EXPLOSIVE DUSTS
ADVANCED IMPROVISED EXPLOSIVES

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WARNING

The dusts and fine powders of all materials described in this manual are deadly explosives. Many of these materials are also extreme fire and explosive hazards in their natural forms, and some are deadly poisons. Whenever dealing with high explosives or hazardous materials, special precautions should be followed in accordance with industry standards for experimentation and production. Failure to strictly follow such industry standards may result in harm to life or limb.

Therefore, the author and publisher disclaim any liability from any damage or injuries of any type that a reader or user of information contained within this manual may encounter from the use of said information. Use this manual and any end product or by-product at your own risk. For information purposes only.

»Between 1910 and 1960, over two hundred fatalities were recorded as a result of explosions of agricultural dusts. In the same period, over one hundred additional fatalities were attributed to dust explosions in the plastics industry.«

National Fire Prevention Association
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Dust explosions account for a significant percentage of the industrial fire deaths that occur every year in mines, grain elevators, food processing plants, chemical plants, and other types of facilities. It is difficult for the ordinary person to comprehend the degree of explosive power of dust deposits. They can be detonated or ignited by heat, spark, flame, static electricity, or other means.

Each dust has a different optimal particle size for maximum explosibility, but generally the finer the particles the higher the explosive capability. Experiments by the United States Department of the Interior Bureau of Mines have shown that dusts composed of irregularly shaped particles represent a greater explosion hazard than those composed of spherical particles.

Dusts represent the most severe danger when the air in an enclosed space is saturated, but dusts can also be detonated when loosely packed in a nonconfining container.

The extent of the hazard of any given dust is related to its ease of ignition and the severity of the ensuing explosion. All the dusts described in this manual are deemed to be severe explosive hazards by the Bureau of Mines.

All dusts should be considered potentially hazardous and toxic.
INDUSTRIAL CHEMICALS

ACETO ACETANILIDE
\( \text{C}_{10}\text{H}_{11}\text{O}_{2}\text{N} \)

Synonyms
Alpha-Ketobutyranilide, Alpha-Acetyl Acetanalide, N-Phenylacetamide.

Description
White, odorless crystalline powder or solid. Slightly burning taste.

Uses
Manufacture of penicillin and other Pharmaceuticals, dyestuffs, cellulose ester coatings, rubber, synthetic camphor.

Hazards
Highly toxic. Can release highly toxic fumes upon heating.

Fire Fighting
Alcohol foam, water mist, \( \text{CO}_2 \), dry chemical.

Additional Information
Can react vigorously with oxidizing materials.

ACETOCET-O-TOLUIDIDE
\( \text{C}_{11}\text{H}_{13}\text{O}_{2}\text{N} \)

Synonyms
None.

Description
Fine white granular powder.

Uses
Manufacture of Hansa and benzidine yellows.

Hazards
Moderately toxic. Avoid inhalation.
**Fire Fighting**
Water, foam, CO₂, dry chemical.

**Additional Information**
Combustible.

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**ACETOACET-P-PHENETIDIDE**
\[ \text{C}_{12}\text{H}_{15}\text{O}_3\text{N} \]

**Synonyms**
None.

**Description**
Crystalline powder.

**Uses**
Intermediate for azo pigments.

**Hazards**
Moderately toxic. Avoid inhalation.

**Fire Fighting**
Water, foam, CO₂, dry chemical.

**Additional Information**
Combustible. Can react with oxidizing materials.

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**ACETYLSALICYLIC ACID**
\[ \text{C}_9\text{H}_8\text{O}_4 \]

**Synonyms**
Aspirin, Acetol, O-Acetoxybenzoic Acid.

**Description**
White crystals or powder. Slightly bitter taste.

**Uses**
Medicine, most commonly aspirin tablets.
Hazards
A 10-gram dose can be fatal to an adult. Avoid inhalation of dust.

Fire Fighting
Water.

ANTHRANILIC ACID
\( C_6 H_4 (NH_2)(CO_2)H \)

Synonym
O-Amino Benzoic Acid.

Description
Yellow, needle-like crystals. Sweetish taste.

Uses
Manufacture of dyes, drugs, perfumes, and Pharmaceuticals.

