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Storage Properties of
Ammonium Polyphosphate
(11-37-0 / 10-34-0)

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LOMAG - Feed to 11-37-0/10-34-0 Plant

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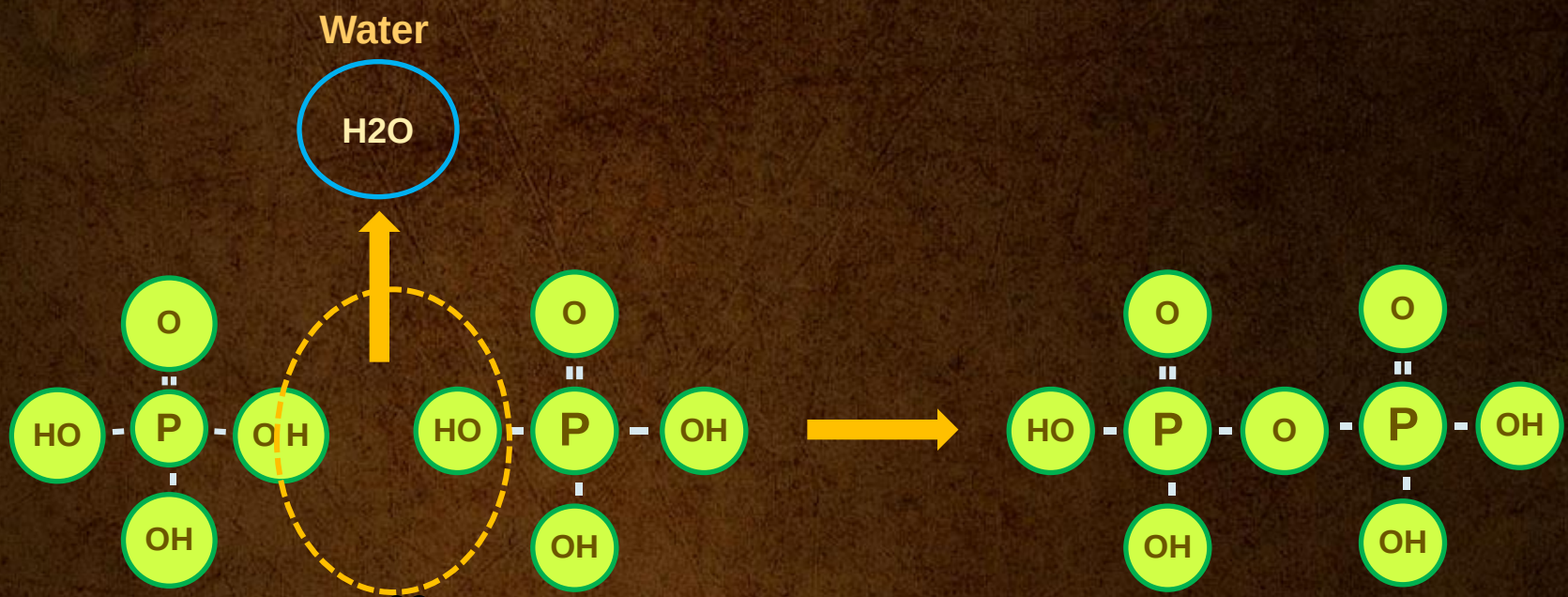
LOMAG - Low Magnesium Superacid

