EXPLOSIBILITY OF DUSTS USED IN THE PLASTICS INDUSTRY

By Murray Jacobson, John Nagy, and Austin R. Cooper

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EXPLOSIBILITY OF DUSTS USED IN THE PLASTICS INDUSTRY[1]

by

Murray Jacobson,[2] John Nagy,[3] and Austin R. Cooper[4]

SUMMARY AND INTRODUCTION

Facts obtained by the Bureau of Mines on the dust-explosion hazard in air of materials used in the plastics industry are presented for 313 samples studied in the laboratory. Information is given on ignition temperature of dust clouds and layers, minimum explosive concentration, minimum energy required for ignition, explosion pressure and rates of pressure rise, amount of inert dust required to prevent ignition and flame propagation, and, in some instances, on the limiting oxygen concentration in an atmosphere to prevent ignition by spark and by heated surface. The effects of particle shape, additives, and resin structure on explosibility are discussed.

Relative explosibility of the materials is related to the ignition sensitivity and explosion severity and is denoted by an empirical index. Recognition of the degree of hazard will facilitate adoption of adequate measures for preventing ignition and explosion during manufacturing or processing.

The results of an early study by the Bureau of Mines on the flammability and explosibility of powders used in the plastics industry was published in 1944.[5] Since then new synthetic resins, ingredients, and other associated materials have been developed by the industry. This paper summarizes data

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[5]Hartmann, Irving, and Nagy, John, Inflammability and Explosibility of Powders Used in the Plastics Industry: Bureau of Mines Rept. of Investigations 3751, 1944, 38 pp.

obtained in laboratory studies by the Bureau of Mines on ignition and explosibility of many of these materials; limited portions of the results were published previously.[6-8]

In the plastics industry potential dust-explosion hazards exist during the production of resins from basic new materials, the formulation of molding compounds, and the processing and fabricating of these materials into finished products. The amount of materials used by the plastics industry is increasing rapidly. In 1943, approximately 0.7 billion pounds of resins and molding compounds was manufactured; in 1953, this increased to 2.8 billion pounds; and in 1960, the annual production was about 6 billion pounds. This tremendous rise in productivity has increased proportionately the potential explosion hazard inherent in manufacturing and processing. According to the National Fire Protection Association,[9] since 1910 about 20 percent of the reported dust explosions (excluding those in coal mining) involved plastics materials. These explosions resulted in about a hundred fatalities and a property loss of more than $15 million.

CLASSIFICATION OF MATERIALS AND ANALYTICAL PROCEDURES

For clarification the following terms associated with materials discussed in this report are defined.

Plastic

A general term referring to synthetic or natural resins with or without additives, which can be molded by heat or pressure, or both, and to the finished product.

Molding Compound

A mixture of resins, ingredients, and fillers before processing into the finished product.

Resin

A synthetic addition or condensation polymerization substance or natural substance of high molecular weight, which under heat, pressure, or chemical treatment becomes moldable.

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[6] Hartmann, Irving, Recent Research on the Explosibility of Dust Dispersions: Ind. Eng. Chem., vol. 40, No. 4, April 1948, pp. 752-758.
[7] ______, Explosion and Fire Hazards of Combustible Dusts; ch. in Industrial Hygiene and Toxicology ed. by Patty: Interscience Publishers, Inc., New York, N. Y., rev. 2d ed., 1958, pp. 549-578.
[8] ______, Dust Explosions; Sec. 7 in Marks' Mechanical Engineers' Handbook: McGraw-Hill Book Co., New York, N. Y., rev. 6th ed., 1958, pp. 41-48.
[9] National Fire Protection Association, Report of Important Dust Explosions: 1957, pp. 30-79.

Ingredient

The primary and higher order reactants of the resins and the chemical constituents of the molding compound, such as plasticizer, lubricant, solvent, catalyst, stabilizer, fire retardant, hardener, and coloring material.

Filler

A nonreacting additive to the molding compound to change its physical characteristics such as increasing bulk, reducing shrinkage, improving strength, and increasing heat resistance and dielectric strength.

Resins are usually two basic types: (1) Thermoplastic, and (2) thermosetting, depending on physical characteristics and properties--particularly behavior toward heat. Thermoplastic resins are those which soften by heating and reharden by cooling. Thermosetting resins are those which becom substantially infusible or insoluble products when cured by heat, pressure, or chemical means; these materials soften when initially heated and become permanently hard on continued heating as the final curing completes a chemical change.

A list of the samples studied is given in the appendix, table A-1. The materials are arranged as shown in table 1 in an order corresponding to that followed by the industry.[10] Data are given for dust through No. 200-sieve. Although in industrial practice materials may be handled in relatively coarse particle size, many contain fines which may segregate and accumulate in equipment or in plant areas. Previous research[11] has shown that ignition temperature, explosion pressure, and minimum explosive concentration of most materials are relatively unaffected by particle size if the material passes a No. 200 sieve. Thus, comparison of these parameters may be made for the numerous dusts reported. Evaluation of the explosibility of the dusts was made with the equipment and procedures previously described.[12] Most of the materials received for study contained little moisture; those having more than 5 percent moisture were dried prior to testing.

To facilitate evaluating the explosibility of dusts and to provide a numerical rating for the relative hazard, an empirical index has been developed.[13] The index is not derived from theoretical considerations, but provides a rating of explosibility which is consistent with research observations and practical experience. The potential hazard of a dust is related to its ignition sensitivity and to the severity of the subsequent explosion. Ignition sensitivity may be considered as a function of ignition temperature, minimum igniting energy, and minimum explosive concentration; explosion severity is related

[10] Modern Plastics, Encyclopedia Issue for 1961: Vol. 38, No. 1-A, September 1960, p. 4.

[11] Jacobson, Murray, Nagy, John, Cooper, Austin R., and Ball, Frank J., Explosibility of Agricultural Dusts: Bureau of Mines Rept. of Investigations 5753, 1960, 23 pp.

[12] Dorsett, Henry G., Jr., Jacobson, Murray, Nagy, John, and Williams, Roger P., Laboratory Equipment and Test Procedures for Evaluating Explosibility of Dusts: Bureau of Mines Rept. of Investigations 5624, 1960, 21 pp.

[13] Work cited in footnote 11, p. 3.

to maximum explosion pressure and rate of pressure rise. Ignition sensitivity and explosion severity relative to Pittsburgh (Pgh.) coal[14] are computed as follows:

$$\text{Ignition sensitivity} = \frac{\text{(Ign. temp. x min. energy x min. conc.) Pgh. coal dust}}{\text{(Ign. temp. x min. energy x min. conc.) sample dust}}, \text{ and}$$

$$\text{Explosion severity} = \frac{\text{(Max. explosive press. x max. rate of press. rise) sample dust}}{\text{(Max. explosive press. x max. rate of press. rise) Pgh. coal dust}}.$$

The index of explosibility is the product of the ignition sensitivity and the explosion severity. This index is a dimensionless quantity having a numerical value of 1.0 for a dust equivalent to the standard Pittsburgh coal. An index greater than 1.0 indicates a hazard greater than that for the coal dust. The notation <<0.1 designates materials presenting primarily a fire hazard as ignition of the dust cloud is not obtained by the spark or flame source but only by the intense heated surface source.