Hazards
Moderately toxic. Avoid inhalation.

Fire Fighting
Water, alcohol foam.

Additional Information
Combustible.

BENZETHONIUM CHLORIDE
\( C_{27}H_{42}ClNO_2 \)

Synonym
Hyamine 1622.

Description
Colorless, odorless crystals. Very bitter taste.

Uses
Antiseptic, cationic detergent.

Hazards
Highly toxic. Heat or contact with acid or acid fumes can lead to the release of toxic gas.

Fire Fighting
Water, dry chemical, C02 foam.
**BENZOIC ACID**

\[ \text{C}_6\text{H}_5\text{COOH} \]

**Synonyms**
- Carboxybenzene, Benzenecarboxylic Acid, Phenylformic Acid.

**Description**
- White powder or white needle crystals.

**Uses**
- Plasticizers, alkyd resins, food preservative, seasoning tobacco, flavors, perfumes, antifungal agent.

**Hazards**
- Mildly toxic. Use in foods is restricted to 0.1%. Avoid skin contact or ingestion.

**Fire Fighting**
- Water, \( \text{CO}_2 \), dry chemical.

**Additional Information**
- Combustible. Can react with oxidizing materials.

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**1,2,3-BENZOTRIAZONE**

\[ \text{C}_6\text{H}_4\text{NHN}_2 \]

**Synonyms**
- Aziminobenzene, Benzene Azimide,

**Description**
- White to light tan, odorless, crystalline powder or needlelike crystals.

**Uses**
- Photographic restrainer, chemical intermediate.

**Hazards**
- Highly toxic. Can release highly toxic fumes when heated.

**Fire Fighting**
- Water, dry chemical.

**Additional Information**
- Can detonate under vacuum distillation.
CARBARYL
\( \text{C}_{10}\text{H}_7\text{OOCNHCH}_3 \)

**Synonyms**
Sevin, 1-Napthyl Methyl Carbamate, 1-Napthyl-N-Methylcarbamate.

**Description**
White crystals.

**Uses**
Insecticide.

**Hazards**
Highly toxic. Avoid inhalation, ingestion, or skin contact.

**Fire Fighting**
Water.

DEHYDROACETIC ACID
\( \text{C}_8\text{H}_8\text{O}_4 \)

**Synonyms**
3-Acetyl-6-Methyl-1, 2-Pyran-2, 24(3H)-Dione Methylacetopyranone, DHA.

**Description**
Colorless, odorless, tasteless crystals.

**Uses**
Fungicide, bactricidc, medicated toothpastes, plasticizer, chemical intermediate.

**Hazards**
Highly toxic. Permitted as a food additive, but avoid ingestion.

**Fire Fighting**
Water, foam.

**Additional Information**
Mildly combustible.
**DIAZOAMINOBENZENE**  
\[ \text{C}_6\text{H}_5\text{N}_3\text{H}\text{C}_6\text{H}_5 \]

**Synonyms**  
(Alpha) Diazodimobenzol; 1, 3 Diphenyl-triazine; Benzeneazoanilide.

**Description**  
Golden-yellow crystals.

**Uses**  
Insecticide, organic synthesis, dyes.

**Hazards**  
Highly toxic. Can release toxic fumes when heated.

**Fire Fighting**  
Dry chemical foam, CO₂

**Additional Information**  
Can detonate if heated or shocked.

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**DICYCLOPENTADIENE DIOXIDE**  
\[ \text{C}_{10}\text{H}_{12}\text{O}_2 \]

**Synonyms**  
None.

**Description**  
White crystalline powder,

**Uses**  
Intermediate for epoxy resins, plasticizers, and protective coatings.

**Hazards**  
Mildly toxic. Avoid inhalation.

**Fire Fighting**  
Alcohol foam, dry chemical.

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**DIELDRIN**  
\[ \text{C}_{12}\text{H}_{10}\text{OCl}_6 \]

**Synonyms**  
Compound 497, Octalox, HEOD.
**Description**
White odorless crystals.

**Uses**
Insecticide.

**Hazards**
Extremely toxic. Can release extremely toxic fumes when heated.

**Fire Fighting**
Water, dry chemical, foam CO₂.

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**DIMETHYL TEREPTHALATE**

\[ \text{C}_6\text{H}_4(\text{COOCH}_3)_2 \]