- **It is a Polyphosphoric Acid**

LOMAG is Made by Evaporating Phosphoric Acid



H_3PO_4
Ortho

H_3PO_4
Ortho

HEAT
330 ^{O}F

Pyrophosphoric Acid ($H_4P_2O_7$)
- A Polyphosphoric Acid

Conversion: The Amount of Orthophosphate Converted to Polyphosphate

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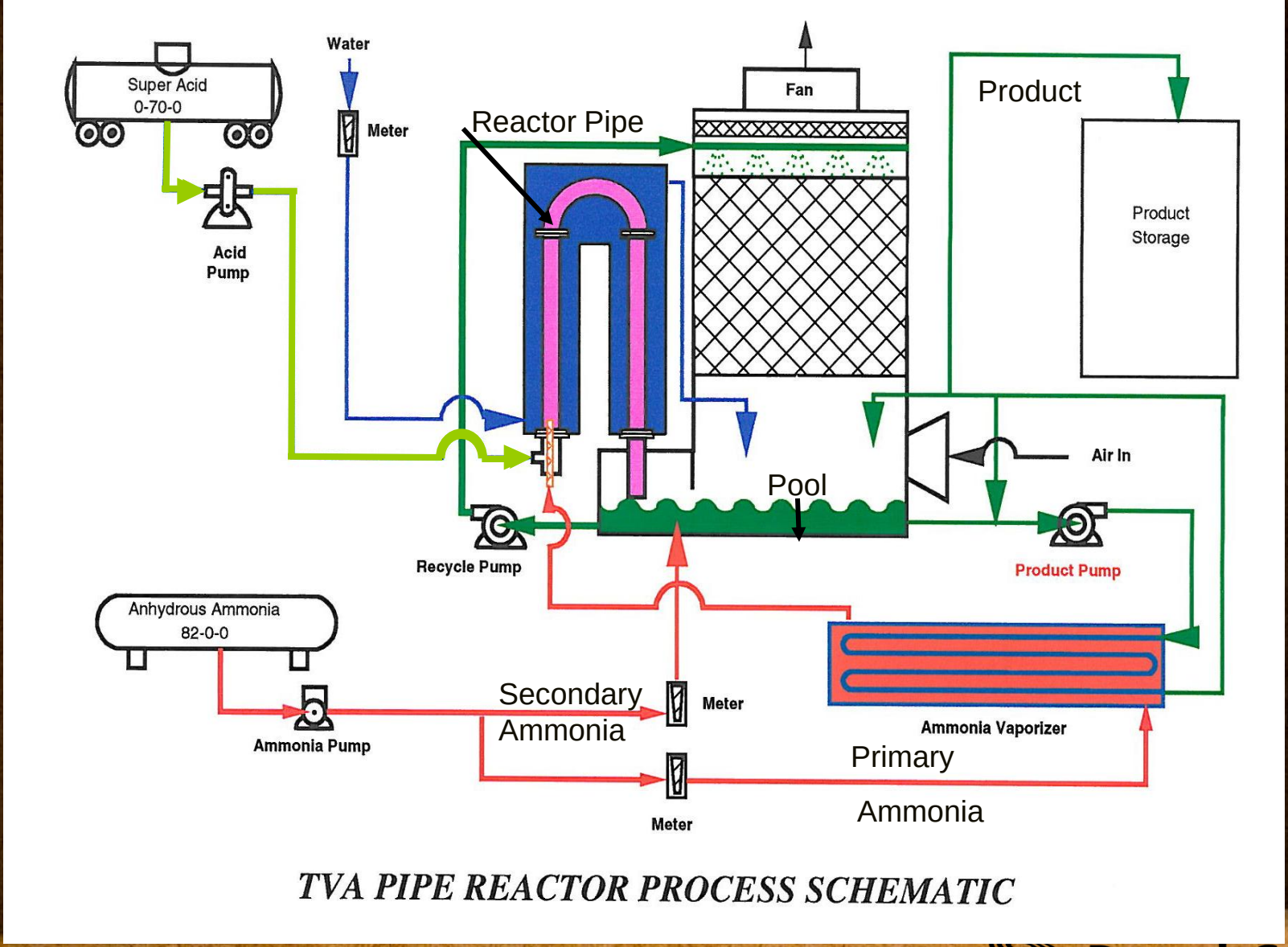
LOMAG - Low Magnesium Superacid

- **It is a Polyphosphoric Acid**
- **It is used to Produce Ammonium Polyphosphates (11-37-0 or 10-34-0)**

Producing Liquid Fertilizer from LOMAG



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Converting the LOMAG to 11-37-0/10-34-0 Increases the Phosphate Conversion Level

- The Pipe Reactor Temperature Exceeds 600 ^{o}F
- This Increases the Conversion Level
  - 20 - 28 Percent in Superacid to
  - 70 Percent or Higher in the 11-37-0 or 10-34-0
- The Majority of the Polyphosphates in the 11-37-0/10-34-0 Range from $H_4P_2O_7$ to $H_{10}P_8O_{25}$

