

Summary of Grain Storage, Handling and Transport Entrapments and Suffocations Documented in the U.S. 1964 - 2010

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Photos from Brock® Grain Systems

Overview

- Introduction & Background
- Current Issues
- Problem Statement
- Research Methods & Limitations
- Findings
- Conclusions & Recommendations
- Next Steps



Introduction & Background

- Why the current interest in grain storage, handling and transport incidents?
 - Historically, these incidents account for the largest number of cases related to agricultural confined spaces
 - Record number of U.S. cases in 2010
 - North Central Education / Extension Research Activity Committee 197 Agenda Priority
 - Targeted enforcement by OSHA
 - High profile events involving multiple victims

Current Issues Related to Grain Storage, Handling and Transport

- Lack of clarity
 - Confined spaces in agriculture terminology
 - i.e. what constitutes a confined space?
 - Current interpretation of the OSHA regulations
 - CFR Chapter 29, Part 1910.146: Permit-Required Confined Space
 - CFR Chapter 29, Part 1910.272: Grain Handling Facilities
 - CFR Chapter 29, Part 1928: Occupational Safety and Health Standards for Agriculture
 - Uncertainty concerning exempt vs. non-exempt facilities and workplaces
 - General agricultural safety and health literature contributes to confusion
- Lack of a comprehensive reporting system for incidents
- Rapid growth in the amount of grain storage being built

Problem Statement

- Confined-space hazards in production agriculture are significant causes of work-related injuries and fatalities
 - ~10% of all farm-related incidents
 - Record number of grain-related entrapments in 2010
- The lack of reliable data and clearly defined terminology has made developing an effective evidenced-based solution difficult
- The frequency of these events appears to be increasing



Research Methods & Limitations

- Sources of data collection included:
 - Online search engines
 - Newspaper clipping services
 - Death certificates
 - Police reports
 - Litigation documents
 - Cross-referenced w/ other land-grant universities & agencies
- Limitations
 - Not comprehensive - there are recognized gaps
 - No requirements to report incidents, especially if non-fatal
 - Inaccurate/incomplete reporting of incidents



Definitions

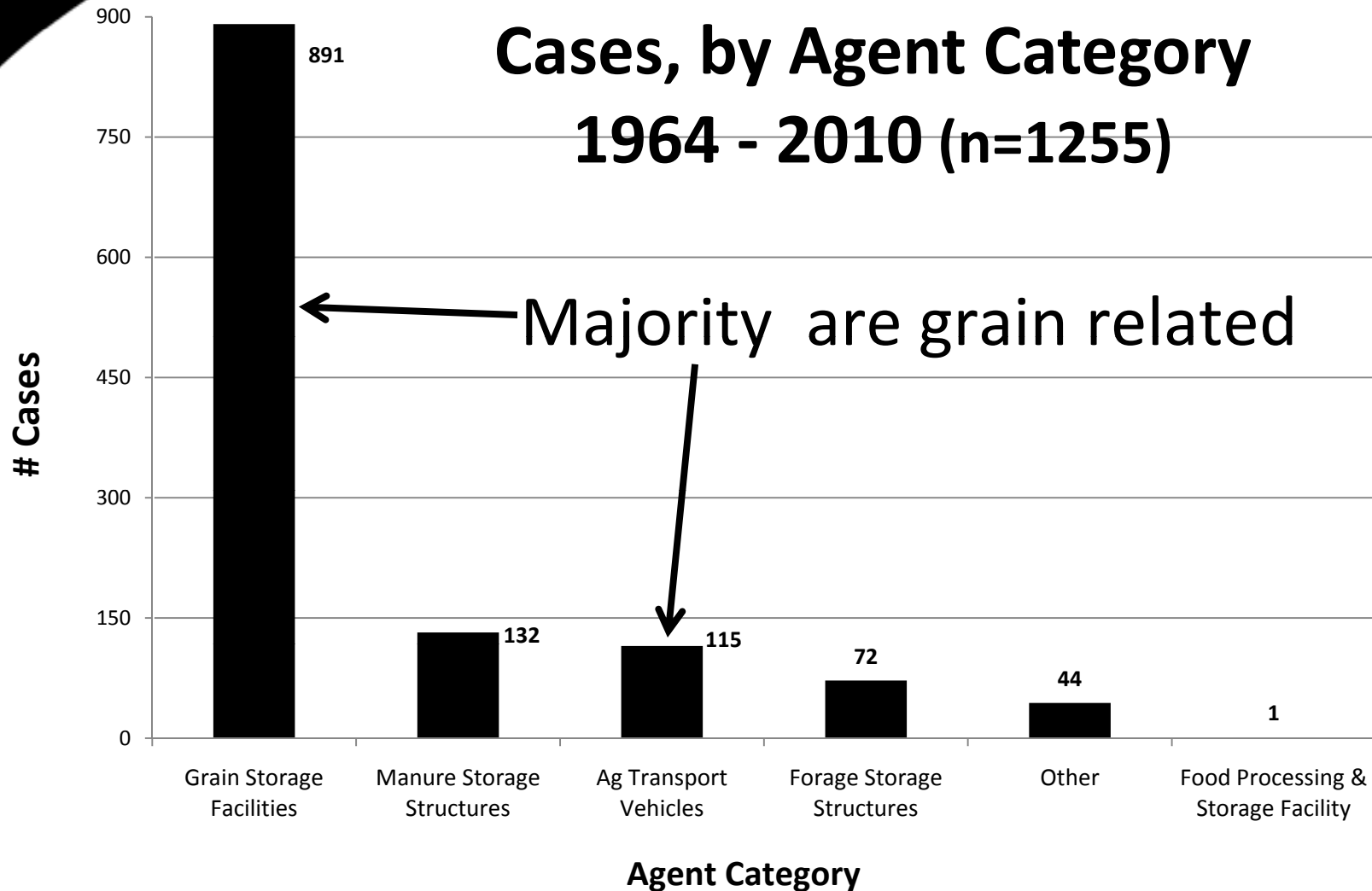
- **Engulfment** – event in which an individual is submerged, i.e. fully buried, in flowable agricultural material such as corn, small grain, or feed
- **Entrapment** – used in a broader way to describe event in which an individual is trapped, possibly due to engulfment, inside a structure considered a confined space such as a bin, silo, or grain transport vehicle where self-extrication is not possible
- **Flowing Agricultural Material (FAM)**: free-flowing agricultural crops or material (including grain)
- **OSHA Exempt facility** – used to describe an agricultural facility that employs less than 11 employees or does not operate a work camp that is not required to follow the OSHA Permit-Required Confined Space Standard. It is customarily used to describe a family owned or operated farm