The relative explosion hazard of a dust may be further classified by ratings of weak, moderate, strong, or severe. These ratings are correlated with the empirical index as follows:

Relative explosion hazard rating:	Ignition sensitivity	Explosion severity	Index of explosibility
Weak..........	<0.2	<0.5	<0.1
Moderate.......	0.2-1.0	0.5-1.0	0.1-1.0
Strong.........	1.0-5.0	1.0-2.0	1.0-10
Severe.........	>5.0	>2.0	>10

In calculating explosion severity, values of explosion pressure and maximum rate of pressure rise at a dust concentration of 0.50 oz./cu.ft. are considered. When the laboratory studies were made, two techniques were used to obtain maximum pressure and rates of pressure rise. Before 1950 dust dispersion was obtained by an airblast from an 80-in.^{3} reservoir charged to 14-p.s.i.g. pressure (technique A). Currently the technique is standardized using a 3-in.^{3} reservoir charged to 100-p.s.i.g. pressure (technique B). To eliminate differences in explosion severity and in the index of explosibility from variations in explosion pressure and rate obtained by the two techniques, conversion factors are applied. Regression analysis of data from 100 samples with duplicate tests using both techniques indicates that conversion factors for the pressure and the average and maximum rates of pressure rise obtained using technique A are 1.4, 2.0, and 2.0, respectively, at dust concentrations of 0.20, 0.50, and 1.00 oz./cu.ft. No conversion factors are required at a dust concentration of 0.10 oz./cu.ft. The conversion factors were applied to the data obtained using technique A.

[14] Line 314 in appendix tables A-1, A-2, and A-3.

TABLE 1. - Classification of molding compounds, plastics, ingredients, and fillers

Class A. - Thermoplastic resins and molding compounds:

I..........Acetal.
II.........Acrylic.
III........Cellulosic.
IV.........Chlorinated polyether.
V..........Fluorocarbon.
VI.........Nylon (polyamide).
VII........Polycarbonate.
VIII.......Polyethylene.
IX.........Polymethylene.
X..........Polypropylene.
XI.........Rayon.
XII........Styrene polymers and copolymers.
XIII.......Vinyl polymers and copolymers.

Class B. - Thermosetting resins and molding compounds:

I..........Alkyd.
II.........Allyl.
III........Amino (melamine and urea).
IV.........Epoxy.
V..........Furane.
VI.........Phenolic (phenol formaldehyde).
VII........Polyester.
VIII.......Polyurethane (isocyanate).

Class C. - Special resins and molding compounds:

I..........Cold molded (asphalt and gilsonite).
II.........Coumarone - indene.
III........Natural (gums, lignin, rosin, shellac, and cashew oil resin).
IV.........Rubber (natural and synthetic).
V..........Miscellaneous.

Class D. - Ingredients.

Class E. - Fillers:

I..........Cellulosic.
II.........Mineral.

DISCUSSION

Complete data from the laboratory studies of the 313 samples are given in the appendix, tables A-2 and A-3, along with the calculated values of ignition sensitivity, explosion severity, and index of explosibility. In addition to the data used in calculating the index of explosibility, the tables contain information on ignition temperature of the dust layer; relative flammability (percent added inert dust required to prevent flame propagation); maximum pressures and rates of pressure rise developed by explosions of dust clouds at concentrations other than 0.50 oz./cu.ft.; and in some instances, the limiting oxygen concentration in the atmosphere to prevent ignition by spark and by a hot surface. The relative flammability parameter is of primary interest for coals, as it indicates percentage of admixed inert dust required to arrest explosions in mines; this parameter may, however, be useful where inert or mineral fillers are admixed in molding compounds of plastic materials.

A summary of relative hazards of dusts studied is given in table 2. In general most of the materials present a strong to severe hazard.

The relative position of each subclass is determined by the sample within the subclass having the highest index of explosibility. The arrangement is not exact because of the wide range of indexes within the group; variation in explosibility index is attributed to differences in chemical composition, particle shape, and treatment, and to the inherent variation in the reproducibility of the tests used to evaluate the explosibility parameters.

Variation of Explosibility With Source of Dust

Fifteen samples of cellulose acetate were studied in the laboratory. These were received from four companies over a period of 19 years. The average index of explosibility of these cellulose acetate dusts is 7.3 with a range from 3.2 to >10. The variability of the 15 samples as indicated by the standard deviation is 3.45.

Analysis of the ratio of the variances of indexes of explosibility for the 15 cellulose acetate dusts and for 10 samples of cornstarch[15] prepared from a single lot shows that no significant difference exists between the variances at 95-percent confidence. This indicates the spread of the indexes for the 15 cellulose acetate samples received from four manufacturers is not significantly different from that expected for samples obtained from a single source.

Factors Affecting Explosibility of Plastic Dusts

Information on factors affecting explosibility is gained by examining data for comparable dusts. The following comparisons are made from data available, which in most instances are too limited to draw a definite conclusion.

Particle Shape

Processing of materials used in the plastics industry results in dusts which vary in particle shape. For example, irregular particles generally evolve from grinding or milling operations, whereas spray drying produces spherical particles. Table 3 shows that dusts composed of irregular particles present a greater explosion hazard than those composed of spherical particles. Spherical and irregular shaped particles are illustrated in figure 1, a photomicrograph of a non-heat-reacted phenol formaldehyde.

[15]Work cited in footnote 12, p. 19.

TABLE 2. - Summary of the explosibility of resins, molding compounds, ingredients, and fillers