**Synonyms**
DMT, Dimethyl-1, 4-Benzene-Dicarboxylate.

**Description**
Colorless crystals.

**Uses**
Polyester resins for film and fiber production.

**Hazards**
Moderately toxic. Avoid inhalation.

**Fire Fighting**
Alcohol foam.

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**DIPHENYL**

\[ \text{C}_6\text{H}_5\text{C}_6\text{H}_5 \]

**Synonym**
Biphenyl.

**Description**
White scales. Pleasant odor.

**Uses**
Organic synthesis, heat transfer agent, fungistat in packaging of citrus fruit, plant disease control, dyeing assistant for polyesters.

**Hazards**
Highly toxic. Avoid inhalation or ingestion.
Fire Fighting
Water, CO₂, dry chemical.

Additional Information
Combustible. Can react with oxidizing materials.

FERRIC DIMETHYL DITHIOCARBAMATE
\[ \left(\text{CH}_3\right)_2\text{NCSS}\]_3\text{Fe}  

Synonyms
Ferbam, Fennate.

Description
Dark to black fluffy powder. May be compressed to solid.

Uses
Fungicide.

Hazards
Moderately toxic. Can release highly toxic fumes when heated.

Fire Fighting
Water, dry chemical.

HEXAMETHYLENETETRAMINE
\(\text{(CH}_2\text{)}_6\text{N}_4\)

Synonyms
Methenamine, HMTA, Aminoform, Hexamine Formamine, Urotropin, Metramine. Often erroneously called Hexamethyleneamine.

Description
Colorless, lustrous crystals or white crystalline powder.

Uses
Curing of phenol formaldehyde; adhering rubber to textile; protein modifier; organic synthesis; manufacture of pharmaceuticals, fuel tablets, and shrinkproof textiles; fungicide; antibacterial; corrosion inhibitor.

Hazards
A skin irritant. Can release toxic fumes when heated.
Fire Fighting
Water, foam.

Additional Information
Combustible. Can react with oxidizing materials. Reacts violently with Na₂O₂.

METHIONINE
CH₃SCH₂CH₂CH(NH₂)COOH

Synonyms
Methionine, 2-Amino-4-(methylthio)butyric acid.

Description
White crystalline powder.

Uses
Feed additive, vegetable oil enrichment, manufacture of pharmaceuticals. A nutrient.

Hazards
Unknown. Permitted as a food additive for humans.

Fire Fighting
Water, alcohol foam.

Additional Information
May react violently with powerful oxidizers or acids.

PARAFORMALDEHYDE
(CH₂O)ₓ

Synonym
Paraform.

Description
White crystals, flakes, or powder. Odor of formaldehyde.

Uses
Fungicides, bactericides, disinfectants, adhesives, contraceptive creams, hardener, waterproofing agent for gelatin.

Hazards
Moderately toxic. Releases oxides of carbon and formaldehyde gas
when heated.

**Fire Fighting**
Alcohol foam, CO₂, dry chemical.

**Additional Information**
Can react with oxidizing materials. Reacts violently with O₂ liquid.

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**PHOSPHORUS PENTASULFIDE**

\[ \text{P}_2\text{S}_5 \]

**Synonym**
Phosphoric Sulfide, Phosphorus Persulfide, Thiophosphoric Anhydride.

**Description**
Light yellow or greenish yellow crystalline mass. Odor similar to hydrogen sulfide.

**Uses**
Insecticides, float agents, safety matches and other ignition compounds, intermediate for lubrication oil additives.

**Hazards**
Highly toxic. Can release highly toxic fumes when heated. Will react with water, steam, or acids to produce toxic and flammable vapors.

