

NYEMASTER

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PREVENTING CATASTROPHIC EVENTS AT YOUR GRAIN FACILITY

“WHO’S MINDING THE **Ma κ I, Aljets** STORE?”

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Explosion Statistics

| Years | Explosions | Injuries | Deaths |
|-----------|------------|----------|--------|
| 1976-1989 | 281 | 480 | 155 |
| 1990-1999 | 130 | 119 | 15 |
| 2000-2010 | 89 | 77 | 7 |
| 2011 | 3 | 1 | 7 |
| 2012 | 7 | 6 | 0 |

United States Department of Labor, www.OSHA.gov: “Grain Elevator Explosion Chart” and www.fireworld.com

In 2012, 6 of the 7 explosions occurred in the Midwest states.



Catastrophic Events:

No Company is Immune

No Matter How Large or Small

Two Areas of Focus

I. Protecting Grain Companies and Grain Cooperatives

Prevent the Catastrophic Event

- Proper Housekeeping at the Facility
- Preventive Maintenance of Equipment
- Proper Training of Employees



Who Brings the Lawsuit?

- 1. Injured Employee of Grain Co./Coop.**
- 2. Independent Worker on site**
- 3. Insurance Company Which Insures
The Grain Company/Cooperative**

Insurance Coverage

Grain Companies – Cooperatives

- **Replacement Cost Policy – not ACV**
- **Loss of Business Income**
- **Insurance Coverage for Co-Employees**
- **Liability Coverage**

Elements Of A Dust Explosion

A dust explosion can occur if the following five elements are met:

- **Grain dust must be present**
- **Oxygen must be present in a concentration to sustain rapid combustion**
- **The grain dust must be well mixed with the oxygen at a concentration above the lower explosive limit**
- **An ignition source must be present**
- **Ignition must occur in a confined space**

The Goal For Prevention:


- **To remove the ignition source through proper maintenance of equipment.**
- **To remove the “fuel” i.e. the grain dust, through proper housekeeping measures.**

OSHA Housekeeping Requirements

“The Grain Handling Standard”

CFR 1910.272: “The employer shall develop and implement a **written housekeeping program** that establishes the **frequency** and **methods** determined best to reduce accumulations of fugitive grain dust on ledges, floors, equipment and other exposed surfaces.”

- **Essential that the program is in place and followed.**
- **Maintain a log sheet to ensure completion.**



**“If it’s not documented,
assume it’s not getting
done.”**

OSHA Housekeeping Requirements

CFR 1910.272: “The employer shall immediately remove any fugitive grain dust accumulations whenever the accumulations **exceed 1/8 inch (.32 cm) at priority housekeeping areas pursuant to the housekeeping program. . .”**

- **Priority Housekeeping Areas Shall Include **at least** the following:**
 - **Floor Area Within 35 Feet of Inside Bucket Elevators**
 - **Floors of Enclosed Areas Containing Grinding Equipment**
 - **Floors of Enclosed Areas Containing Grain Dryers Located Inside Facility**

My Experience with Explosions Attributed to Housekeeping Issues

- **Lack Of Safety Culture and General Lack Of Accountability By Management**
- **No Written Housekeeping Program in Place**
- **Log Sheets Are Not Maintained**
- **Housekeeping Performed–“when there’s time”**
- **Out Of Sight, Out Of Mind**



**The Housekeeping Program is not
Difficult to Develop –**

The Difficulty is in **Consistently
Enforcing It.**

My Personal Observations

- **Boot Pits Full of Dust - Particularly in Older Facilities**
- **Blowdown Of Dust Into Boot Pit Areas/ Not Promptly Removed**
- **Dust Leaking From Equipment/Ducting**
- **Conveying Equipment with Layers of Dust on Top – **Recipe for Disaster****
- **Gallery – Out Of Sight – No Attention**





What's Wrong with this Picture?



Iowa Fire Marshal's Report of Incident

- **“When I interviewed employees of the elevator, they indicated that there was so much dust that the boot pits looked as though the dust was flowing like water.”**
- **“Two contractors I interviewed who did work at the facility over the years, indicated they recently refused to service the equipment because, in their words, that place was an accident just waiting to happen.”**











Obtain an Accurate Housekeeping Assessment of Your Facility - Inspections Done by:

- **Insurance Company Representatives**
- **Paid Safety Consultants**
- **Objective Internal Employee Audits**

**Consider unannounced inspections.
OSHA doesn't tell you they're coming!**

Company Follow-up On Inspection Recommendations

Does anyone pay any attention to these?