Material Type	Material Class	Number of samples tested	Range of explosibility index	Material presenting maximum explosion hazard
Natural resins	C III	17	0.3->10	Rosin, DK.
Ingredients	D	51	<.1->10	Hexamethylene tetramine.
Coumarone-indene resins	C II	2	>10	Coumarone-indene resin, hard.
Miscellaneous resins	C V	19	<.1->10	Petrin acrylate monomer, crude.
Cellulosic resins	A III	41	<.1->10	Ethyl cellulose molding compound.
Phenolic resins	B VI	35	<.1->10	Phenol formaldehyde molding compound, cotton-flock filled.
Furane resins	B V	2	>10	Phenol furfural resin.
Polyethylene resins	A VIII	9	3.5->10	Polyethylene, low-pressure process.
Styrene polymer resins	A XII	11	.9->10	Polystyrene latex, spray-dried, with surfactants.
Acrylic polymer resins	A II	15	<.1->10	Methyl methacrylate-ethyl acrylate copolymer.
Polyester resins	B VII	5	4.9->10	Dimethyl terephthalate.
Epoxy resins	B IV	3	1.9->10	Epoxy resin.
Vinyl polymer resins	A XIII	30	<.1->10	Vinyl multipolymer, with vinylidene cyanide.
Allyl resins	B II	3	<.1->10	Allyl alcohol derivative, CR-39 resin, from dust collector.
Cellulosic fillers	E I	22	<.1->10	Wood flour.
Polyurethane resins	B VIII	2	>10	Polyurethane foam, fire-retardant.
Polypropylene resins	A X	6	<.1->10	Polypropylene, no antioxidant.
Cold-molded resins	C I	4	6.4->10	Petroleum resin, regular.
Acetal resin	A I	1	>10	Acetal resin (polyformaldehyde).
Nylon polymer resins	A VI	3	4.0->10	Nylon polymer resin.
Rubber	C IV	4	<.1->10	Rubber, synthetic.
Amino resins	B III	12	<.1->10	Urea formaldehyde molding compound, grade II, fine.
Polycarbonate resin	A VII	1	8.6	Polycarbonate resin.
Rayon	A XI	3	.1- 0.2	Rayon (viscose) flock, 1.5-denier, 0.02-inch, maroon.
Chlorinated polyether resin	A IV	1	.2	Chlorinated polyether alcohol resin.
Polymethylene resins	A IX	2	<.1	Carboxypolymethylene resin.
Alkyd resins	B I	2	<.1	Alkyd molding compound, mineral filler, not self-extinguishing.
Fluorocarbon resins	A V	5	<<.1	Fluoroethylene polymer resins.
Mineral fillers	E II	3	0	Asbestine, asbestos, and mica.

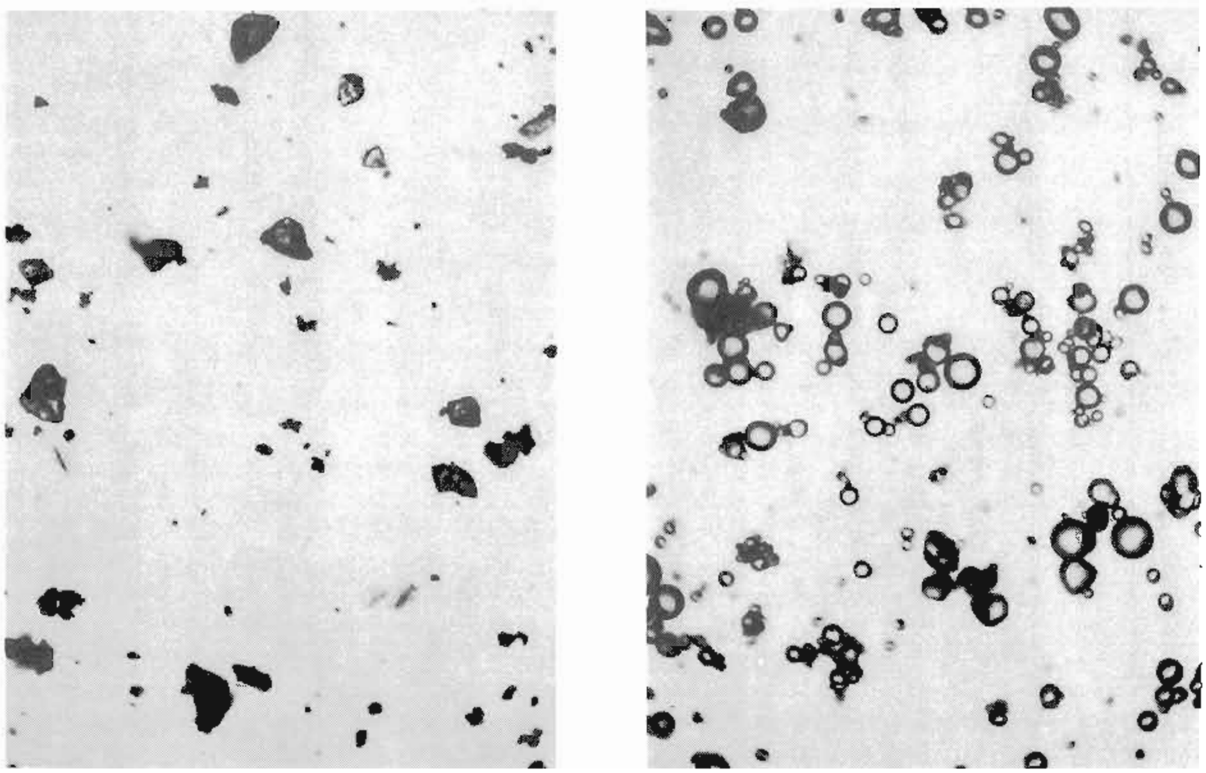

FIGURE 1. - Spherical and Irregular Shaped Particles of Non-Heat-Reacted Phenol Formaldehyde Resin (X 140).

TABLE 3. - Effect of particle shape on explosibility

	Explosibility index	
	Spherical shaped particles	Irregular shaped particles
Methyl methacrylate molding compound...........	6.1	>10
Methyl methacrylate-ethyl acrylate copolymer...	9.2	>10
Phenol formaldehyde...........................	<.1	>10
Phenol formaldehyde, non-heat-reacted..........	2.3	>10
Phenol formaldehyde derivative.................	5.8	>10

Additives

Table 4 summarizes materials studied with and without additives. Generally, admixing fillers affects the explosion hazard of the dusts. Adding combustible materials tends to increase, and adding inert fillers tends to decrease the explosion hazard. Cellulosic fillers present strong to severe explosion hazards, whereas the mineral fillers such as asbestos, glass, and mica are completely inert, presenting no fire or explosion hazard. In one instance addition of a catalyst reduced the explosibility of an epoxy resin. Incorporation of a fire retardant had only slight effect on explosibility of an alkyd molding compound or a polyurethane foam, probably due to the small proportion of the ingredient used.

TABLE 4. - Effect of additives on explosibility

Additive:	Explosibility index
Allyl alcohol derivative resin:	
None	>10
Glass fiber (35%)	<.1
Nitrosamine:	
None	>10
Oil-silica (5 and 15%)	1.0
Oil-silica (5 and 55%)	.7
Silica (60%)	<.1
Urea formaldehyde glue:	
None	<.1
Hardener	.1
Melamine formaldehyde resin:	
None	<.1
Plasticizer	.7
Polyvinyl chloride:	
None	<.1
Dioctyl phthalate plasticizer (33%)	2.9
Ethylene-maleic anhydride copolymer:	
None	.2
Wet with benzene-type solvent	>10
Epoxy resin:	
None	>10
Catalyst	7.2
Alkyd molding compound:	
None	<.1
Fire retardant	≪.1
Polyurethane foam:	
None	>10
Fire retardant (7.4%)	>10

Resin Structure

Table 5 indicates that modification of the resin affects the dust-explosion hazard. In general, the basic chemical structure of a resin governs its explosibility. Incorporation of the halogens, fluorides, and chlorides tends to decrease the hazard; substitution of a relatively nonflammable salt of a compound for the flammable compound reduces the potential hazard.