**Fire Fighting**
CO₂, snow, dry chemical, sand.

**Additional Information**
Can react vigorously with oxidizing materials. Combustible; ignites by friction.

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**PHTHALIC ANHYDRIDE**

\[ \text{C}_8\text{H}_4\text{O}_3 \]

**Synonym**
Phthalandione.

**Description**
White crystalline needles. Mild odor.

**Uses**
Manufacture of resins, plasticizers, dyes, chlorinated products,
pharmaceuticals, and insecticides.

**Hazards**
Moderately toxic. A common air contaminant. Avoid inhalation.

**Fire Fighting**
CO₂, dry chemical.

**Additional Information**
Combustible. Can react with oxidizing materials. Explodes on contact with HNO₃.

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**PHTHALIMIDE**

\[ \text{C}_6\text{H}_4\text{(CO)}_2\text{NH} \]

**Synonym**
1, 3-Isoindoledione.

**Description**
Light tan to white powder.

**Uses**
Fungicide, organic synthesis, laboratory reagent, manufacture of synthetic indigo.

**Hazards**
Can release toxic fumes when heated. Other toxic properties are unknown.

**Fire Fighting**
Water, dry chemical.

**Additional Information**
Combustible.

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**POLYCARBONATE**

\[ \text{[COOC}_6\text{H}_5\text{C(CH}_3\text{)_2C}_6\text{H}_5\text{O]}_x \]

**Synonyms**
None.

**Description**
Transparent solid.

**Uses**
Heavily used in the manufacture of molded plastic products.
particularly those where strength of construction is of high importance.

Hazards
Mildly toxic. Avoid inhalation or ingestion.

Fire Fighting
Self-extinguishing.

POLYPOLYPHENYLENE
\((C_3H_5)_x\)

Synonyms
None.

Description
Translucent, white to yellow solid.

Uses
Manufacture of molded plastic products, packaging film, acid-dyed clothing, artificial turf, surgical casts, synthetic paper, nonwoven disposable filters, and strapping.

Hazards
Mildly toxic. Permitted additive in food for human consumption.

Fire Fighting
Water, dry chemical.

Additional Information
Combustible, but slow burning. Reacts violently with strong oxidizing agents.

POLYSTYRENE
\((C_6H_5CHCH_2)_x\)

Synonyms
Polystyrol, Styrene Polymer, Styron, Styrofoam.

Description
Transparent to light yellow solid.

Uses
Manufacture of molded plastic products. As a foam it is a commonly used insulation.
Hazards
Mildly toxic. Avoid inhalation or ingestion.

Fire Fighting
Water, dry chemical.

Additional Information
Combustible.

SALICYLANILIDE
\( C_6H_5NHCOC_6H_4OH \)

Synonyms
Anasadol, Salinidol.

Description
White or slightly pink, odorless crystals.

Uses
Fungicide, slimicide, antimildew agent.

Hazards
Moderately toxic. Will irritate skin. Can release toxic fumes when heated.

Fire Fighting
Alcohol foam, CO\(_2\), dry chemical.

SORBIC ACID
\( CH_3CHCHCHCHCOOH \)

Synonyms
2,4-Hexadienoic acid.

Description
Colorless needles.

Uses
Fungicide, mold inhibitor in food products, alkyd resin coatings, cold rubber additive, intermediate for plasticizers and lubricants.

Hazards
Mildly toxic. Avoid inhalation or ingestion.

Fire Fighting
Water.
Additional Information
Can react with oxidizing materials.

STEARIC ACID
\(\text{CH}_3(\text{CH}_2)_\text{16}\text{COOH}\)

Synonyms
Octadecanoic Acid, N-Octadecanoic acid.

Description
White amorphous solid. Slight odor and taste of tallow.

Uses
Manufacture of lubricants, soaps, pharmaceuticals, cosmetics, shoe polish, metal polish, and ointments; dispersing agent and softener in rubber compounds.

Hazards
Highly toxic. Avoid inhalation, ingestion, or skin contact.

Fire Fighting
CO\(_2\), dry chemical.

TEREPHTHALIC ACID
\(\text{C}_6\text{H}_4(\text{COOH})_\text{2}\)

Synonyms
P-Phthalic Acid, TPA, Benzene-p-dicarboxylic acid.

Description
White crystals or powder.

Uses
Additive in poultry feeds; reagent for alkali in wool; production of linear, crystalline polyester resins, fibers, and films by combination with glycols.