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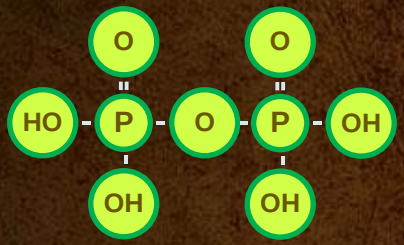
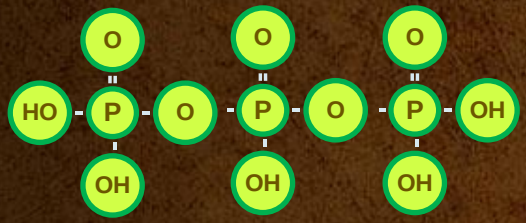
Polyphosphates found in 11-37-0/10-34-0



$H_4P_2O_7$



$H_5P_3O_{10}$

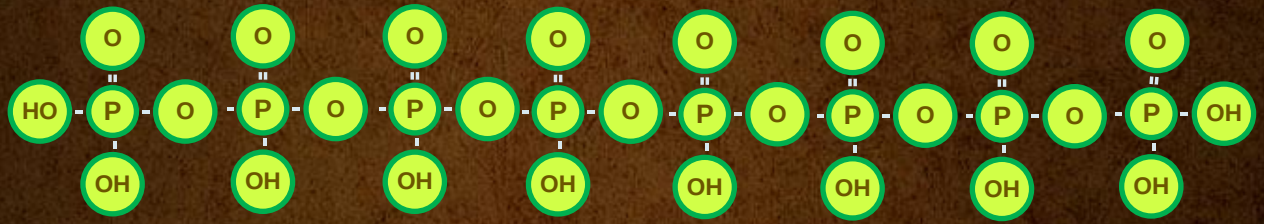
$H_9P_7O_{22}$

$H_6P_4O_{13}$

$H_7P_5O_{16}$

$H_8P_6O_{19}$

$H_{10}P_8O_{25}$



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Benefits of High Conversion

- Extended Shelf life

- Ability to Sequester
  - Metals (Zinc or Boron)
  - Potassium
  - Make NPK's

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What Impacts Quality of 11-37-0/10-34-0 ?

- Conversion Level
- Storage Tank Cleaning
- Agitation in Storage Tank

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What Impacts Conversion ?

