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Agricultural Dust Explosions in 1996*

The title of this report has been changed to more accurately describe the data collected each year.

There were 13 dust explosions reported in the U.S. in 1996 according to Robert W. Schoeff, Professor Emeritus, Kansas State University and Ralph Regan, Safety Director, USDA-FGIS. This compares to 14 in 1995 and a ten-year average of 13 explosions.

There was one fatality and 19 injured.

Four of the thirteen incidents occurred in grain elevators, four in feed mills, and one each in a rice mill, brewery, flour mill, corn mill, and sugar plant.

The **primary explosion** occurred in storage bins in 5 cases, 4 in bucket elevators, two were unknown, and one each in the headhouse and tunnel.

The **probable ignition source** was hot metal (3), bearing failure (2), fire, sparks, lightning, static electricity (1 each), and unknown (4).

Fuel sources were identified as corn (5), soybean meal (2), beet pulp pellets, malted barley, mixed feed, rice, sugar, and wheat flour (1 each).

Dust explosions occurred in 8 different states: Iowa (3); Minnesota (2); North Carolina (2); Pennsylvania (2); Arkansas, Illinois, Nebraska, and South Dakota (1 each).

Property damage was estimated to be \$29.6 million, with the most severe being at a sugar plant in Nebraska. No dollar estimate can be placed on **the pain and suffering of the injured or the loss to the family of the fatally injured employee.**

Readers are reminded that two highly acclaimed video tapes, "**Deadly Dust II**" and "**Deadly Dust III**" are available for training of employees, contractors, and fire department personnel from Kansas State University. Write for brochure or call Steve Ballou, Dept. of Communications, Dole Hall-KSU, Manhattan, KS 66506-6903. For more details about this report, call Robert W. Schoeff, 913-539-8891, Manhattan, KS.

This report is based on a variety of news sources and voluntary cooperation of management as we seek to identify that dust explosions have occurred and what the cause might have been. The data is compiled as a service to the grain storage and processing and allied industries, trade associations, insurance companies, and government agencies.

*This report subject to revision as additional information is received.

REPORTED GRAIN DUST EXPLOSIONS IN U.S. - 1996**

| <u>NO.</u> | <u>DATE</u> | <u>COMPANY AND ADDRESS</u> | <u>FACILITY</u> | <u>DAMAGE*</u> | <u>KILLED</u> | <u>INJURED</u> |
|------------|-------------|---|-------------------|----------------|---------------|----------------|
| 1 | Jan. 29 | Riceland Foods Jonesboro, AR | Rice Mill | Moderate | 0 | 0 |
| 2 | Jan. 31 | Fasco Mills Seward, IL | Grain Elevator | Moderate | 0 | 0 |
| 3 | Feb. 8 | Carroll's Foods Warsaw, NC | Feed Mill | Severe | 0 | 4 |
| 4 | May 6 | National Food Corp. Plankinton, SD | Feed Mill | Minor | 0 | 0 |
| 5 | May 19 | Grainland Coop Frost, MN | Grain Elevator | Severe | 0 | 0 |
| 6 | July 10 | Latrobe Brewing Co. Latrobe, PA | Brewery | Minor | 0 | 0 |
| 7 | July 12 | ConAgra Martin's Creek, PA | Flour Mill | Moderate | 0 | 0 |
| 8 | July 17 | Swaledale Elevator Co. Swaledale, IA | Grain Elevator | Minor | 0 | 0 |
| 9 | July 20 | Western Sugar Co. Scottsbluff, NE | Sugar Plant | Severe | 1 | 15 |
| 10 | Sept. 8 | Quaker Oats Co. Cedar Rapids, IA | Corn Mill | Minor | 0 | 0 |
| 11 | Oct. 1 | Farmers Coop Craig, IA | Grain Elevator | Moderate | 0 | 0 |
| 12 | Oct. 15 | Carroll's Foods Warsaw, NC | Feed Mill | Minor | 0 | 0 |
| 13 | Nov. 12 | Angus Coop Elevator Angus, MN | Feed Mill | Minor | 0 | 0 |

*Minor: Less than \$50,000; Moderate: \$50,000-\$500,000; Severe: Over \$500,000 Robert W. Schoeff
Kansas State University

**Report is subject to revision as new information is received.
In cooperation with Ralph Regan, FGIS, USDA, Washington, DC.