Hazards
Moderately toxic. Avoid inhalation or ingestion.

Fire Fighting
CO\(_2\), dry chemical.

Additional Information
Combustible. This was the twenty-first-highest chemical produced
METALS

ALUMINUM

Al

Synonyms
None.

Description
Silvery white crystalline solid.

Uses
Building and construction, corrosion-resistant equipment, die-cast auto parts, power transmission lines, paints, protective coating, packaging foil.

Hazards
Nontoxic. Avoid inhalation of powder.

Fire Fighting
Specially prepared dry powder.

Additional Information
Will react violently with powerful oxidizers. The most abundant metal in the Earth’s crust.

IRON

Fe

Synonym
Ferrum.

Description
Silver white lustrous metal.

Uses
Manufacture of steel. Iron powder is used in manufacture of magnets, high-frequency cores, and auto parts. Used as a catalyst in ammonia synthesis.
Hazards
Dust is highly toxic. Iron oxide fumes are also highly toxic.

Fire Fighting
Special mixtures of dry chemicals.

Additional Information
Can react vigorously with oxidizing materials.

**MAGNESIUM**

*Synonyms*
None.

*Description*
Silver white crystals of metal.

*Uses*
Flash photography, antiknock gasoline additives, optical mirrors, die-cast auto parts, dry and wet batteries, reducing agent; production of iron, nickel, zinc, titanium, zirconium, and steel.

*Hazards*
Moderately toxic. Avoid inhalation. Will release toxic fumes when heated.

*Fire Fighting*
Powdered talc, powdered graphite, sand.

*Additional Information*
Combustible. Will react violently with oxidizing materials, moisture, or metals. *Dusts from aluminum-magnesium alloys are extremely explosive.*

**THORIUM**

*Synonyms*
None.

*Description*
Silver white soft metal or powder.

*Uses*
Sun lamps, photoelectric cells, target in X-ray tubes, *nuclear fuel.*
Hazards
Radioactive.

Fire Fighting
Dry chemical, powdered talc, graphite.

Additional Information
Dust can ignite at room temperature. Can react with oxidizing materials.

TITANIUM
Ti

Synonyms
None.

Description
Dark gray powder or white lustrous metal.

Uses
X-ray tube target, electrodes in chlorine batteries, manufacture of alloys for a variety of special applications.

Hazards
Nontoxic. Dust is considered to be in the nuisance category.

Fire Fighting
Powdered talc or sand.

Additional Information
Combustible. Can react violently with a wide variety of chemicals. Dusts from titanium-iron alloys (ferrotitanium) are extremely explosive.

TITANIUM HYDRIDE
TiH₂

Synonyms
None.

Description
Dark gray or black metallic powder or crystals.

Uses
Production of pure hydrogen and foamed-metals solder for metal-glass composites, reducing atmosphere for furnaces.
Hazards
Moderately toxic. Avoid inhalation.

Fire Fighting
Dry chemical, powdered talc, sand.

Additional Information
Combustible. May react violently with oxidizing materials.

Zirconium
Zr

Synonyms
None.

Description
Grayish white lustrous metal.

Uses
Corrosion-resistant alloys, flashbulbs, special welding fluxes, getter in vacuum tubes, lab crucibles, manufacture of steel.

Hazards
Moderately toxic. Avoid inhalation of powder.

Fire Fighting
Dry powder, salt, sand.

Additional Information
Combustible. Can react with oxidizing materials. Dusts must be kept dry or completely soaked.

Zirconium Hydride
ZrH₂

Synonyms
None.

Description
Gray black metallic powder.

Uses
Getter in vacuum-tube, source of hydrogen, metal foaming agent, reducing agent, nuclear moderator.
Hazards
Moderately toxic. Avoid inhalation.

Fire Fighting
Dry chemical, powdered talc, sand.

Additional Information
Combustible, especially when wet. Can react with oxidizing materials.
CHAPTER 3

CARBONACEOUS MATERIALS

ASPHALT

Synonyms
Bitumen, Petroleum Pitch.

Description
Black or dark brown mass.

Uses
Hot-melt adhesives, sealants, roof and road coatings.