Findings

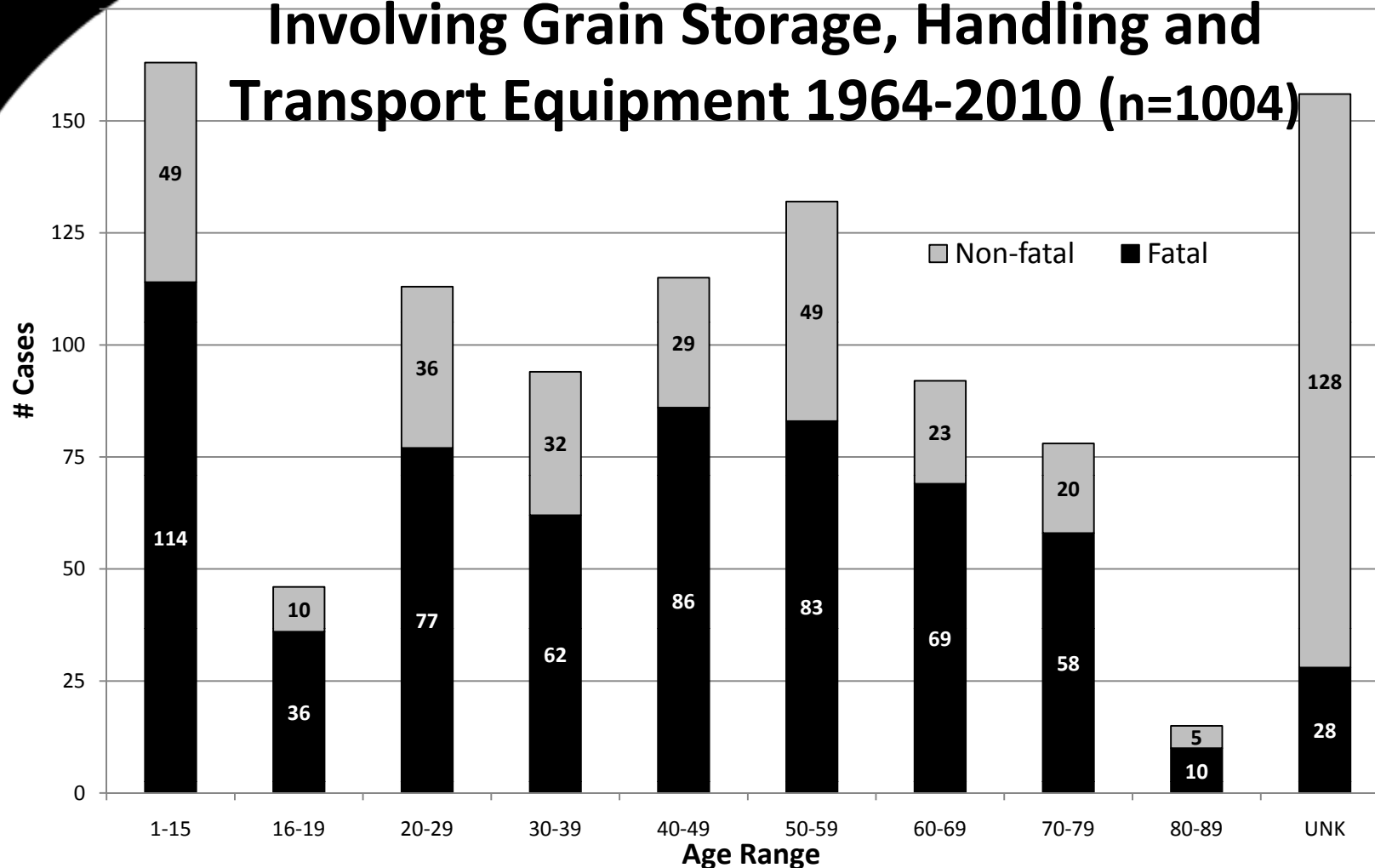
- Frequency
- Severity
- Facilities Involved
 - Grain Storage Facilities
 - Agricultural Transport Vehicles
- Contributing Factors