- **Was the assessment accurate?**
- **Was management made aware of the assessment?**
- **Whose job is it to ensure the recommendations are carried out?**
- **Are safety deficiencies being handled promptly?**



Substantial Damage Can Be Caused by Secondary Explosions





Made in
U.S.A.

DA







**“A little dust can’t cause
much damage”**





**“We do a pretty good job of
keeping the place clean.”**

=

**“Being the healthiest horse
in the glue factory.”**

Preventive Maintenance and Inspection of Equipment

OSHA – CFR 1910.272:

The employer shall implement **written** preventive maintenance procedures consisting of:

(i) regularly scheduled inspections of at least the mechanical and safety control equipment associated with:

- Grain stream processing equipment
- Bucket Elevators
- Grain Dryers
- Dust Collection Equipment
- Safety/Monitoring Equipment

Preventive Maintenance and Inspection of Equipment

The employer shall implement **written** preventive maintenance procedures consisting of:

(ii) Lubrication and other appropriate maintenance in accordance with **manufacturer's recommendations**, or as determined necessary by **prior operating records**.

This is worth repeating...

The employer shall implement **written** preventive maintenance procedures consisting of:

(ii) Lubrication and other appropriate maintenance in accordance with **manufacturer's recommendations**, or as determined necessary by **prior operating records**.

Who from the grain company has **evaluated** the prior operations records?

Preventive Maintenance and Inspection of Equipment

Records Must be Maintained By The Facility:

“A preventive maintenance schedule must be put in place and complied with by personnel, containing the date of the inspection, the name of the person who performed the inspection and the equipment specified.”

My Personal Observations on Maintenance Programs

- **No Written Preventive Maintenance Program In Place**
- **If The Program Is In Place – Not Followed Consistently**
- **Equipment Manuals – Either Not Kept or Not Utilized**
- **Manufacturer's Specifications/Recommendations **Simply Ignored****

My Personal Observations – Poorly Maintained Equipment

- **Bearings Are Not Consistently Lubricated**
- **Bearings Not Timely Replaced**
- **Rub Sensors Basically Worn Away**
- **Grooves Worn Into Head Pulley Covers**

- **Sensor Wires Cut Or Rusted Away At The Bearings**
- **Hazard Monitoring Equipment Simply Shut Off – False Alarms**
- **Conveying Belts Spliced Multiple Times and Beyond Safe Running Capability**



Red Green Method of Preventive Maintenance



Courtesy of PMI, Inc.



Focal Point of Lawsuits




This Doesn't Happen Overnight









“It’s difficult to maintain the bearing”



WARNING

BAASCH & SONS, INC.
FARM & RANCH LINE

WARNING

BAASCH & SONS, INC.
FARM & RANCH LINE



Housekeeping/Maintenance Schedules

- **Create Your Own**
 - ▶ **Who Knows Your Facility Better Than You?**
- **Obtain From Your Insurance Company**
- **Obtain From Outside Consultant**



Examples of Maintenance Schedules

Grain Elevator SAFETY CHECKLIST

The best protection against elevator fires and explosions is a regular program of maintenance, inspection and housekeeping.

LEGS

- Leg belt in good condition
- Leg belt properly aligned
- Drive belts in good condition
- Cups in good repair
- Cup bolts secure
- Lagging in good condition
- Leg housing dust tight
- Explosion vent operable
- Head, boot, idler bearings lubricated
- Drive oil level OK
- Motion detection system operable
- Connecting spouts dust tight
- Dust control systems operable

MOTORS AND BEARINGS

- Bearings clean
- Bearings lubricated
- Gear box oil levels OK
- Motors clean
- Motors properly secured
- Drive belts/shafts aligned
- Guards in place
- Hot motor/bearing sensor systems OK
- Motors electrically bonded

HOUSEKEEPING

- Head-drive level clean
- Distributor level clean
- Bin-top level clean
- Scale, cleaner areas clean
- Boot area clean
- Workfloor level clean
- Tunnel area clean
- Stairs and passageways clean
- Walls, spouting, ledges clean
- Manlift/freight elevators clean
- Tools, shovels, ladders, power cords in place
- Dust control systems clean

EXTERIOR

- Area near building free of combustibles
- Trash area safe distance away
- Outside access ladder in good condition
- Lightning protection satisfactory
- Building foundation closed
- Access roads/driveways clear

