 3P, 3S, 6P, 6S, 7P, 7S, 8P, 8S, 10P & 10S
DISCHARGED TO SHORE TANK(S) No. : SOUTH
SHIPMENT TONNAGE: **18,468.974 METRIC TONS**
RECEIVER : [redacted]
DISCHARGE DATE (S) : DECEMBER 01-02, 2012
DATE(S) TESTED: DECEMBER 04, 2012

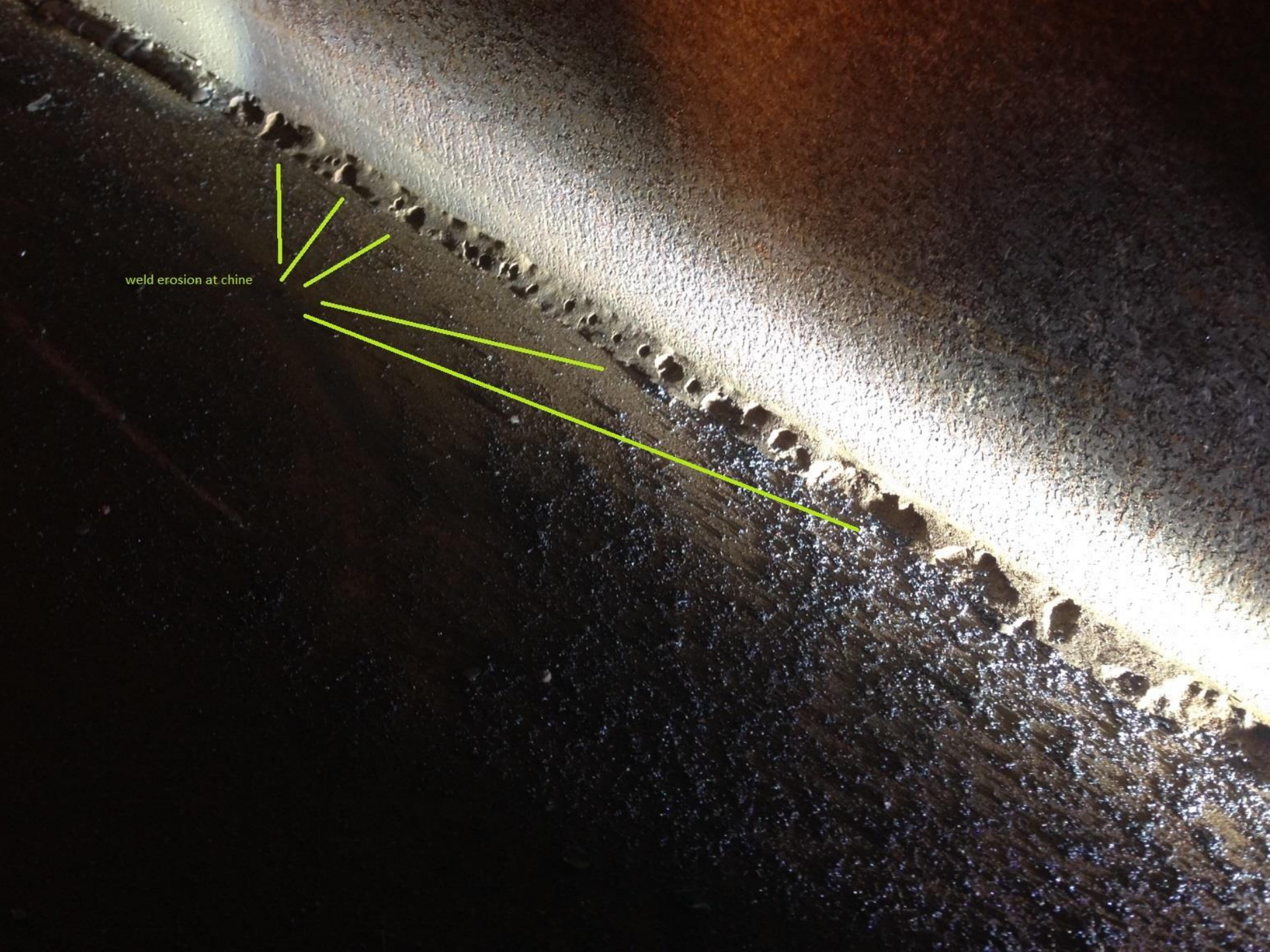
SPECIFICATIONS:	TEST METHOD	SPECIFICATIONS	RESULTS
Appearance:	Visual	Transparent slightly dyed liquid	Transparent slightly dyed liquid
Total Nitrogen Content, %	AOAC 993.13	32.0 MIN	32.08
Mass Ratio-Urea / Ammonium Nitrate	CALCULATION	0.78 +/- 0.05	0.72
Alkalinity in terms of free Ammonia %	TFI 11.A.7	0.01 - 0.5	0.04
Density @ 15 deg. C G/CM3 (*)	ASTM D4052	None Specified	1.3294
Density @ 15 deg. C G/CM3 in Air	By conversion	-	1.3284
Nitrogen in the form of Ammonia & Nitrate, %	T.F.I. 11.A.6.	14-18	8.16
Nitrogen in the form of Urea, %	T.F.I. 11.A.14 / By Difference	14-18	15.73
Fraction of Total Mass of Inhibitor as P205, ppm	EWI.027.L	None Specified	3.6

(*) Tested at Intertek Wilmington Lab

Upon arrival at the first discharge port on 12/01/2012, samples were drawn from all above-mentioned Vessel tanks and a composite sample was prepared. This analysis conducted on the Vessel composite sample prior to discharge, represents the quality of the total cargo on board and not for individual parcels (if any) subsequently discharged.

Intertek


weld erosion at bottom
of tub ring vert


weld erosion at chine

THE FUTURE

- Know what the AN/UREA ratio
- Consider pH (ammonia) above pH 7
- Know total Nitrogen
- Inhibitor?
- A Crystal Ball would be nice