Among the acrylic resins, the modified methacrylic acid polymer presents the lowest explosion hazard. The potential hazard is increased by substituting an amide group on the acrylic nucleus and forming the isobutyl and methyl methacrylate esters. Polyacrylonitrile presents the most severe hazard. Imposing the alkyl groups on the esters had only a slight effect on explosibility. Similarly, little difference in explosibility was noted among the hydrocarbon resins, polyethylene, polypropylene, and polystyrene.

TABLE 5. - Effect of resin structure on explosibility

Material:	Explosibility index
Acrylic resins:	
Methacrylic acid polymer, modified	0.6
Acrylamide polymer	2.5
Isobutyl methacrylate polymer	4.3
Methyl methacrylate polymer	6.3
Acrylonitrile polymer	>10
Aldehyde resins:	
Melamine formaldehyde	<.1
Urea formaldehyde	<.1
Phenol formaldehyde	>10
Cellulosic resins:	
Carboxy methyl cellulose, sodium	<.1
Carboxy methyl hydroxy ethyl cellulose, sodium	<.1
Cellulose triacetate	7.4
Cellulose propionate	7.5
Cellulose acetate butyrate	8.0
Cellulose acetate	>10
Methyl cellulose	>10
Ethyl cellulose	>10
Vinyl resins:	
Polyvinyl chloride	<.1
Polyvinyl acetate	.2
Polyvinyl acetate alcohol	1.1
Polyvinyl butyral	>10

Explosibility of the formaldehyde resins, melamine, urea, and phenol, appears to increase as the nitrogen content of the primary ingredient decreases. The respective chemical compositions of the primary ingredients (exclusive of formaldehyde) are $C_3N_3(NH_2)_3$, $CO(NH_2)_2$, and C_6H_5OH.

With cellulosic resins, explosibility is not materially affected by differences in degree of substitution in the cellulose unit or by different radicals in the esters and ethers. However, explosibility is affected by the final form of the resin. The cellulose gums, sodium carboxy methyl and sodium carboxy methyl hydroxy ethyl cellulose, present weak hazards; the esters, cellulose acetate, cellulose acetate butyrate, and cellulose propionate, present strong to severe hazards; the ethers, ethyl and methyl cellulose, present severe explosion hazards.

Changing the chemical nature and structure of the substituents on the vinyl nucleus affects explosibility of the resin. Polyvinyl chloride is the least explosive; hydrolysis of polyvinyl acetate to polyvinyl acetate alcohol increases the explosibility. Polyvinyl butyral, which differs in chemical structure from the other vinyl resins, presents the most severe hazard.

Copolymerization

Combining or copolymerizing two or more monomers produces a copolymer having physical properties that differ from those of the polymeric resins. As shown in table 6, in three instances copolymerization resulted in a product with a higher degree of explosibility than the basic polymer. Copolymerization of acrylamide with a vinyl compound resulted in a product less explosive than the basic polymer. These data indicate that the dust-explosion hazard of copolymerized materials is essentially related to the explosibility of the separate components.

TABLE 6. - Effect of copolymerization on explosibility

Type of copolymer:	Explosibility index
Methyl methacrylate:	
Basic polymer	6.3
Ethyl acrylate copolymer	>10
Ethyl acrylate-styrene copolymer	>10
Ethyl acrylate-styrene-butadiene copolymer	>10
Styrene-butadiene-acrylonitrile copolymer	>10
Polystyrene:	
Basic polymer	.9
Acrylonitrile copolymer	1.9
Polyvinyl chloride:	
Basic polymer	<.1
Octyl acrylate copolymer (21%)	<.1
Hycar rubber copolymer	.3
Diisopropyl fumarate copolymer (30%)	.9
Acrylonitrile copolymer (40%)	1.9
Hycar rubber copolymer (30% more rubber than other sample)	8.8
Acrylonitrile copolymer (67%)	>10
Acrylonitrile copolymer (70%)	>10
Polyacrylamide:	
Basic polymer	2.5
Vinyl benzyl ammonium chloride copolymer (70%)	<.1

PREVENTION OF IGNITION AND EXPLOSIONS

There are many ways of reducing dust explosion hazards. Good housekeeping, preventing dust dissemination, elimination of igniting sources, use of inert atmospheres or explosion suppression devices, and venting are effective. Details for elimination of igniting sources and control of dust explosions are published by the National Fire Protection Association.[16]

[16] National Fire Protection Association, Combustible Solids, Chemicals and Explosives; chap. in National Fire Codes: Vol. 2, 1960-61.