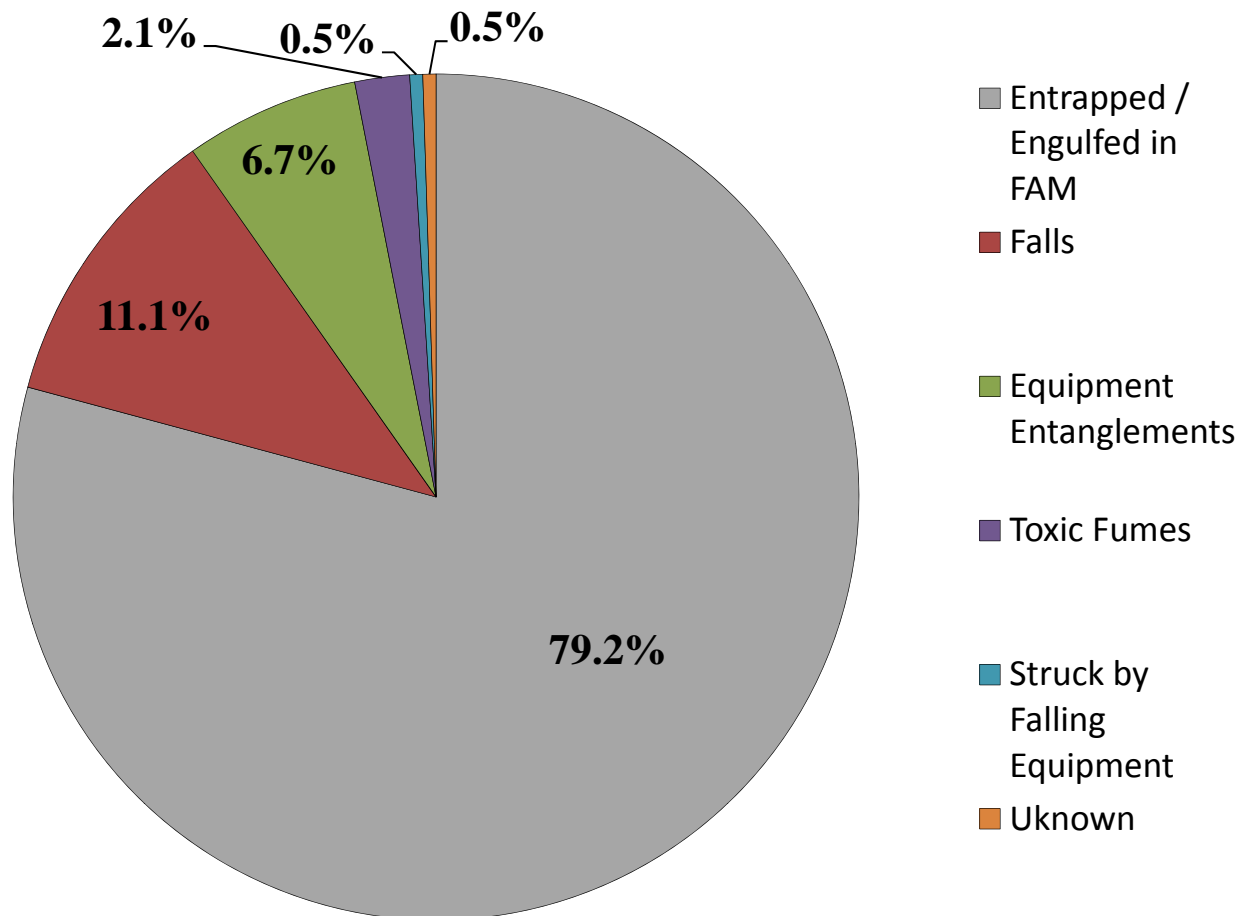
Total Agricultural Confined Space Cases, by Agent Category 1964 - 2010 (n=1255)