Manhattan, KS 66506-2201
February 3, 1997

TABLE 1. U.S. GRAIN DUST EXPLOSION STATISTICS*

| | <u>1987</u> | <u>1988</u> | <u>1989</u> | <u>1990</u> | <u>1991</u> | <u>1992</u> | <u>1993</u> | <u>1994</u> | <u>1995</u> | <u>1996</u> | <u>TEN YEAR TOTAL</u> |
|--------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------------------|
| Number | 16 | 12 | 13 | 15 | 12 | 6 | 13 | 15 | 14 | 13 | 129 |
| Dead | 0 | 8 | 2 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 17 |
| Injured | 18 | 10 | 7 | 7 | 4 | 8 | 20 | 14 | 12 | 19 | 119 |
| Est. Damage to Facility (\$ Mil.) | 8.3 | 8.7 | 3.9 | 5.0 | .3 | .4 | 4.0 | 7.1 | 6.7 | 29.6 | 74.0 |
| Type of Facility: | | | | | | | | | | | |
| Grain Elevator | 11 | 7 | 7 | 8 | 4 | 5 | 9 | 7 | 4 | 4 | 66 |
| Feed Mill | 4 | 1 | 1 | 1 | 4 | 0 | 0 | 3 | 4 | 4 | 22 |
| Flour Mill | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 2 | 0 | 1 | 7 |
| Other: | | | | | | | | | | | |
| Corn Milling, Dry | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 6 |
| Corn Milling, Wet | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 2 | 0 | 7 |
| Rice Mill | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 1 | 6 |
| Oat Mill | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Other | 1 | 0 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 14 |

*Source: Robert W. Schoeff, Kansas State University, in cooperation with Ralph Regan, FGIS-USDA, February 3, 1997

TABLE 2. GRAIN DUST EXPLOSIONS
BY COMMODITY HANDLED AT TIME OF EXPLOSION
1987-1996

| <u>COMMODITY</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> | <u>1990</u> | <u>1991</u> | <u>1992</u> | <u>1993</u> | <u>1994</u> | <u>1995</u> | <u>1996</u> | <u>TEN YEAR TOTAL</u> |
|---------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------------------------|
| Corn | 13 | 7 | 4 | 2 | 5 | 4 | 9 | 8 | 3 | 5 | 60 |
| Sorghum | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| Soybeans | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 8 |
| Wheat | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 2 | 1 | 0 | 8 |
| Barley (malted) | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 4 |
| Oats | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 4 |
| Beet Pulp | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Corn Starch | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 6 |
| Corn Gluten Meal | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Distillers Feed | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| Feed By-Products | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Grain Screenings | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Mixed Feed | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 4 |
| Rice (Bran)(Flour)(Hulls) | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 3 | 1 | 7 |
| Wheat Flour | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| Wheat (Starch) (Gluten) | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Other | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 1 | 2 | 1 | 11 |
| TOTAL EXPLOSIONS | 16 | 12 | 13 | 15 | 12 | 6 | 13 | 15 | 14 | 13 | 129 |

Source: Robert W. Schoeff, Kansas State University, Manhattan, KS 66506-2201, February 3, 1997

TABLE 3. U.S. GRAIN DUST EXPLOSIONS

LEADING STATES - 1958 to Date

| <u>STATE</u> | <u>1958- 1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> | <u>1990</u> | <u>1991</u> | <u>1992</u> | <u>1993</u> | <u>1994</u> | <u>1995</u> | <u>1996</u> | <u>10-YEAR TOTAL</u> |
|--------------|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------------------|
| Iowa | 45 | 2 | 1 | 3 | 0 | 4 | 2 | 1 | 4 | 2 | 3 | 22 |
| Illinois | 46 | 2 | 1 | 2 | 2 | 0 | 1 | 0 | 1 | 3 | 1 | 13 |
| Minnesota | 32 | 1 | 3 | 1 | 2 | 0 | 0 | 1 | 1 | 0 | 2 | 11 |
| Kansas | 28 | 0 | 0 | 3 | 3 | 1 | 0 | 0 | 3 | 0 | 0 | 10 |
| Nebraska | 58 | 0 | 0 | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 1 | 8 |
| Louisiana | 10 | 0 | 1 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 7 |
| Indiana | 16 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 6 |
| Ohio | 19 | 2 | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 7 |
| Texas | 37 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 5 |
| Washington | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 4 |
| Missouri | 24 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| South Dakota | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 |

Source: Robert W. Schoeff, Kansas State University, Manhattan, KS 66506-2201, February 3, 1997