- **Storage Temperature**

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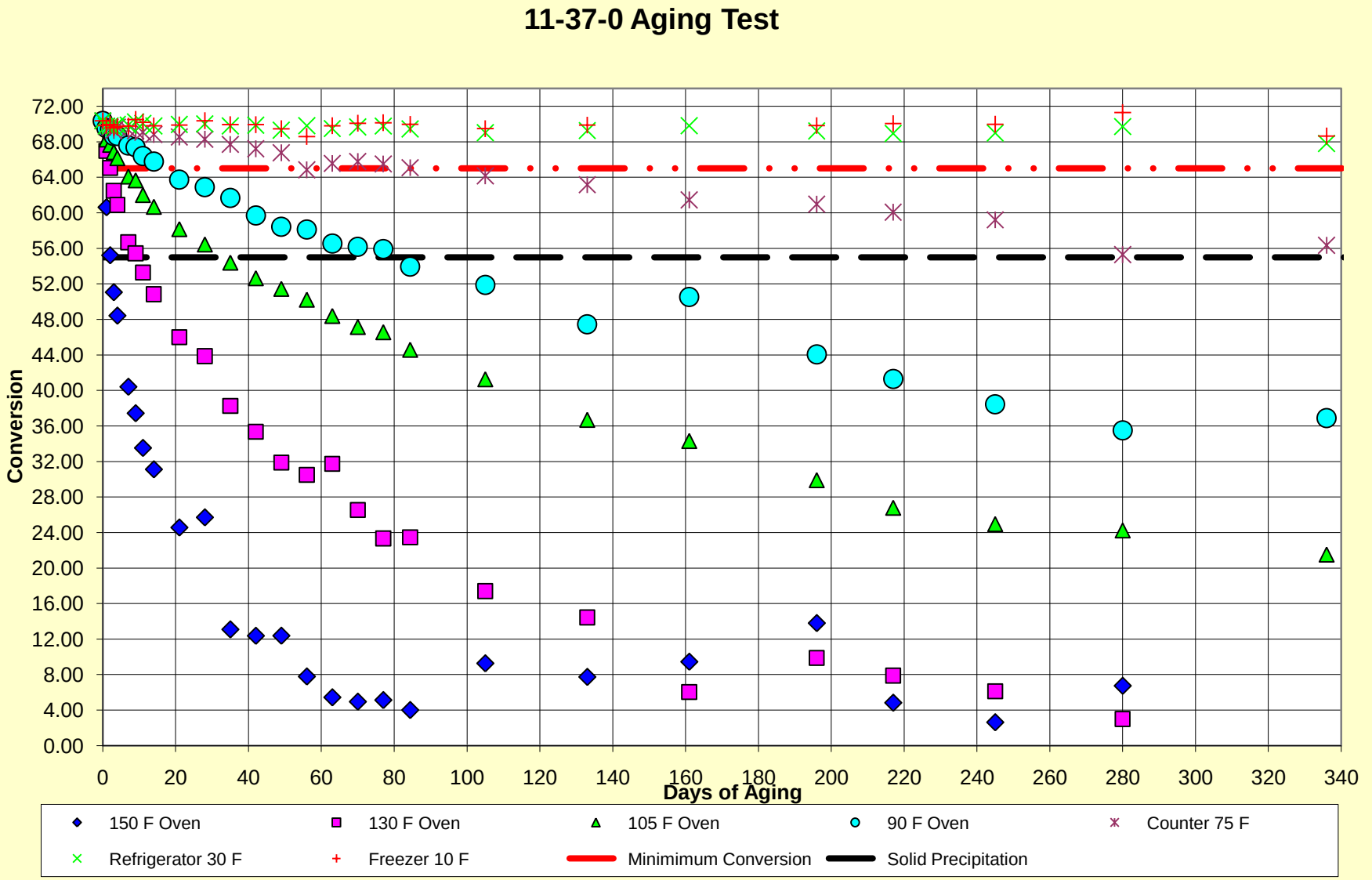
Impact of Temperature on Conversion Level



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Impact of Temperature on Conversion Level

11-37-0		
	Days of Aging to Drop Conversion Level to 65%	Days of Aging to Drop Conversion Level to 55%
Temperature		
150 F	Less Than 1 Day	2
130 F	2	9
105 F	7	35
90 F	14	77
75 F	84	Plus 336

Starting Conversion 70.4 percent

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Maximizing Shelf Life of 11-37-0

Date	Temp (F) Average	Case 1 11-37-0 Tons	11-37-0 Conversion (%)	Case 2 11-37-0 Tons	11-37-0 Conversion (%)
Aug 1	90	300	72.00	100	72.00
Sep 1	75		64.50		64.50
Oct 1	50		62.60		62.60
Nov 1	40		62.30	100	67.15
Dec 1	30		62.20		67.05
Jan 1	<30		62.20		67.05
Feb 1	40		62.20	100	68.70
Mar 1	50		62.10		68.60
Apr 1			61.80		68.30
Change in Conversion			**10.20**		**3.70**

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Conversion Level

- As the Conversion Drops
  - Reduces Ability of the 11-37-0/10-34-0 to Sequester
  - Solids Begin to Precipitate when the Conversion Drops Below 55 Percent
- TVA Identified Several Solids That Can Precipitate
  - $MgAl(NH_4)_5(P_2O_7)_2F_2*6H_2O$
  - $Mg(NH_4)_2P_2O_7*4H_2O$
  - $(NH_4)_2HPO_4$ - DAP
  - $NH_4H_2PO_4$ - MAP