ELECTRICAL

- Dust tight globes in place
- Drop cords of approved type
- Drop cords approved for Class II dusty locations
- Surge capacitor fused/grounded
- Motors free of dust buildup
- Main disconnect switch off each night
- Self closing door on electric room

FIRE PROTECTION

- Alarm system operable
- Alarm thermostat circuit tested
- Fire extinguishers in working condition
- Fire extinguishers in place
- Adequate number of fire extinguishers
- Fire extinguishers properly marked
- Employees trained in use of fire extinguishers
- Sprinkler system operable
- Local fire department orientation

EMPLOYEE TRAINING IN:

- Bearing maintenance schedule
- Emergency action plan
- Leg choke procedures
- Welding and cutting procedures
- Personal protective equipment
- Railroad procedures
- Confined space entry

SIGNS POSTED

- No smoking
- Manlift capacity
- For use of employees only (controls)
- Hoist operation rules
- Leg choke procedures
- Magnet
- Welding and cutting procedures

Inspected by _____

Date _____

Sample Monthly Equipment Inspection and Lubrication Schedule

Month _____


| Plant Area | Equipment | Date | Completed By |
|-------------------|--------------------------|------|--------------|
| Basement | Receiving Conveyor | | |
| | Receiving Leg | | |
| | Hammermill Feeder | | |
| | Hammermill | | |
| | Rollermill | | |
| | Grinding Conveyor | | |
| | Grinding Leg | | |
| | Mixer | | |
| | Surge Conveyor | | |
| | Mixing Leg | | |
| | Pellet Cooler | | |
| | Crumble Rolls | | |
| | Pellet Conveyor | | |
| | Pellet Chip Grinder | | |
| | Pellet Leg | | |
| | Molasses Pump | | |
| | Fat Pump | | |
| | Condensate Pump | | |
| Work Floor | Ingredient Feeder Screws | | |
| | Premix Dump Hopper | | |
| | Pellet Mill Feeder | | |
| | Pellet Mill Conditioner | | |
| | Pellet Mill | | |
| | Bagging Conveyor | | |
| | Bagging Scale | | |



Special Emphasis:

Hazard Monitoring and Alarms

**“Those false alarms sure
are irritating!”**



**OSHA 29 CFR 1910.272: Inside Bucket Elevator
Legs – The Employer shall:**

**(i) Mount Bearings Externally to the Leg
Casings, or**

**(ii) Provide Vibration Monitoring, Temperature
Monitoring Or Other Means To Monitor The
Condition Of Bearings Mounted Inside Or
Partially Inside The Leg Casing.**

NFPA 61 – Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities

- **Bearing Monitoring systems are Recommended for Head, Tail and (Knee) Pulley Bearings on Elevator Legs**

A large, complex industrial bearing assembly is shown on a wooden pallet in a workshop. The assembly consists of a large, dark grey metal housing with various bolts and a central shaft. A large, orange-painted metal component is attached to the right side. The background shows a concrete floor and the legs of people in blue jeans. The text "Visualize The Bearing Without The Sensor" is overlaid in yellow on the left side of the image.