APPENDIX

TABLE A-1. - Description and explosibility index of dusts

Line No.	Sample No.	Explo-sibility index	Material
			CLASS A. Thermoplastic Resins and Molding Compounds
			GROUP I, Acetal Resins
1	2382	>10	Acetal, linear (polyformaldehyde).
			GROUP II, Acrylic Resins
2	2158	6.3	Methyl methacrylate polymer.
3	832	>10	Methyl methacrylate molding compound, cyclone fines.
4	833	6.1	Methyl methacrylate molding compound, drier fines.
5	2162	>10	Methyl methacrylate-ethyl acrylate copolymer.
6	2392	9.2	Methyl methacrylate-ethyl acrylate copolymer, spray-dried.
7	2325	>10	Methyl methacrylate-ethyl acrylate-styrene copolymer.
8	2163	>10	Methyl methacrylate-styrene-butadiene-acrylonitrile copolymer.
9	2393	>10	Methyl methacrylate-styrene-butadiene-ethyl acrylate copolymer.
10	1639	.6	Methacrylic acid polymer, modified.
11	1193	5.0	Isobutyl methacrylate, from ledges in pulverizing room.
12	2269	2.5	Acrylamide polymer.
13	2268	<.1	Acrylamide-vinyl benzyl trimethyl ammonium chloride copolymer.
14	1859	>10	Acrylonitrile polymer.
15	2312	>10	Acrylonitrile-vinyl pyridine copolymer.
16	2184	>10	Acrylonitrile-vinyl chloride-vinylidene chloride copolymer (70-20-10).
			GROUP III, Cellulosic Resins
17	813	>10	Cellulose acetate.
18	814	4.1	Do.
19	1119	3.5	Cellulose acetate, 54.5 percent acetyl, for spinning.
20	1120	4.6	Cellulose acetate, 53.0 percent acetyl, for molding.
21	1258	-	Cellulose acetate.
22	1259	-	Do.
23	1296	>10	Do.
24	1304	7.7	Do.
25	1358	5.5	Do.
26	1454	6.5	Cellulose acetate, from bag filter on conveyor system.
27	1479	6.7	Cellulose acetate.
28	1550	5.8	Do.
29	1586	>10	Cellulose acetate, 5 to 10-micron dust.
30	1985	>10	Cellulose acetate, from rails and beams.
31	2074	>10	Cellulose acetate.
32	906	-	Do.
33	834	3.2	Cellulose acetate molding compound.
34	816	5.4	Cellulose triacetate.
35	1986	7.4	Cellulose triacetate, from floor near bag loader.
36	815	5.6	Cellulose acetate butyrate.
37	905	-	Do.
38	835	8.0	Cellulose acetate butyrate molding compound.
39	907	-	Cellulose acetate butyrate-cellulose acetate mixture.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explo-sibility index	Material
			CLASS A. Thermoplastic Resins and Molding Compounds (Con.)
			GROUP III. Cellulosic Resins (Con.)
40	1122	7.5	Cellulose propionate, 0.3 percent free hydroxyl.
41	1121	7.0	Cellulose tripropionate, 0 percent free hydroxyl.
42	1096	-	Ethyl cellulose.
43	1585	>10	Ethyl cellulose, 5 to 10-micron dust.
44	1703	>10	Ethyl cellulose, no fillers or plasticizers.
45	836	>10	Ethyl cellulose molding compound.
46	1702	>10	Methyl cellulose, no fillers or plasticizers.
47	1038	-	Carboxy methyl cellulose.
48	1318	<.1	Carboxy methyl cellulose, low viscosity, 0.3 to 0.4 percent substitution.
49	1319	1.4	Carboxy methyl cellulose, low viscosity, 0.3 to 0.4 percent substitution, acid product.
50	1376	<.1	Carboxy methyl cellulose, medium viscosity, 0.84 percent substitution.
51	2094	<.1	Carboxy methyl cellulose, 0.65 to 0.95 percent substitution.
52	2095	<.1	Do.
53	2096	<.1	Carboxy methyl cellulose, 0.2 to 0.3 percent substitution.
54	1381	<.1	Carboxy methyl cellulose, 0.98 percent substitution, 56.4 percent active agent.
55	1959	<.1	Carboxy methyl hydroxyethyl cellulose.
56	2093	<.1	Carboxy methyl hydroxyethyl cellulose, 0.65 to 0.85 percent substitution.
57	1846	1.7	Hydroxyethyl cellulose-mono sodium phosphate sizing compound.
			GROUP IV. Chlorinated Polyether Resins
58	2040	.2	Chlorinated polyether alcohol.
			GROUP V. Fluorocarbon Resins
59	2058	<<.1	Tetrafluoroethylene polymer, micronized.
60	1834	<<.1	Monochlorotrifluoroethylene polymer.
61	2216	<<.1	Do.
62	2271	<<.1	Monochlorotrifluoroethylene polymer, contaminated with monomer.
63	2272	<<.1	Monochlorotrifluoroethylene polymer, vacuum-dried.
			GROUP VI. Nylon Resins (Polyamide)
64	1837	>10	Nylon (polyhexamethylene adipamide) polymer, from filter.
65	1897	8.6	Nylon polymer, from duct, contains monomer, dust, and decomposition products from melt unit.
66	2041	4.0	Nylon, chemically precipitated.
			GROUP VII. Polycarbonate Resins
67	2369	8.6	Polycarbonate.
			GROUP VIII. Polyethylene Resins
68	944	2.4	Polyethylene, type D.
69	1862	>10	Polyethylene, high-pressure process.
70	1971	-	Do.
71	2015	4.0	Polyethylene, low-pressure process.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explo-sibility index	Material
			CLASS A. Thermoplastic Resins and Molding Compounds (Con.)
			GROUP VIII. Polyethylene Resins (Con.)
72	2142	>10	Polyethylene, low-pressure process.
73	2345A	-	Polyethylene, low-pressure process, melt index 0.4.
74	2345B	-	Polyethylene, low-pressure process, melt index 6.0.
75	2347	5.8	Polyethylene wax, low molecular weight.
			GROUP IX. Polymethylene Resins
76	2261	<.1	Carboxy polymethylene, regular.
77	2262	<.1	Carboxy polymethylene, dense.
			GROUP X. Polypropylene Resins
78	2255	.1	Polypropylene, molecular weight 1.8 million.
79	2256	2.3	Polypropylene, molecular weight 1.1 million.
80	2257	<.1	Polypropylene, molecular weight 0.6 million.
81	2298	8.0	Polypropylene, linear.
82	2342A	>10	Polypropylene, contains no antioxidant.
83	2342B	-	Polypropylene, contains 0.3 to 0.4 percent antioxidant.
			GROUP XI. Rayon
84	1673	.2	Rayon (viscose) flock, 1.5-denier, 0.020-inch, maroon.
85	1674	.1	Rayon (viscose) flock, 3.0-denier, 0.030-inch, red.
86	1675	.1	Rayon (viscose) flock, 5.5-denier, 1-millimeter, blue.
			GROUP XII. Styrene Polymer and Copolymer Resins
87	812	.9	Polystyrene, clear.
88	831	>10	Polystyrene molding compound.
89	2241	-	Polystyrene, special grind.
90	1451	4.1	Polystyrene, beads.
91	1931	>10	Polystyrene latex, spray-dried, contains surfactants.
92	1508	>10	Styrene-hydrocarbon monomer copolymer (85-15).
93	1509	-	Do.
94	2266	1.9	Styrene-acrylonitrile copolymer (70-30).
95	1584	5.8	Polystyrene-Buna N rubber coprecipitate.
96	1919	1.4	Styrene-butadiene latex copolymer, less than 4 percent zinc stearate blend.
97	2043	>10	Styrene-butadiene latex copolymer, over 75 percent styrene, alum coagulated.
			GROUP XIII. Vinyl Polymer and Copolymer Resins
98	808	.2	Polyvinyl acetate.
99	1637	1.1	Polyvinyl acetate alcohol.
100	807	>10	Polyvinyl butyral.
101	1352	<<.1	Polyvinyl chloride, fine.
102	1353	<<.1	Polyvinyl chloride, coarse.
103	1354	<<.1	Polyvinyl chloride copolymer.
104	1355	<<.1	Polyvinyl chloride, powdered.
105	1512	<<.1	Polyvinyl chloride, binder for fiber batting.
106	2281	<<.1	Polyvinyl chloride.
107	809	<<.1	Vinyl chloride-vinyl acetate copolymer.
108	810	<<.1	Do.
109	811	<<.1	Do.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explo-sibility index	Material
			CLASS A. Thermoplastic Resins and Molding Compounds (Con.)
			GROUP XIII. Vinyl Polymer and Copolymer Resins (Con.)
110	830	<<0.1	Vinyl chloride-vinyl acetate copolymer molding compound, mineral filler.
111	1836	1.9	Vinyl chloride-acrylonitrile copolymer (60-40), water emulsion product.
112	1835	>10	Vinyl chloride-acrylonitrile copolymer (33-67), water emulsion product.
113	1947	<.1	Vinyl chloride-polyoctyl acrylate copolymer (79-21).
114	1939	.9	Vinyl chloride-diisopropyl fumerate copolymer (70-30).
115	1579	2.9	Polyvinyl chloride-dioctyl phthalate mixture (67-33).
116	1356	9.4	Polyvinyl chloride-Hycar rubber copolymer.
117	1357	.3	Polyvinyl chloride-Hycar rubber copolymer (30 percent more resin than 1356).
118	1491	<<.1	Vinyl and vinylidene chloride copolymer, mainly vinyl.
119	1490	<<.1	Vinyl and vinylidene chloride copolymer, mainly vinylidene.
120	1452	<<.1	Vinylidene copolymer, contains 10 percent plasticizer.
121	829	<<.1	Vinylidene chloride polymer molding compound.
122	1868	>10	Vinyl multipolymer, contains monomeric vinylidene cyanide.
