Production Issues for Fluid Fertilizer Plants

Fluid Fertilizer Marketing and Technology Workshop
December 9, 2009

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PRESENTATION FORMAT

SAFETY – COMPLIANCE

GREEN OPPORTUNITIES

BLENDING & HANDLING

- Question & Answer Session

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SAFETY

- Our Most Important Priority
- Every Employee Goes Home Safe
  - Training – Documented
  - PPE when you can't eliminate hazards
  - Regular Tailgate & Huddles Meetings
  - Policies, Procedures, Work Directions
  - Develop Culture of Safety in
  - Environmental Safety
  - Facility / Equipment Safety

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SAFETY

- Special Situations
  - Respirators
  - Confined Space Entry
  - Forklifts/Loaders/Shuttle Trucks
  - Elevated Work / Maintenance
    - Harnesses
    - Safety Cages
    - Rest Platforms
    - Ladders & Manlifts

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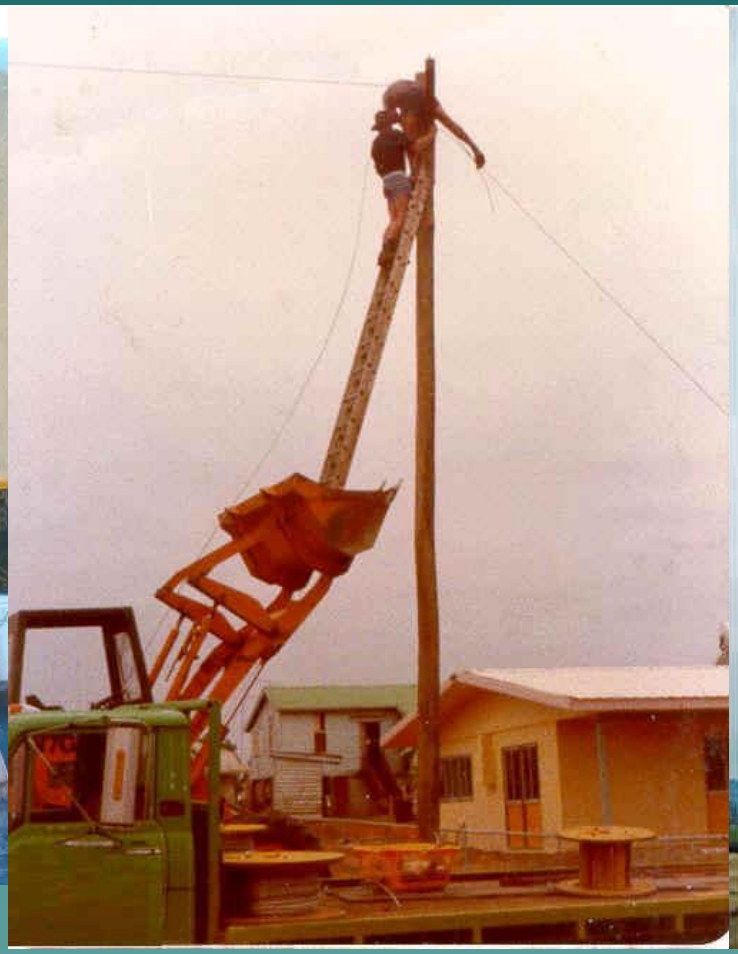
Ingenuity Deserves Recognition



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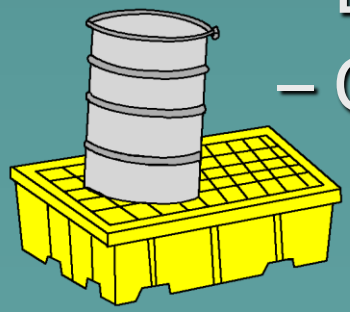
SAFETY with CHEMICALS

- MSDS
- PPE (Spill, Blending, Handling)
- SPILLS
  - Reporting Requirements
  - Emergency Response Plan
  - Training
  - Spill Response Kits
  - Emergency Response Companies
  - Customer Liabilities & Need to Know