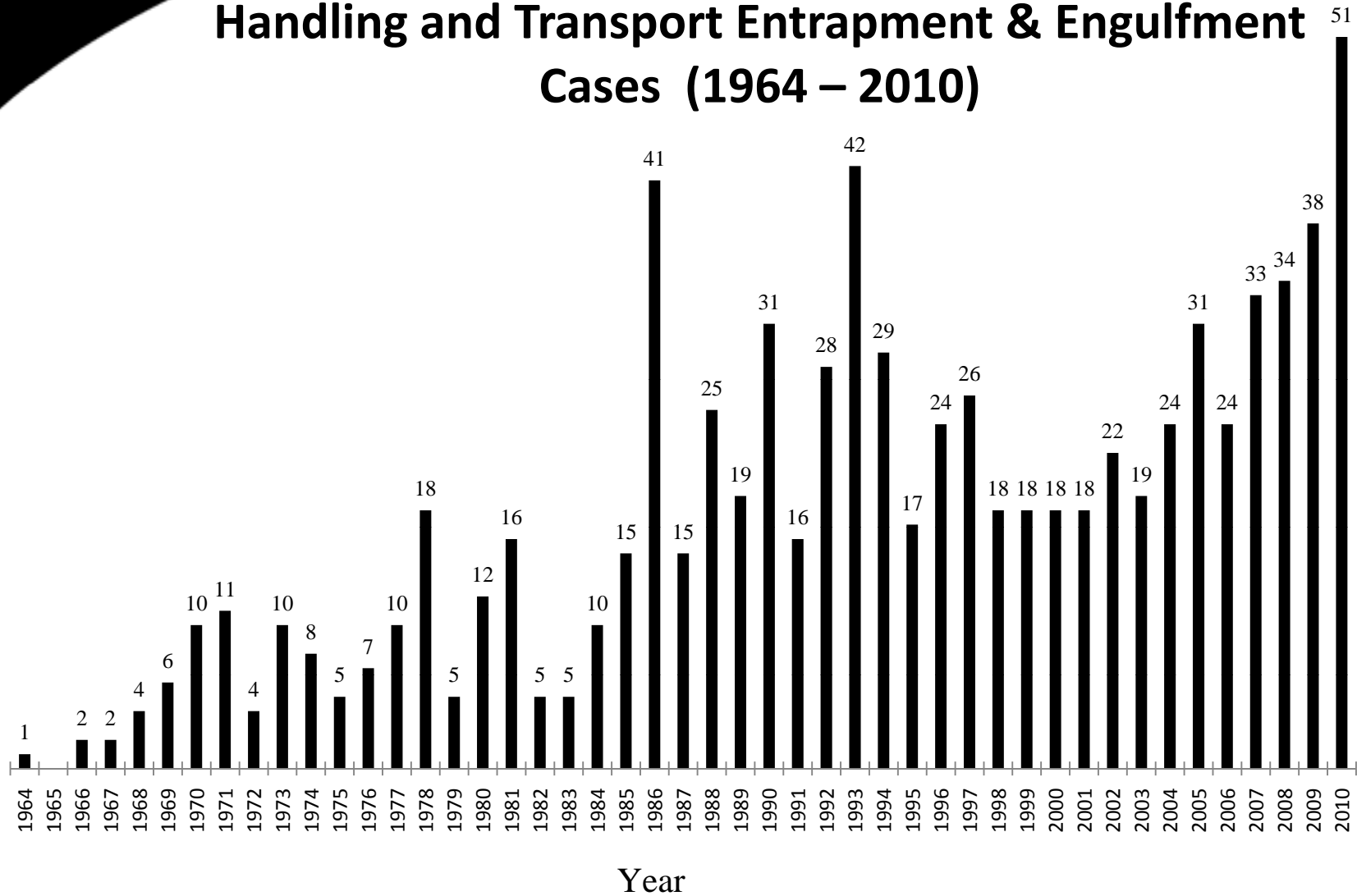
Fatal vs. Non-fatal Cases per Age Range Involving Grain Storage, Handling and Transport Equipment 1964-2010 (n=1004)



Grain Storage, Handling and Transport Cases by Type of Incident: 1964-2010 n=1004