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Tank Cleaning

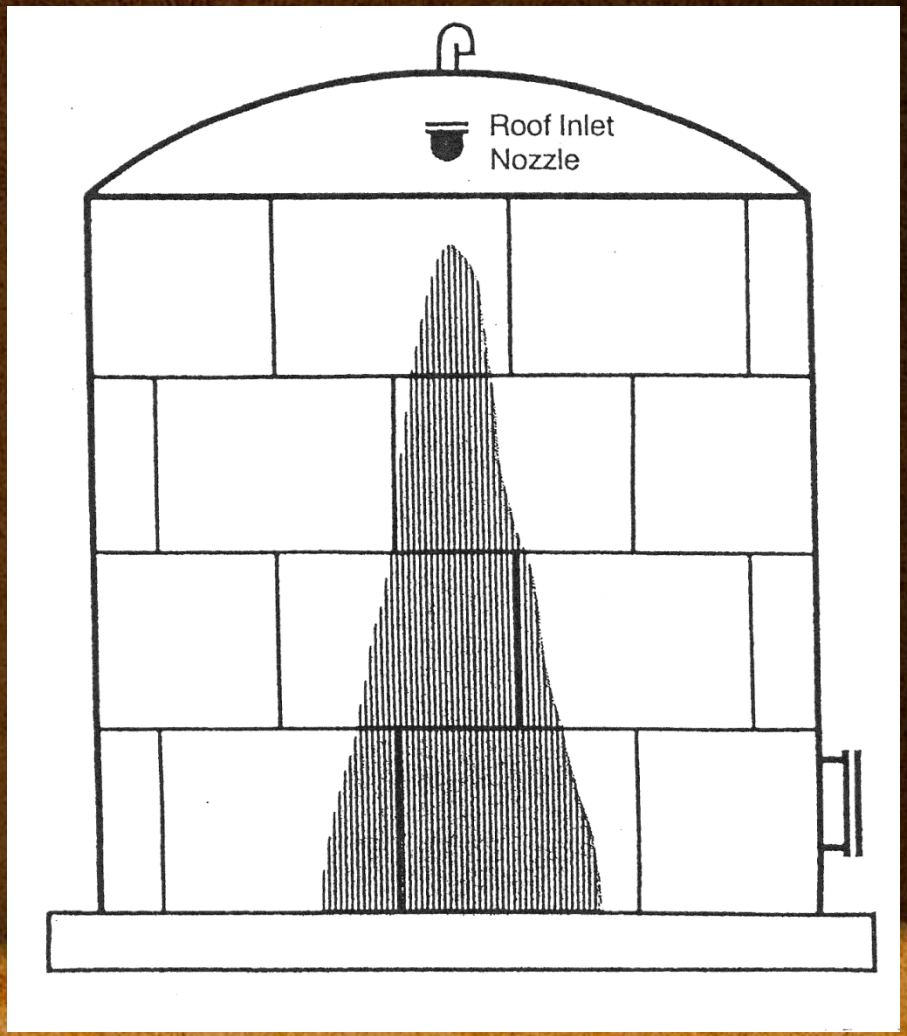
- Annual Cleaning Reduces Solids Precipitation
- Uses for Liquid Fertilizer Tank Solids/Sludge
  - Make Suspensions
  - Make Solid Fertilizers
  - Applied to a Field by Farmer Using Manure Spreader

Agitation

- **10-34-0 and 11-37-0 are often stored in mild steel tanks. The products react with iron in the steel to form an iron phosphate coating, which serves as a barrier to further corrosion.**
- **Tank design must take into consideration the need to preserve this phosphate coating. It is critically important to avoid product turbulence and high velocities.**
- **If the iron phosphate is repeatedly removed by turbulence, a solids layer can form in the storage tank**

Tank With Hydrogen Grooving

Area of shell susceptible to hydrogen grooving below a roof inlet nozzle.



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Aurora's Procedures to Maintain 11-37-0 Quality

- Annually Clean 11-37-0 Storage Tank
- Air Blow 11-37-0 Loading Lines
- Only Sell 11-37-0 with No Less Than a Conversion Level of 65 Percent
- Mild Steel Storage Tank is Lined with Devchem 253
- Minimize the Agitation and Recirculation