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LABELING

- Label All Containers Properly
  - Avoid trade symbols: KOH, MOP, APP
- Use Placards, NFPA, and Caution Labels & Symbols

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SECURITY

- Site & Transportation Security
  - Homeland Security Compliance
    - Hazmat Railcar Training
    - Security Fencing
    - Restricted Entry

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Green Opportunities

- Promote Fluid Fertilizer's Green Benefits
- Precision Application
- Spoon Feeding
- Slow Release Liquids
- Multi-Task Applications (Weed & Feed)
- Promote Green Activities

  (Save Energy, Save Water, Reduce Contamination, Recycle)

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BLENDING LIQUID FERTILIZERS

- Solubilities
- Order of Addition
- Stability

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Solubility of Different Potash Materials at different Temperatures

Temperature	Potassium Nitrate	Potassium Chloride	Potassium Sulfate	Monopotassium Phosphate		Dipotassium Phosphate	
(F)	K2O	K2O	K2O	K2O	P2O5	K2O	P2O5
32	**5.4**	**13.8**	**3.7**	**4.3**	**6.4**	**30.8**	**23.3**
35	5.8	14.0					
40	6.6	14.3		4.7	7.0		
45	7.4	14.7					
50	8.1	14.9	4.6	5.2	7.7	32.3	24.1
55	9.0	15.2					
60	**9.9**	**15.6**	**5.6**	**5.9**	**8.6**	**32.6**	**24.5**
65	10.8	15.9					
70	11.7	16.1		6.4	9.6	33.3	25.1
75	12.7	16.4		6.9	10.2	33.9	25.6
80	13.4	16.7		7.0	10.5	34.2	25.8
85	14.5	17.0	6.1	7.4	11.0	34.7	26.1

(TVA data)

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Potassium Nitrate
(Hot Water Requirement)

- Hot Water 2 – 2.5 : 1
- Total Water: 3:1
- Example: 5:0:10
  - PN, AN-21, Water

Pot. Nitrate	441 Lb/Ton
Hot Water	882 Lb/Ton
Cold Water	487 Lb/Ton
Amm Nit - 21%	190 Lb/Ton

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Solubility Calculation Example

Raw Material	Solubility	Target	% Sol	Lb/Ton	N - Units
Pot. Nitrate (13.5-0-45)	12.7	12	94%	444	3.00
UAN - 32%	32	0.36	1%	23	0.36
Calcium Nitrate 9-0-0-11	11	0.5	5%	364	1.64
Water				1169	
Total Mix			100%	2000	5.00

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Solubility of micronutrients in Ammonium Poly Phosphate Solutions			
	% by weight of element (Zn, Cu, Fe, Mn, B, Mo)		
Material Added	in 11-37-0	in 10-34-0	in 8-24-0
Zinc Oxide	3.0	2.25	0.05
Zinc Sulfate	2.0	1.30	0.05
Zinc Carbonate	3.0	2.25	0.05
Cupric Oxide	0.7	0.53	0.03
Copper Sulfate	1.5	0.14	0.13
Ferric Sulfate	1.0	0.80	0.08
Manganous Oxide	0.2	0.15	0.02
Sodium Molybdate	0.5	0.38	0.50
Borax (Na2B4O7*10H20)	0.9	0.90	0.90

If more than one micronutrient is used in a liquid mixture, the micronutrients can react with each other over time creating crystals or insoluble precipitant.

