

ABSTRACT

Roberts, Matthew J. M.S., Purdue University, August, 2008. Summary of Prior Grain Entrapment Rescue Strategies and Application Principles Associated with using a Grain Rescue Tube as a Grain Retaining Device. Major Professors: Dirk Maier and Bill Field.

Because entrapment in flowable agricultural material continues to be a relevant problem, there has been a growing interest in both preventative strategies and developing more effective first response or extrication techniques. It was concluded that there was a need to develop evidence-based rescue strategies especially with respect to the use of grain entrapment rescue tubes that were being introduced as a form of grain retaining system to protect the victim from further entrapment and to aid in extrication. There was also a need for a summary of rescue techniques currently being used in real-world situations and to document the history of grain retaining walls (GRWs) and how they developed into grain entrapment rescue tubes (GERTs), the only rescue devices specific to grain entrapment.

Significant findings included: from 1964 – 2006 an average of 16 entrapments were documented per year; of the 196 cases where the rescue technique was known, fifty-six percent (56%) included cutting or punching holes in the side of the grain storage structure and nineteen percent (19%) of the cases utilized the construction of a GRW to extricate the victim.

It was determined that as the moisture content of corn increased from 13.6% to 21.9% the amount of resistance against the LRS Grain Rescue Tube sheet insertion increased from 1368 Joules to 2169 Joules.

Inserting the tube around the victim without removing any grain from inside the tube increased the amount of vertical pull needed for extrication of the victim. In the scenario where the victim was entrapped to the waist and underarms, placing the tube around the mannequin increased vertical pull by 26% and 22% respectively.

Recommendations for further study included: determining the safest way to cut into a large bin or silo (i.e., >20,000 bushels) without causing substantial structural fatigue, quantify coefficients of friction of various grains at varying moisture contents on UHMW plastic, analyze the effects of pulling a human body out of grain during extrication, and determine the most effective means of training volunteer first responders, full-time first responders, and elevator personnel in grain entrapment rescue techniques.