Production Issues for Fluid Fertilizer Plants

Fluid Fertilizer Marketing and Technology Workshop
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PRESENTATION FORMAT

SAFETY – COMPLIANCE
GREEN OPPORTUNITIES
BLENDING & HANDLING

◆ Question & Answer Session
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
Special Situations
- Respirators
- Confined Space Entry
- Forklifts/Loaders/Shuttle Trucks
- Elevated Work / Maintenance
  - Harnesses
  - Safety Cages
  - Rest Platforms
  - Ladders & Manlifts
Ingenuity Deserves Recognition
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
LABELING

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

Labels & Symbols
SECURITY

- Site & Transportation Security
  - Homeland Security Compliance
    - Hazmat Railcar Training
    - Security Fencing
    - Restricted Entry
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)
BLENDING LIQUID FERTILIZERS

- Solubilities
- Order of Addition
- Stability
# Solubility of Different Potash Materials at different Temperatures

<table>
<thead>
<tr>
<th>Temperature (F)</th>
<th>Potassium Nitrate (K2O)</th>
<th>Potassium Chloride (K2O)</th>
<th>Potassium Sulfate (K2O)</th>
<th>Monopotassium Phosphate (K2O P2O5)</th>
<th>Dipotassium Phosphate (K2O P2O5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>5.4</td>
<td>13.8</td>
<td>3.7</td>
<td>4.3</td>
<td>6.4</td>
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<tr>
<td>35</td>
<td>5.8</td>
<td>14.0</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>40</td>
<td>6.6</td>
<td>14.3</td>
<td></td>
<td>4.7</td>
<td>7.0</td>
</tr>
<tr>
<td>45</td>
<td>7.4</td>
<td>14.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>8.1</td>
<td>14.9</td>
<td>4.6</td>
<td>5.2</td>
<td>7.7</td>
</tr>
<tr>
<td>55</td>
<td>9.0</td>
<td>15.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>9.9</td>
<td>15.6</td>
<td>5.6</td>
<td>5.9</td>
<td>8.6</td>
</tr>
<tr>
<td>65</td>
<td>10.8</td>
<td>15.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>11.7</td>
<td>16.1</td>
<td></td>
<td>6.4</td>
<td>9.6</td>
</tr>
<tr>
<td>75</td>
<td>12.7</td>
<td>16.4</td>
<td></td>
<td>6.9</td>
<td>10.2</td>
</tr>
<tr>
<td>80</td>
<td>13.4</td>
<td>16.7</td>
<td></td>
<td>7.0</td>
<td>10.5</td>
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<tr>
<td>85</td>
<td>14.5</td>
<td>17.0</td>
<td>6.1</td>
<td>7.4</td>
<td>11.0</td>
</tr>
</tbody>
</table>

(TVA data)
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
### Solubility Calculation Example

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Solubility</th>
<th>Target</th>
<th>% Sol</th>
<th>Lb/Ton</th>
<th>N - Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pot. Nitrate (13.5-0-45)</td>
<td>12.7</td>
<td>12</td>
<td>94%</td>
<td>444</td>
<td>3.00</td>
</tr>
<tr>
<td>UAN - 32%</td>
<td>32</td>
<td>0.36</td>
<td>1%</td>
<td>23</td>
<td>0.36</td>
</tr>
<tr>
<td>Calcium Nitrate 9-0-0-11</td>
<td>11</td>
<td>0.5</td>
<td>5%</td>
<td>364</td>
<td>1.64</td>
</tr>
<tr>
<td>Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Mix</td>
<td></td>
<td>100%</td>
<td></td>
<td>2000</td>
<td>5.00</td>
</tr>
</tbody>
</table>
### Solubility of micronutrients in Ammonium Poly Phosphate Solutions

<table>
<thead>
<tr>
<th>Material Added</th>
<th>% by weight of element (Zn, Cu, Fe, Mn, B, Mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>in 11-37-0</td>
</tr>
<tr>
<td>Zinc Oxide</td>
<td>3.0</td>
</tr>
<tr>
<td>Zinc Sulfate</td>
<td>2.0</td>
</tr>
<tr>
<td>Zinc Carbonate</td>
<td>3.0</td>
</tr>
<tr>
<td>Cupric Oxide</td>
<td>0.7</td>
</tr>
<tr>
<td>Copper Sulfate</td>
<td>1.5</td>
</tr>
<tr>
<td>Ferric Sulfate</td>
<td>1.0</td>
</tr>
<tr>
<td>Manganous Oxide</td>
<td>0.2</td>
</tr>
<tr>
<td>Sodium Molybdate</td>
<td>0.5</td>
</tr>
<tr>
<td>Borax (Na2B4O7*10H20)</td>
<td>0.9</td>
</tr>
</tbody>
</table>

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.
Ammonium Polyphosphate Stability vs. Temperature

Impact of Temperature on Conversion Level of 11-37-0

1999 Study

Conversion Level

Freezer  Frig  Counter  Oven 90 oF  Oven 105 oF  Oven 150 oF
Order of Addition

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

Many exceptions to Rules of Addition
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
Pump Seals

- Packing Seals
- Mechanical Seals
  - Silbide on Silbide
  - Product Cooled
  - Water Cooled – Internal Discharge
  - Water Cooled – External Discharge
  (~ 75 gal / minute)
THANKS . . .
FOR YOUR ATTENTION & YOUR TIME!

QUESTIONS?