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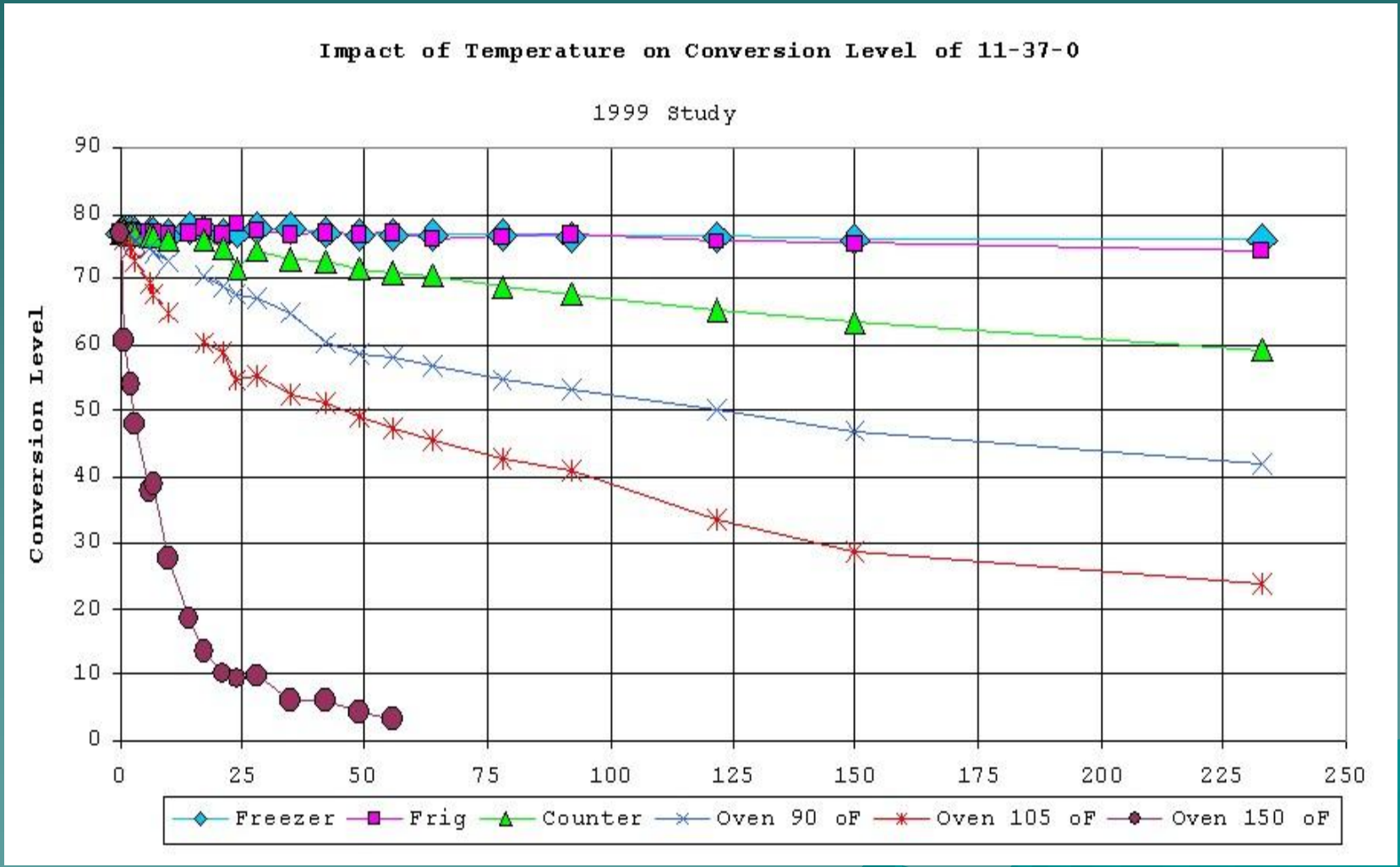
Ammonium Polyphosphate Stability vs. Temperature



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Order of Addition

- Suspend Solids While Mixing
- Chelating / Complexing
- pH
- Temperature
- Reaction / Compatibilities
- Foaming / Air Entrapment

Many exceptions to Rules of Addition

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Order of Addition

- Water (Hot / Cold)
- Chelating /Complexing Agent
- pH adjustment (initial)
- Micronutrients for Chelating/Complexing
- Potash
- Additional Micronutrients
- Phosphates
- Nitrogen
- Calcium Nitrate / Chloride
- ATS / Pot Carbonate / SRN's
- Final pH Adjustment

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Pump Seals

- Packing Seals
- Mechanical Seals
  - Silbide on Silbide
  - Product Cooled
  - Water Cooled – Internal Discharge
  - Water Cooled – External Discharge
    (~ 75 gal / minute)

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THANKS . . .

FOR YOUR ATTENTION & YOUR TIME!

QUESTIONS ?