**Visualize The Bearing
Without The Sensor**

This is the Drive-Side



Employee Training

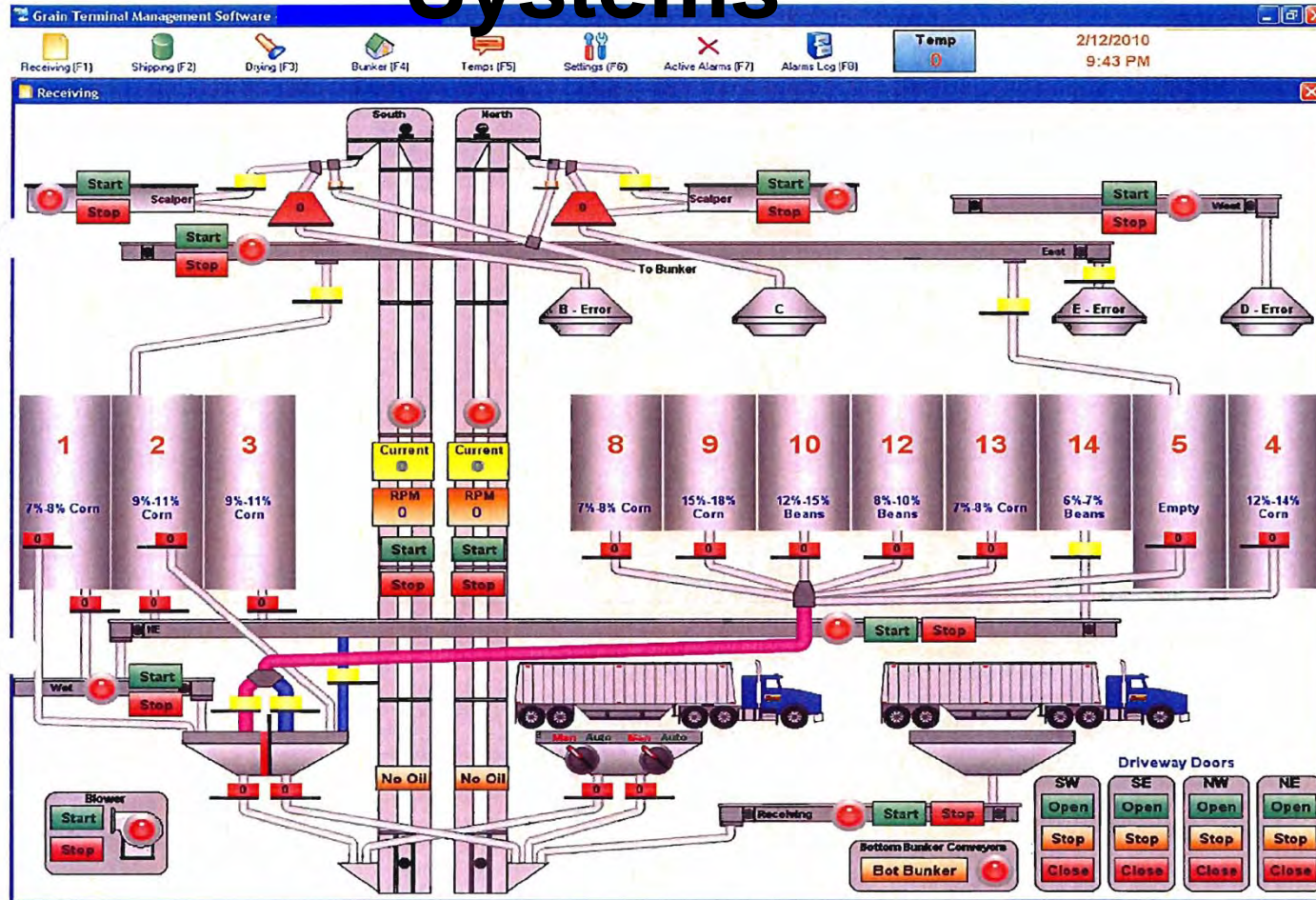
Required by OSHA and NFPA 61 (Appendix D – Employee Health and Safety)

“The employer shall provide training to employees at least **annually** and when **changes in job assignment** will expose employees to new hazards.”

Critical: “. . . employees prior to starting work, shall be trained in at least the following . . .”

- Safety Precautions Associated With Facility
- Recognition And Preventive Measures For Hazards Related To Dust Accumulations
- Common Ignition Sources
- Specific Procedures And Safety Practices Applicable To Their Job Tasks For . . . Housekeeping Procedures, Hot Work Procedures, Preventive Maintenance Procedures

PLC Systems



- 
- **Housekeeping**
 - **Preventive Maintenance**
 - **Employee Training**

**Play by the Rules or
The Penalties Can Be Stiff!**

What are the Potential Ramifications?

- **Loss of Life**
- **Personal injuries**
- **Extensive property damage**
- **Loss of business income**
- **Fines and penalties**
- **Litigation – For Years**



This is Not A Good Day







Management Representatives

- **Ensure Written Policies In Place For Housekeeping Procedures and Preventive Maintenance of Equipment**
- **Demand Compliance With The Policies by Regularly Reviewing Housekeeping and Maintenance Log Sheets**

Management Representatives

- **Develop and Implement an Employee Training Program for at Least the Following:**
 - ▶ **Recognition and Preventive Measures for Hazards Related to Dust Accumulations**
 - ▶ **Common Ignition Sources**
 - ▶ **Specific Procedures and Safety Practices Applicable to Their Job Tasks for . . .
Housekeeping Procedures, Hot Work Procedures, Preventive Maintenance Procedures**



CONCLUSION

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