123	2199C	>10	Vinyl toluene-acrylonitrile-butadiene copolymer (58-19-23).
124	2199D	>10	Do.
125	2306	<.1	Polyvinyl toluene, sulfonated.
126	2305A	.2	Polyvinyl benzyl trimethyl ammonium chloride, flake.
127	2305B	1.0	Polyvinyl benzyl trimethyl ammonium chloride, yellow, contains some divinyl benzene.
			CLASS B. Thermosetting Resins and Molding Compounds
			GROUP I. Alkyd Resins
128	2367A	<.1	Alkyd molding compound, mineral filler, not self-extinguishing.
129	2367B	<<.1	Alkyd molding compound, mineral filler, self-extinguishing.
			GROUP II. Allyl Resins
130	1111	>10	Allyl alcohol derivative, CR-39, from dust collector.
131	1112	>10	Allyl alcohol derivative, CR-39, from sanding machine.
132	1130	<.1	Allyl alcohol derivative, CR-149 - glass fiber mixture (65-35).
			GROUP III. Amino Resins (Melamine and Urea)
133	2366A	<.1	Melamine formaldehyde, unfilled laminating type, no plasticizer.
134	2366B	.7	Melamine formaldehyde, unfilled laminating type, contains plasticizer.
135	801	<.1	Urea formaldehyde, spray-dried.
136	802	<.1	Urea formaldehyde, glue, no hardener or conditioning agents.
137	803	.1	Urea formaldehyde, glue, contains hardener and conditioning agents.
138	804	.5	Urea formaldehyde, laminating and impregnating glue.
139	825	.1	Urea formaldehyde molding compound, granular.
140	826	.6	Urea formaldehyde molding compound, from dust collector.
141	827	.4	Urea formaldehyde molding compound, grade I, medium-fine.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explo-sibility index	Material
			CLASS B. Thermosetting Resins and Molding Compounds (Con.)
			GROUP III. Amino Resins (Melamine and Urea) (Con.)
142	828	1.0	Urea formaldehyde molding compound, grade II, fine.
143	1638	.3	Urea formaldehyde molding compound, wood flour filler, spray-dried.
144	1678	.2	Urea formaldehyde-phenol formaldehyde molding compound, wood flour filler.
			GROUP IV. Epoxy Resins
145	2230	7.2	Epoxy, one part anhydride type, 1 percent catalyst.
146	2242	>10	Epoxy, no catalyst, modifier or additives.
147	2244	1.9	Epoxy-bisphenol A mixture.
			GROUP V. Furane Resins
148	799	>10	Phenol furfural.
149	2229	>10	Phenol furfural, contains 1.5 percent glycerol monooleate and 1 percent K_2CO_3.
			GROUP VI. Phenolic Resins
150	797	>10	Phenol formaldehyde.
151	1159	-	Do.
152	1181	1.9	Do.
153	1213	5.6	Do.
154	1549	>10	Do.
155	800	<.1	Phenol formaldehyde, powdered.
156	796	<.1	Phenol formaldehyde, spray-dried.
157	1672	<.1	Do.
158	1161	-	Phenol formaldehyde, alkaline.
159	792	>10	Phenol formaldehyde, 1-step.
160	793	>10	Phenol formaldehyde, 2-step.
161	794	>10	Do.
162	1162	-	Do.
163	2052	>10	Phenol formaldehyde, 2-step (novalac), non-heat-reacted, angular particles.
164	2053	2.3	Phenol formaldehyde, 2-step (novalac), non-heat-reacted, spherical particles.
165	2036	<.1	Phenol formaldehyde, non-heat-reacted, hollow spherical particles.
166	2037	<.1	Phenol formaldehyde, heat-reacted, hollow spherical particles.
167	1922	<.1	Phenol formaldehyde, heat-reacted, infusible, insoluble.
168	2228	>10	Phenol formaldehyde, contains 1.5 percent zinc stearate and 1 percent oxalic acid.
169	1511	>10	Phenol formaldehyde, binder for fiber batting.
170	1114	<.1	Phenol formaldehyde, semiresinous.
171	1513	-	Phenol formaldehyde, contains glass, organic and synthetic fibers.
172	1514	-	Phenol formaldehyde, contains higher percentage of fibers than 1513.
173	798	<.1	Phenol formaldehyde, contains 20 percent cellulosic extender.
174	824	>10	Phenol formaldehyde molding compound, cotton flock filler.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explosibility index	Material
			CLASS B. Thermosetting Resins and Molding Compounds (Con.)
			GROUP VI. Phenolic Resins (Con.)
175	823	>10	Phenol formaldehyde molding compound, wood flour filler.
176	947	-	Phenol formaldehyde, C stage, modified by hydrophilic groups on phenol.
177	948	-	Do.
178	949	-	Do.
179	946		Phenol formaldehyde, amine modified.
180	1733	>10	Phenol formaldehyde, polyalkylene polyamine modified.
181	795	>10	Phenol anhydro formaldehyde anilin, 2-step.
182	1431	5.8	Phenol formaldehyde derivative, contains calcium, spray-dried.
183	1432	>10	Phenol formaldehyde derivative, contains calcium, spray- and drum-dried.
184	1377	<<.1	Phenol formaldehyde, sulfonated.
			GROUP VII. Polyester Resins
185	2033	7.5	Polyethylene terephthalate.
186	2380	4.9	1, 4-cyclohexylene dimethylene isophthalate - 1, 4-cyclohexylene dimethylene terephthalate copolymer.
187	1875	5.2	Styrene modified polyester-glass fiber mixture (65-35).
			GROUP VIII. Polyurethane Resins (Isocyanate)
188	2361A	>10	Polyurethane foam (toluene diisocyanate-polyhydroxy with fluorocarbon blowing agent), not fire retardant.
189	2361B	>10	Polyurethane foam (toluene diisocyanate-polyhydroxy with fluorocarbon blowing agent), fire retardant.
			CLASS C. Special Resins and Molding Compounds
			GROUP I. Cold-Molded Resins
190	1196	>10	Gilsonite, from Michigan.
191	1199	>10	Gilsonite, from Utah.
192	1385	>10	Petroleum resin (blown asphalt), regular.
193	1386	6.2	Petroleum resin (blown asphalt), collector fines.
			GROUP II. Coumarone-Indene Resins
194	817	>10	Coumarone-indene, hard.
195	818	>10	Coumarone-indene, medium.
			GROUP III. Natural Resins
196	2326	>10	Cashew oil phenolic, hard.
197	2327	>10	Cashew oil phenolic, soft.
198	1492	1.0	Gum arabic, from Sudan.
199	822	>10	Gum, DK.
200	1493	.3	Gum, karaya, from India.
201	1489	>10	Gum, manila (copal), from Philippines.
202	1494	7.5	Gum, tragacanth, from Iran.
203	805	.8	Lignin, pure.
204	806	>10	Lignin, hydrolized-wood-type, fines.
205	821	>10	Rosin, DK.
206	899	-	Rosin, pine.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explo-sibility index	Material
CLASS C. Special Resins and Molding Compounds (Con.)			
			GROUP III, Natural Resins (Con.)
207	820	>10	Shellac.
208	1628	1.0	Sodium resinate, dry size, grade X.
209	1631	1.4	Sodium resinate, dry size, grade X, fines.
210	1147	2.6	Sodium resinate, dry size, grade XXX.
211	1636	1.0	Sodium resinate, dry size, grade NVX.
212	1643	1.0	Sodium resinate, dry size, plasticized.
			GROUP IV, Rubber
213	945	7.4	Rubber, crude, hard.
214	837	>10	Rubber, synthetic, hard, contains 33 percent sulfur.
215	2067	<<.1	Rubber, chlorinated.
216	1139	1.3	Rubber, from floor under buffer in tire recapping plant.
			GROUP V. Miscellaneous Resins
217	2165	>10	Alkyl ketene dimer sizing compound, dimer dispersed on silica (50-50).
218	819	<<.1	Chlorinated paraffin, plant milled, 70 percent chlorine.
219	1019	1.1	Chlorinated phenol (bis 2-hydroxy-5-chlorophenyl methane).
220	1485	<<.1	Chlorinated phenol (bis 2-hydroxy-3, 5, 6 trichlorophenyl methane).
221	1855	7.5	Cracking polymer, hydrocarbon, formed in separation of ethylene and propylene.
222	1945	<.1	Formaldehyde-naphthalene sulfonic acid copolymer, drum-dried.
223	1946	<.1	Do.
224	2240	5.8	Ethylene oxide polymer.
225	2258A	.2	Ethylene-maleic anhydride copolymer, dry.
226	2258B	>10	Ethylene-maleic anhydride copolymer, wet with benzene solvent.
227	1671	4.6	Styrene-maleic anhydride copolymer.
228	1600	>10	Styrene-maleic anhydride copolymer, non solvent process.
229	1601	1.1	Styrene-maleic anhydride copolymer, solvent process.
230	1602	.1	Styrene (sodium salt)-maleic anhydride copolymer, 75 percent salt of styrene.
231	2029	<<.1	Styrene sulfonate, sodium.
232	2115	<<.1	Styrene sulfonate, sodium, 25 percent active ingredient.
233	2116	<<.1	Styrene sulfonate, sodium, 35 percent active ingredient.
234	2117	<<.1	Styrene sulfonate, sodium, 45 percent active ingredient.
235	2259	>10	Petrin acrylate monomer, crude.
236	1554	<.1	Lacquer, stripped from gas cylinders.