Hazards
Moderately toxic. Can irritate skin.

Fire Fighting
Foam, CO₂, dry chemical.

Additional Information
Can react with fluorine.

COAL

Synonym
Anthracite.

Description
Black powder or chunks.

Uses
Heat, energy, production of synthetic crude oil and fuel gas.

Hazards
Moderately toxic. Avoid inhalation or ingestion.

Fire Fighting
Foam, CO₂, dry chemical.

Additional Information
Can react with oxidizing material.
GILSONITE

Synonym
Uintaite.

Description
Solid black asphaltic material.

Uses
Wire insulation compounds, black varnish, lacquers, baking enamels, linoleum and floor tile, paving, insulation, diluent in low-grade rubber compounds; add, alkali, and waterproof coatings.

Hazards
Moderately toxic. Can release toxic fumes upon heating.

Fire Fighting
Water foam, dry chemical, CO₂.

LIGNITE

Synonym
Brown Coal.

Description
Brown peat-like material. May contain 40-percent water before drying.

Uses
Fuel, production of polymer resins. May be used in the future to produce methanol.

Hazards
A nuisance dust. Avoid inhalation.

Fire Fighting
Water.

Additional Information
Can react with oxidizing materials.
AGRICULTURAL PRODUCTS

Dusts of these agricultural products represent severe explosive dangers.

- Apricot pit
- Barley
- Brown sugar
- Cake flour (25-percent commeal)
- Cherry pit
- Cinnamon
- Cocoa bean shell
- Coconut shell
- Corn
- Corncobs
- Cornstarch
- Dehydrated citrus peel
- Filbert shell
- Hemp
- Oats
- Pea flour
- Peach pit shell
- Peanut hull
- Pecan shell
- Pectin
- Potato starch
- Rice
- Safflower
- Skimmed milk
- Soy
- Sugar
- Walnut shell
- Wheat
- Wheat starch
- Yeast
1. Container
2. Wedge (aids duet flow)
3. Spring
4. Safety plug  
5. Optional second firing system  
6. Battery  
7. 1/4 lb. explosive charge  
8. Pressure-release firing system  
9. Spout and plug  
10. 5 lbs. of dust (minimum)

Fill the container with a minimum of five pounds of dust. *Do not tamp the dust.* The weight of the dust keeps the pressure-release firing system in the open position. Place the device in the center of a closed room in an elevated position. Remove the plug from the container. Dust will flow from the container and form an extremely explosive mixture with the air. As the dust flows from the container, the pressure on the springs will weaken and the pressure-release firing system will detonate the charge.
1. Electrical firing system
2. $\frac{1}{4}$ lb. of explosive charge
3. Plastic jerry can containing 5 lbs. (minimum) of dust
Pour the dust into the jerry can at the last possible minute. Dust should not be allowed to settle and compress itself. Set timer to detonate at the appropriate time. Allow enough time to leave the vicinity but not enough time for the dust to settle in the jerry can.

1. Cardboard carton containing 5 lbs. (minimum) of dust
2. Electrical firing system with $\frac{1}{4}$ lb. explosive charge

Electrical firing system and charge should be wrapped in plastic and placed in the center of the carton. Set timer to detonate at the appropriate time. Allow enough time to leave the vicinity but not
enough time for the dust to settle in the box.
APPENDIX

RECOMMENDED READING

*Improvised Munitions Black Book, Volume I*
Frankford Arsenal (available from Paladin Press)

*Special Forces Demolition Techniques*
Paladin Press

*Explosibility of Agricultural Dusts*
U.S. Bureau of Mines
Report #5753

*Explosibility of Metal Powders*
U.S. Bureau of Mines
Report #6516

*Explosibility of Carbonaceous Dusts*
U.S. Bureau of Mines
Report #6597

*Dust Explosibility of Chemicals, Drugs, Dyes, and Pesticides*
U.S. Bureau of Mines
Report #7132

*Expolability of Miscellaneous Dusts*
U.S. Bureau of Mines
Report #7208

*Report of Important Dust Explosions (1957)*
National Fire Protection Association

*Theory and Nature of Dust Explosions*
D.J. Price and H.H. Brown National Fire Protection Association