Quality Grain Management and Safety
Objective of Storage:

Primary:
To maintain QUALITY of stored products \textit{after} harvest and \textit{before} end use!

\textit{Safety}
DANGER
DO NOT ENTER
How does “IT” happen?

Three ways “IT” can happen; all are associated with unloading:

• Flowing Grain
• Collapse of a Grain Bridge
• Avalanche of a Vertical Grain Wall

Grain Bin or Gravity Wagon…
Flowing Grain

2 – 3 seconds for engulfment
Collapse of grain bridge

Out of Condition Grain

Victim may travel 4 – 5 ’
Avalanche of grain wall

Vibration!!!
And one more…
Air Quality

<table>
<thead>
<tr>
<th>Gases</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>19.5% min., 23.6% enriched, 6% death in minutes</td>
</tr>
<tr>
<td>Carbon Monoxide, Carbon Dioxide</td>
<td>&lt;25 ppm, &lt;30,000 ppm for 15 minutes (STEL)</td>
</tr>
<tr>
<td>Phosphine</td>
<td>&lt;0.3 ppm</td>
</tr>
<tr>
<td>Other gases to monitor</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>15 ppm STEL, Death in seconds at 200 ppm, heavier than air</td>
</tr>
<tr>
<td>Methane</td>
<td>5000ppm = no entry, lighter than air</td>
</tr>
<tr>
<td>Acetylene, Propane, Gasoline, Diesel</td>
<td></td>
</tr>
<tr>
<td>Welding fumes</td>
<td></td>
</tr>
<tr>
<td>Chemical vapors</td>
<td></td>
</tr>
</tbody>
</table>
And one more...

Air Quality

Multi Gas Monitors  Personal Protection
Dilemma of Storage:

Quality \textit{NEVER} improves during storage!
Causes of Grain Spoilage

Solar vs. shaded effect
  • moisture migration, condensation, wall caking

Day vs. night time effect
  • headspace condensation, surface crusting

Self-heating of stored product
  • biological vs. chemical heating

Moisture infiltration
  • bolt holes, cracks, spouts, bin sheets, vents
Where to look for answers?

✓ Are your roof vents adequate?
✓ Do you have aeration or enough aeration?
✓ Do you need to monitor differently to detect problems earlier?
How Clean is Your Equipment?

- Handling equipment
- Transportation vehicles
- Storage structures
  - inside and outside
- Pest prevention
  - Sanitation Controls Pests!
Pest Prevention

External Spray

Internal Spray

Empty Bin Treatment
Over-Filling

- Poor head space ventilation
- Spoiled grain on silo wall
- Impossible to monitor grain surface
Core of fines
- Foreign Material (FM)
- Broken grain
- Weed seeds
Coring

One time coring

- Eliminate grain peak
- Remove core of fines
- Improve airflow through center
- Better monitor grain surface

1/3-1/2 bin dia.
Monitoring

- Grain quality going into the bin
- Temperature
- Moisture
- Molds
- Insects
  - present or absent
  - population growth
  - pest control (fumigation)
- Rodents
Why monitor?

You can’t manage what you don’t know is there!

• Detection of grain spoilage problems
• Detection of pests
• Determination of population dynamics
• Evaluation of pesticide applications
When things go wrong…

Bridging…Avalanches…Auger Engaged….Air Quality

• Key to safety is keeping grain in good condition in the first place
• No reason to enter bin
• Saves dollars….  
• Saves equipment and fumigant….  
• Saves LIVES
Cofferdams …

Purpose: Allow grain to be removed from around an entrapped victim

• Do you have one close by?
• Do you know how to use it?
• What if you don’t have one?
The “rules” ...

Purpose: To keep workers safe!

- Bin Entry Permits
- Bin Entry Kits
- Training
- Not working alone
- Communication
- LOTO
- Is there a better way?
Grain Conditioning = Safety

Proper Storage and Handling of product + Training + Proper Equipment =

✔ $$$$

✔ safer work environment

Saving LIVES
Questions

Email: jcarol@okstate.edu