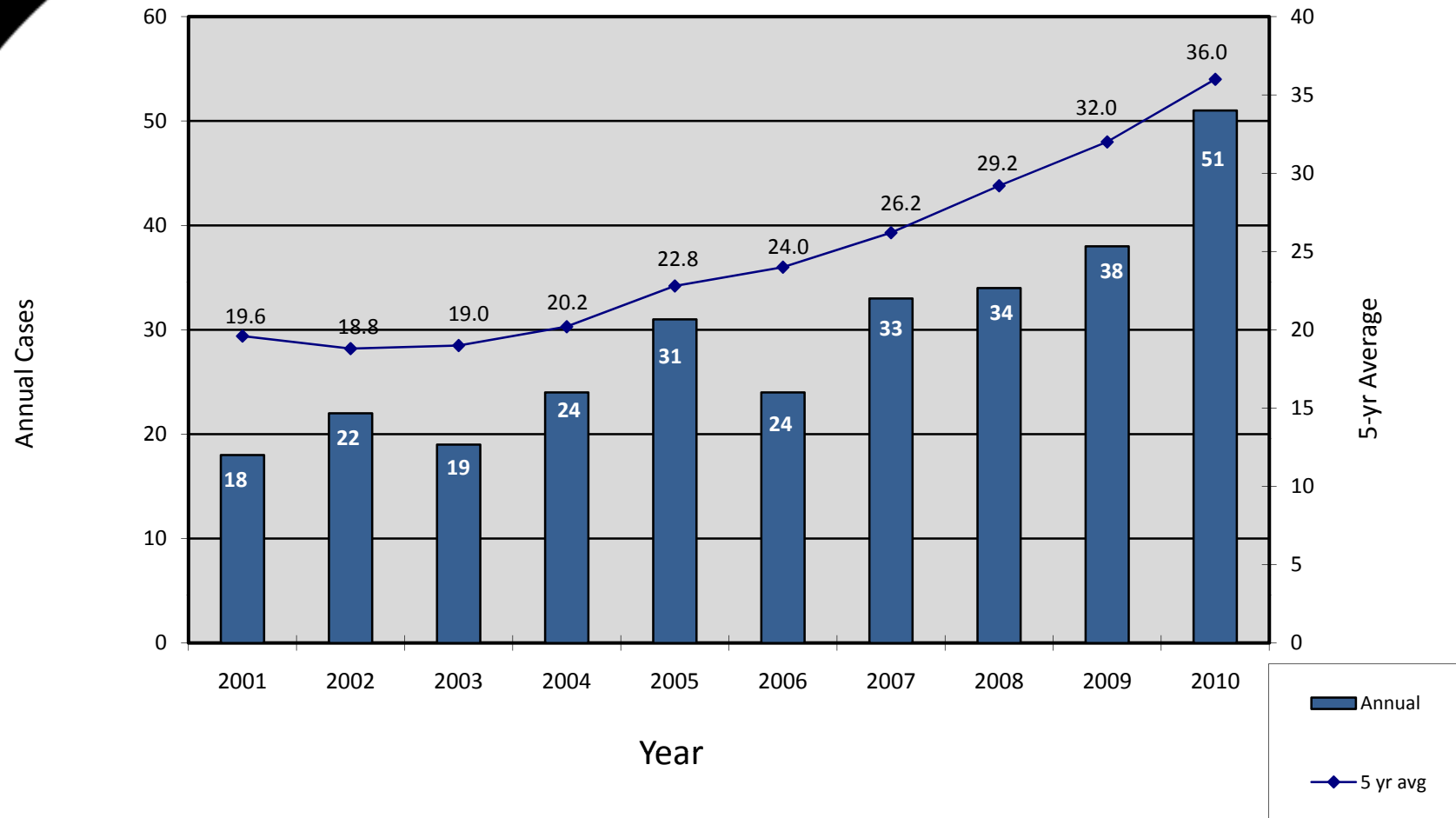


Annual Frequency of Grain Storage, Handling and Transport Entrapment & Engulfment Cases (1964 – 2010)