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explo-sibility index	Material
			CLASS D. Ingredients
237	1936	>10	Aceto acetanilide.
238	1711	1.9	Adipic acid.
239	1524	>10	α Amino, α methyl mercaptan butyric acid (dl-methionine).
240	2286	>10	Alkyl nitroso methyl amide.
241	2287	>10	Alkyl nitroso methyl amide-mineral oil (80-20).
242	2284	>10	Aryl nitroso methyl amide.
243	2285	>10	Aryl nitroso methyl amide-mineral oil (80-20).
244	2363	6.4	Azelaic acid.
245	1453	>10	α, α' Azoisobutyronitrile.
246	2243	>10	Bisphenol A.
247	839	.4	Casein, rennet.
248	2108	6.8	Dicumyl peroxide suspended on $CaCO_3$ (40-60).
249	2303	>10	Dicyclopentadiene dioxide.
250	2377	>10	Dimethyl isophthalate.
251	1924	>10	Dimethyl terephthalate.
252	2045	>10	Ditertiary butyl para cresol.
253	2104	>10	Do.
254	2183	>10	Do.
255	2091	.8	Ethylene diamine tetra acetic acid, technical grade, spray-dried.
256	2238	1.6	Fumaric acid, finely divided.
257	2283	>10	Glyoxyl hydrate, polymeric.
258	2368	>10	Hardener mixture.
259	838	>10	Hexamethylene tetramine.
260	2362	4.0	Isophthalic acid.
261	1317	3.2	Lactalbumin.
262	2335A	.4	N-cyclohexyl-2-benzothiazole sulfanamide, from wet hopper.
263	2335B	8.9	N-cyclohexyl-2-benzothiazole sulfanamide, from dry hopper.
264	1808	>10	Nitrosamine, 100 percent.
265	1809	1.0	Nitrosamine-oil-silica mixture (80-5-15).
266	1810	.7	Nitrosamine-oil-silica mixture (40-5-55).
267	1811	<.1	Nitrosamine-silica mixture (40-60).
268	1896	>10	Para formaldehyde.
269	1345	<.1	Para nitro chlor benzol ferric sulfonate.
270	1344	<.1	Para nitro chlor benzol sodium sulfonate.
271	1321	<<.1	Para nitro chlor benzol sodium sulfonate, before explosion.
272	1322	<<.1	Para nitro chlor benzol sodium sulfonate, after explosion.
273	1268	>10	Para oxy benzaldehyde.
274	2051	9.0	Para phenylene diamine, milled.
275	2105	>10	Para tertiary butyl benzoic acid.
276	841	>10	Pentaerythritol.
277	661	-	Pentaerythritol (dipentaerythritol).
278	1085	-	Pentaerythritol, resin grade, 46.3 percent hydroxyl.
279	1086	-	Pentaerythritol, spray-dried, 39.6 percent hydroxyl.
280	1963	7.1	Phenyl beta naphthylamine, contains some beta naphthol.
281	840	>10	Phthalic anhydride.
282	662	-	Salicylic acid, U.S.P.
283	1575	<<.1	Salicylic acid sublimer dust (45 percent carbon, 3.3 percent hydrogen).

