A Day in the Life of a Deepwell

GWPC Annual Forum
September 2016
Stephen Duering
Agenda

• My background
• Who is Novus International?
• A Day in the Life of a Deepwell
  – History of WDW-326
  – Report of current repair
  – Lessons learned
• Questions
My background

- BS Chem Eng, University of Texas, Austin, 1996
- 20 years of manufacturing experience
  - 12 years in plastic industry
  - 8 years animal nutrition

- Senior Process Engineer for Novus at Alimet plant
  - Responsible for environmental compliance
    - Includes responsibility for 2 hazardous Class I deepwells
      - Novus owned wells
      - Ascend Performance Materials is the well operator
The Novus Story

- Animal Nutrition Ingredients Company
- Born in 1991 out of the scientific heritage of Monsanto
- Owned by Mitsui and Co, (USA) Inc. and Nippon Soda Co, Ltd.
- Headquarters in St. Charles, Missouri
- Around 800 employees
About Novus

- Conducting business in over 100 countries
- Serving more than 2,500 customers globally
The U.N. projects world population will reach 9+ billion by 2050 and has called for a 100 percent increase in world food production. According to the U.N., this doubled food requirement must come from virtually the same land area as today.
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Alimet process description

- Alimet is the trade name for 4-methylthio, 2-hydroxy butanoic acid (MHBA)

- Alimet is the hydroxy analogue of the essential amino acid methionine and is an 88% active source of methionine for a wide range of animal species.

- Principal raw materials are 3 methylthio propanal (MMP) and hydrogen cyanide (HCN).
**Aldehyde**

\[ \text{H}_2\text{C}=\text{CHCHO} + \text{CH}_3\text{SH} \rightarrow \text{CH}_3\text{SCH}_2\text{CH}_2\text{CHO} \]

MMP

**Nitrile**

\[ \text{CH}_3\text{SCH}_2\text{CH}_2\text{CHO} + \text{HCN} \rightarrow \text{CH}_3\text{SCH}_2\text{CH}_2\text{CHCN} \]

Nitrile

\[ \text{CH}_3\text{SCH}_2\text{CH}_2\text{CHCN} + 2 \text{H}_2\text{O} + \text{H}_2\text{SO}_4 \rightarrow \text{CH}_3\text{SCH}_2\text{CH}_2\text{CHCOOH} + \text{NH}_4\text{HSO}_4 \]

Hydrolysis

Alimet®

D,L-HMTBa

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Novus at Chocolate Bayou
Alimet® plant
Have a deepwell, what now?

- **Not much corporate knowledge**
  - Most engineers never learn about wells during education
  - Small niche of geologists and engineers
  - Few understudies or apprentices

- **Deepwell is just a pipe**
  - Few problems to learn from
  - Long lasting permits and petitions.
    - Longer than typical engineer employment at one site
Novus Deepwells

- **Unique deepwell features**
  - No high pressure injection needed
    - Heavy material
      - 1.30 sg
    - Full vacuum
    - Corrosive, near zero pH; Hastelloy G3 waste stringer

- **Second deepwell added for redundancy**
  - WDW-224, 1983 startup
  - WDW-326, 1996 startup
  - Similar MOC, both 270 gpm permitted capacity
  - Both deepwells over a mile deep in Oakville formation
• **Different completion technology**
  – Did not utilize slotted liner as used in WDW-224
  – Formation sand backing up into well and plugging perforations
    • Cleaned in 2003
      – Cleaning out formation sand is hazardous
    • Formation sand plugged perforations again by 2007
    • Well performed normally with many perforations plugged
WDW-326 failure

- October 19, 2015 WDW-326 failed
  - Lost annulus pressure
  - Well was not disposing waste during failure
  - Promptly blocked in the well

- Explore failure
  - Run temperature logs
  - Determined to be packer failure
WDW-326 Workover

• Begin planning workover
  – Need new packer
  – Need to clean out formation sand from well
  – Determine to modify well completion like WDW-324
    • Add slotted liner and gravel pack
    • Modification will require Minor Modification to permit
Workover problems

• **Difficulty removing packer**
  – Heavy corrosion of packer creates retrieval problems
  – Spent much time attempting to fish the packer out of the hole

• **Then the all important, Why?**
  – Packer was made of Hastelloy G3, just like injection tubing
  – However wetted parts are carbon steel
  – Most likely the elastomer seals failed
Workover problems cont

- Formation sand continues to backfill casing
  - Decide to abandon sand 8 and complete well in sand 7
- Permit and petition allow for Sand 7 completion
- Requires changes to Minor Modification
- Determined to isolate sand 8 and 7 with cement
- Must perforate casing for sand 7
Perforate Sand 7

- Requirements for Perforations
  - Explosives brought on site
  - Required in initial well completion
  - No staff on site remain from original well completion
    - Difficult to approve MOC to receive explosives
Workover problems cont

- Gravel pack problems
  - Stuffing box and clutch of wash pipe break apart from work string
  - Forced to fish out gravel pack wash pipe
    - Currently attempting to remove wash pipe
    - Workover complete after wash pipe is removed
  - Complete MIT tests with TCEQ witness
  - Return WDW-326 to waste disposal operation
Summary / Questions