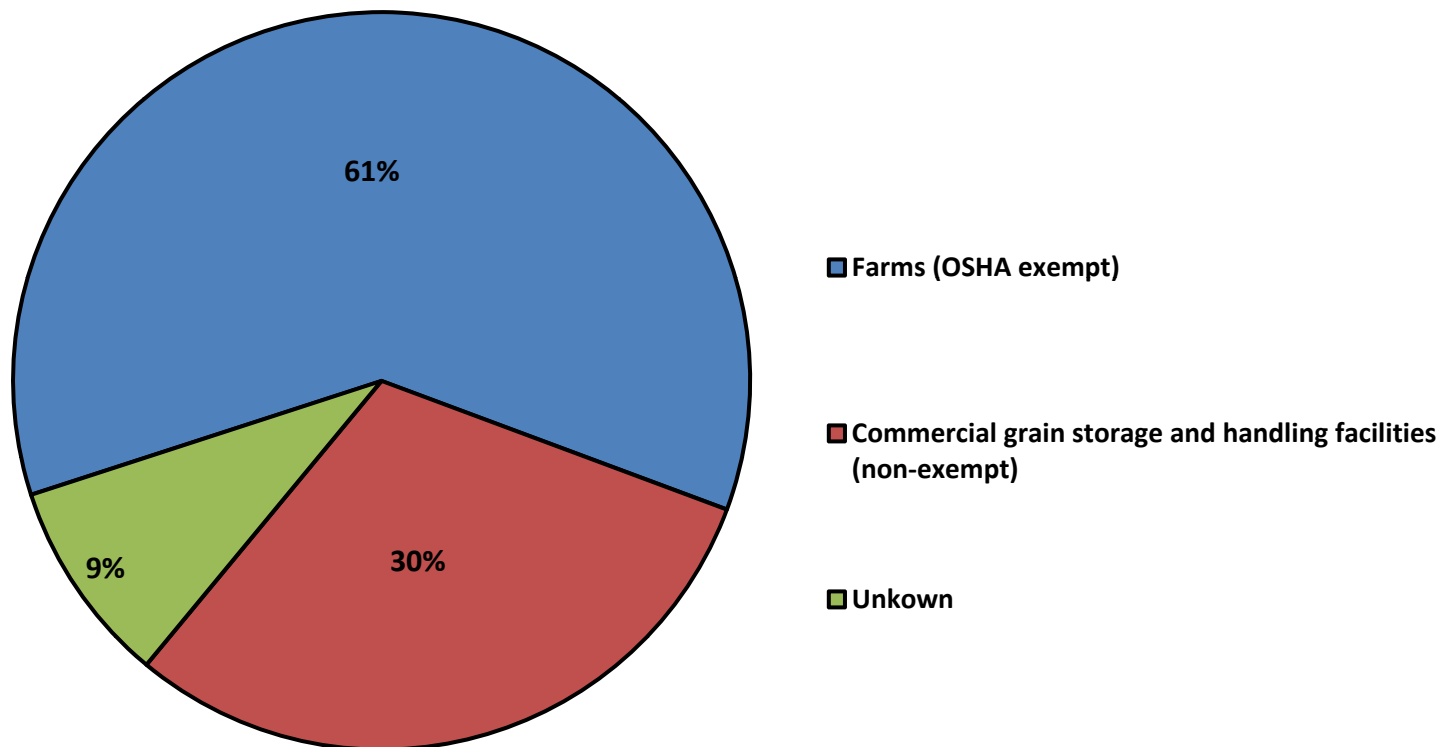


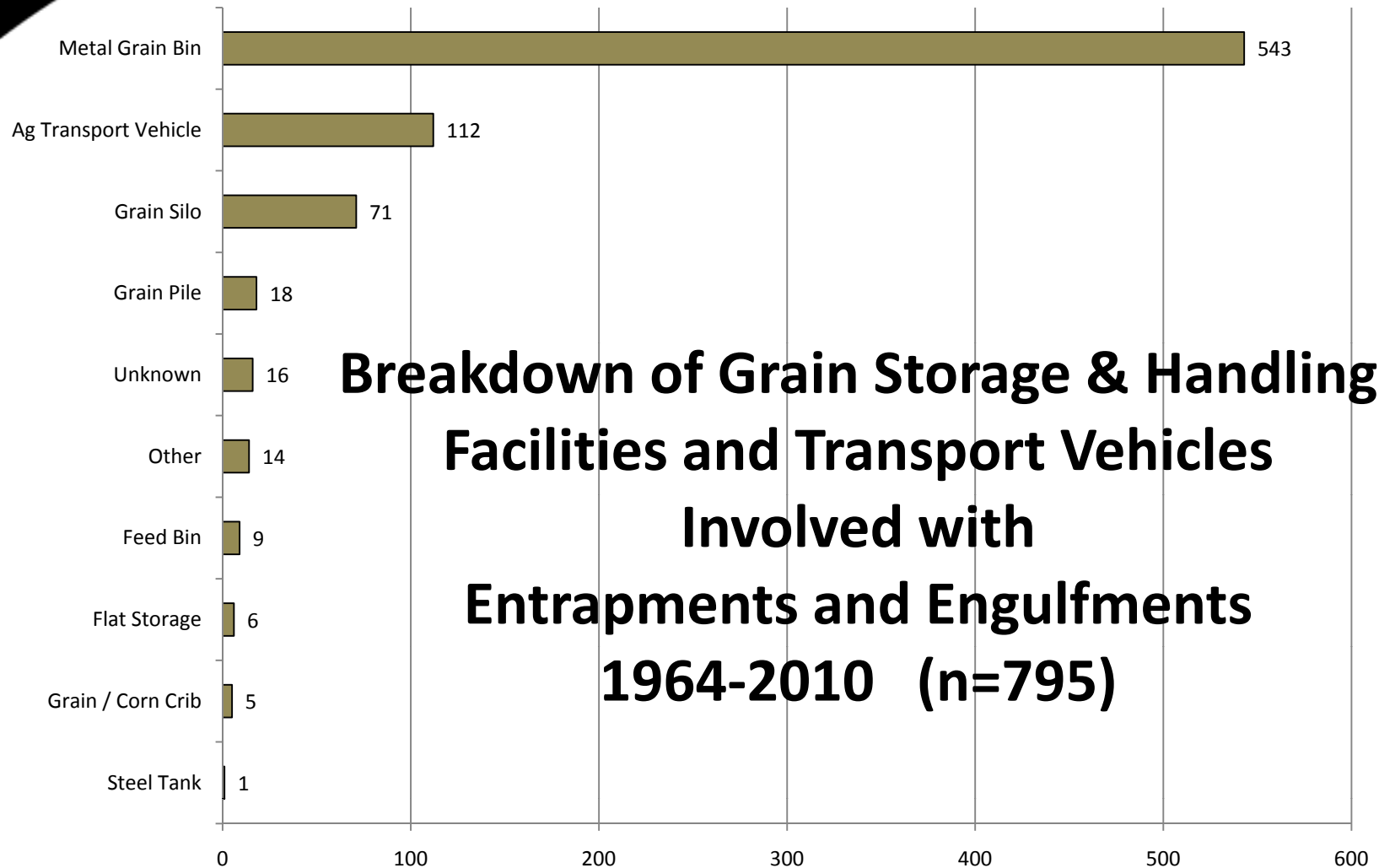
U.S. Grain Entrapments

2001-2010 n=294

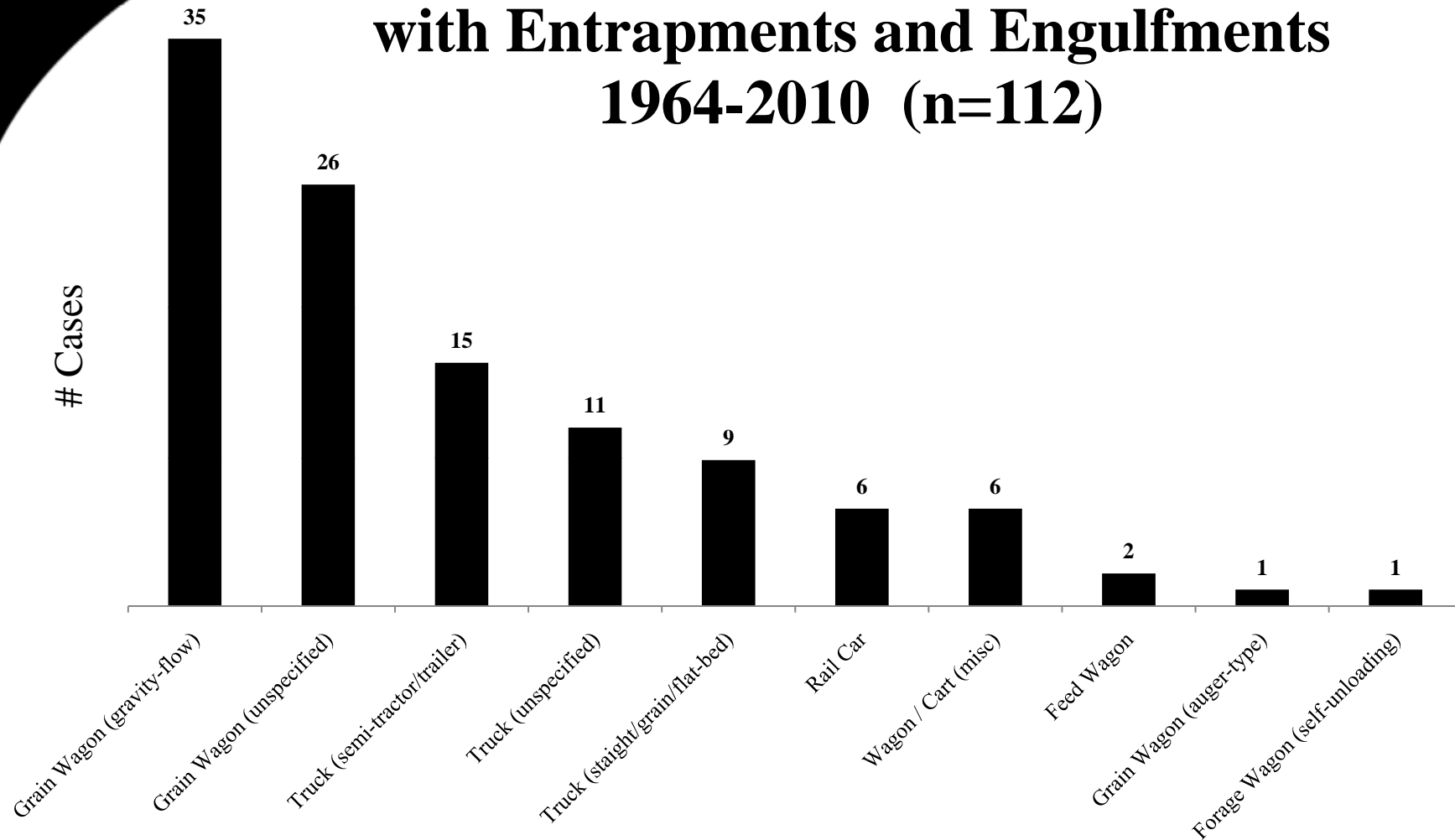


Breakdown by Classification of Facility Status (OSHA Exempt vs. Non-exempt) Involving FAM Engulfments and Entrapments 2009 - 2010 (n=89)