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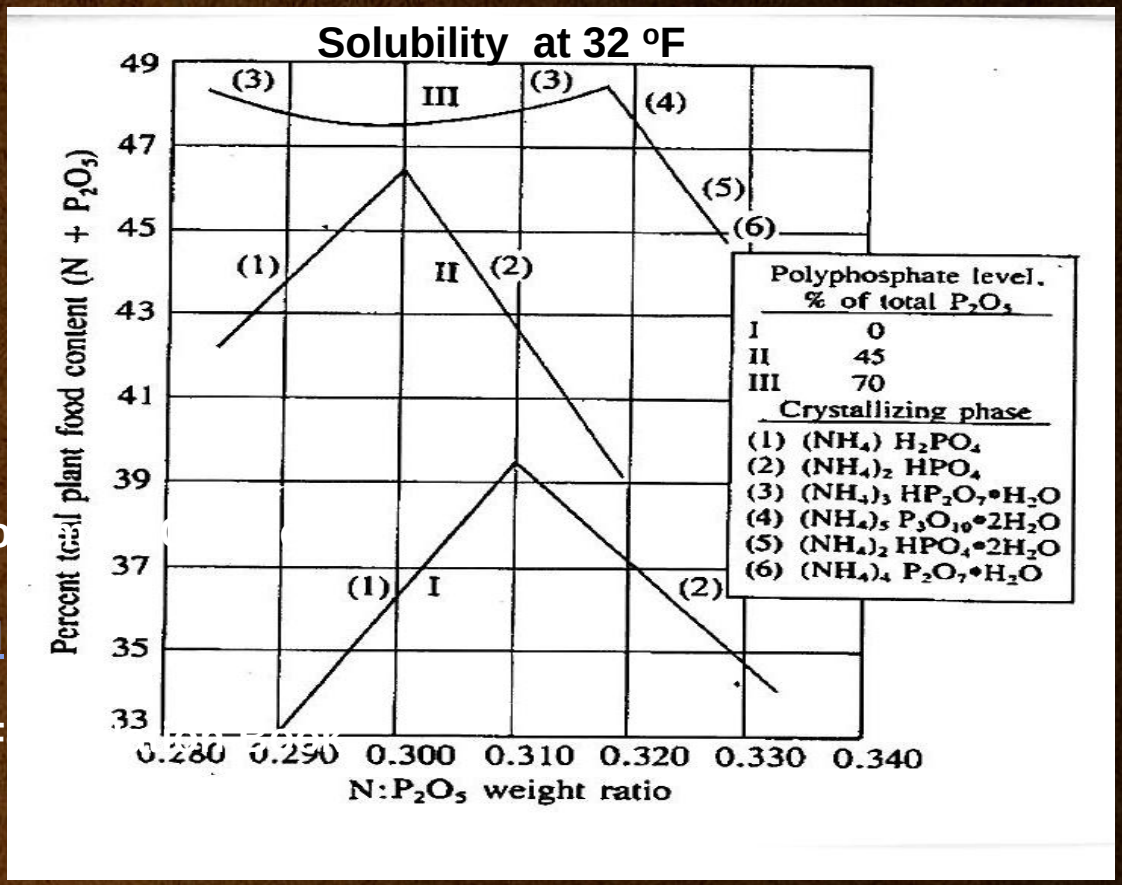
Salt-Out

- Ammonium Polyphosphates Do Have Limits
  - Conversion Level
  - Temperature
  - NPK Blend



References :

Fluid Fertilizer Manual 1994 Vo

WWW.FLUIDFERTILIZER.COM

PCS Sales – Liquid Fertilizer F

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Recommendations and Conclusions

- Annually Clean and Inspect the 11-37-0/10-34-0 Storage Tank
- Inspect Mild Steel 11-37-0/10-34-0 Storage Tank as Per API 653
- Maintain Minimum 11-37-0/10-34-0 Conversion Level of 60 Percent
- Shelf Life of 11-37-0/10-34-0 is Approximately 9 Months at 75 ^{o}F
- Minimize Agitation in Mild Steel Tanks by
  - Introducing the Liquid Away from Walls to Minimize Wall Erosion
  - Extending the Pump Suctions Into the Tank far Enough to Minimize Wall Erosion
  - Minimizing the Recirculation and Agitation
- Minimize Storage Temperature by
  - Operating Coolers to Minimize Temperature of 10-34-0 to Storage
  - Painting the Storage Tank White or Other Light Color

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Thank you.

Questions ?

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