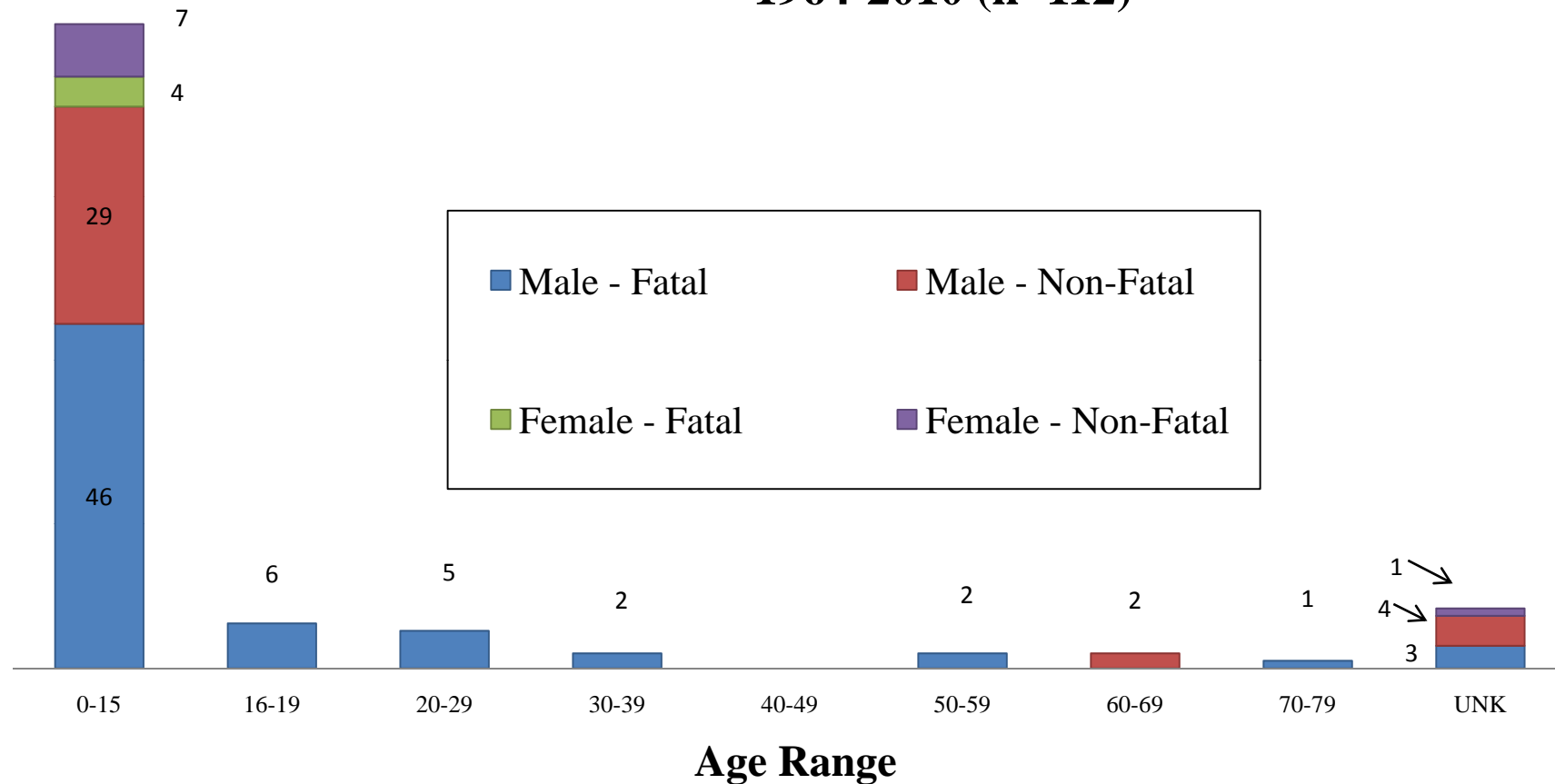


Type of Ag Transport Vehicles Involved with Entrapments and Engulfments 1964-2010 (n=112)



Ag Transport Vehicles Involved with Entrapments and Engulfments

Age Distribution by Gender and Fatal vs. Non-Fatal 1964-2010 (n=112)



Contributing Factors

- Improper Post-Harvest Drying
- Out-of-Condition Grain
- Energized Unloading Equipment
- Working Alone
- Unsupervised Children in the Workplace
 - Most often on the family (OSHA exempt) farm
- Increased On-farm Storage
- Unfamiliarity with Extrication Strategies by First Responders



Conclusions

- Victims are mostly males → over 97%
- Average age of known cases → 39 years old
 - 1/5th of cases where age is known are under the age of 16
- Corn Belt region issue
- In past two years, incidents occur primarily on OSHA exempt (farm) facilities → 61%
- Primary medium (when known) is out-of-condition corn → 38%
 - Likely higher, as corn accounts for approximately 2/3^{rds} of typical FAM crops by yield (NASS, 2009-2010)

Conclusions

- Corrugated metal grain bins are most frequently involved → 68%
- Unloading equipment was typically energized at the time of the incident
- Suffocation occurred in over 50% of fatal entrapment cases
- Frequency of incidents is increasing



Recommendations

- There is a need to:
 - Adopt a comprehensive, consensus definition for agricultural confined spaces and related terminology
 - Continue the current surveillance and documentation program
 - Develop a mutually agreeable set of processes and procedures for exempt facilities to follow that
 - do not unduly burden the producer
 - focus on farm family members under the age of 16

Recommendations

- There is a need to:
 - Develop appropriate engineering standards to enhance the safety of grain storage and handling facilities
 - Continue promoting public awareness of grain handling hazards, especially when out-of-condition grain is present
 - Develop evidence-based grain handling safety curricula for high-risk operations

Next Steps

- Develop recommendations for further research, based on the estimates, which will allow for future development of engineering, educational and regulatory strategies to reduce the frequency and severity of incidents involving grain storage, handling and transport



Questions?