TABLE A-1. - Description and explosibility index of dusts (Con.)

Line No.	Sample No.	Explosibility index	Material
			CLASS D. Ingredients (Con.)
284	1692	-	Sodium benzene disulfonate.
285	1023	0.8	Stabilizer C.
286	1024	.1	Stabilizer L.
287	2378	6.9	Terephthalic acid.
288	1874	<<.1	Urea, crystal, ground.
			CLASS E. Fillers
			GROUP I. Cellulosic
289	1448	2.8	Cellulose.
290	845	1.2	Cellulose, alpha, pulp filler for urea molding compound.
291	1968	7.0	Cellulose, alpha, from dust collector.
292	1969	>10	Cellulose, alpha, from tunnel walls.
293	2153	8.7	Cellulose flock, fine cut.
294	2154	1.4	Cellulose flock, chemical cotton, fine cut.
295	2155	4.6	Cellulose flock, chemical cotton, collector dust.
296	2344A	-	Cellulose flock, unground.
297	1247	1.9	Cellucotton.
298	1882	1.6	Do.
299	844	>10	Cotton flock, ground, filler for phenolic molding compound.
300	2097	<.1	Cotton linters, raw.
301	1341	2.0	Cork.
302	1867	7.8	Do.
303	1889	9.7	Do.
304	1340	6.7	Wood, birch bark, ground.
305	1072	5.0	Wood, Douglas fir bark, ground, before screening.
306	1073	5.0	Wood, Douglas fir bark, ground, after screening.
307	1180	9.4	Wood flour.
308	843	>10	Wood flour, Grasselli ground, filler for urea molding compound.
309	842	>10	Wood flour, ground, filler for phenolic molding compound.
310	1577	9.9	Wood flour, white pine.
			GROUP II. Mineral
311	847	0	Asbestine.
312	846	0	Asbestos.
313	848	0	Mica.
314	-	1.0	Pittsburgh coal, high volatile A, bituminous.

TABLE A-2. - Ignition sensitivity, relative flammability, and limiting oxygen concentration of atmosphere for dusts

Line No.	Sample No.	Ignition sensitivity	Ignition temperature, ° C.		Minimum igniting energy for dust cloud, joule	Minimum explosive concentration, oz./cu.ft.	Relative flammability, percent inert		Limiting oxygen concentration, percent	
			Cloud	Layer			In furnace	In spark apparatus	Spark	Furnace, 850° C.
1	2382	6.5	440	-	0.020	0.035	90+	90+	11	-
2	2158	7.0	480	-	.020	.030	90+	80	11	8
3	832	15.3	440	-	.015	.020	90+	80	14	7
4	833	7.6	440	-	.020	.030	90+	-	14	7
5	2162	14.0	480	-	.010	.030	90+	90	11	-
6	2392	4.6	500	-	.025	.035	-	-	13	-
7	2325	9.2	440	-	.020	.025	90+	90	-	-
8	2163	8.4	480	-	.020	.025	90+	90	11	-
9	2393	6.7	480	-	.025	.025	-	-	13	-
10	1639	1.0	450	290	.100	.045	90+	85	-	-
11	1193	5.0	500	280	.040	.020	90+	90	-	-
12	2269	4.1	410	240	.030	.040	90+	80	-	-
13	2268	<.1	810	500	8.000	1.000	-	10	-	-
14	1859	8.1	500	460	.020	.025	90+	90+	13	-
15	2312	7.9	510	240	.025	.020	90+	90+	-	-
16	2184	5.9	650	210	.015	.035	90+	85	-	-
17	813	8.0	420	-	.015	.040	90+	80	14	7
18	814	4.6	420	-	.030	.035	90+	85	14	7
19	1119	1.4	450	-	.080	.040	90+	35	14	7
20	1120	2.0	470	-	.060	.035	90+	85	-	-
21	1258	2.7	420	420	.045	.040	90+	80	-	-
22	1259	2.1	420	420	.045	.050	90+	80	-	-
23	1296	3.8	470	400	.025	.045	90+	85	13	8
24	1304	2.4	460	430	.040	.045	90+	85	-	-
25	1358	2.5	400	400	.050	.040	90+	80	-	-
26	1454	3.1	460	430	.035	.040	90+	90	14	10
27	1479	2.3	480	380	.045	.040	90+	85	13	5
28	1550	2.4	420	400	.050	.040	90+	85	-	-
29	1586	6.4	450	390	.020	.035	90+	90	11	7
30	1985	3.5	430	-	.030	.045	90+	85	12	6
31	2074	4.2	440	340	.020	.055	90+	85	-	-
32	906	-	430	-	-	.035	90+	80	14	-
33	834	3.5	410	-	.040	.035	90+	80	14	7
34	816	4.5	430	-	.030	.035	90+	80	14	11
35	1986	3.9	430	-	.030	.040	90+	85	12	6
36	815	4.7	410	-	.030	.035	90+	85	14	7
37	905	-	440	-	-	.035	90+	85	14	-
38	835	7.3	370	-	.030	.025	90+	90	14	7
39	907	-	430	-	-	.030	90+	90	14	-
40	1122	2.9	460	-	.060	.025	90+	90	-	-
41	1121	3.9	460	-	.045	.025	90+	85	-	-
42	1096	-	-	-	-	.020	-	-	13	-
43	1585	21.8	370	[1]350	.010	.025	90+	90+	12	8
44	1703	15.8	340	[1]330	.015	.025	90+	90	-	-
45	836	25.2	320	-	.010	.025	90+	90	11	7
46	1702	9.3	360	340	.020	.030	90+	90	13	-
47	1038	-	350	290	-	-	90+	-	-	6
48	1318	.2	450	290	.180	.165	90+	20	-	-
49	1319	.5	460	310	.140	.060	90+	80	-	-
50	1376	.1	370	260	.560	.150	90+	5	-	-
51	2094	<.1	360	-	1.920	.400	90+	15	16	5
52	2095	<.1	330	-	.800	.350	90+	30	16	5
53	2096	<.1	400	-	1.920	.300	90+	5	18	5
54	1381	<.1	400	380	([2])	.340	90	5	-	-

See footnotes at end of table, p. 26.

TABLE A-2. - Ignition sensitivity, relative flammability, and limiting oxygen concentration of atmosphere for dusts (Con.)

Line No.	Sample No.	Ignition sensitivity	Ignition temperature, ° C.		Minimum igniting energy for dust cloud, joule	Minimum explosive concentration, oz./cu.ft.	Relative flammability, percent inert		Limiting oxygen concentration, percent	
			Cloud	Layer			In furnace	In spark apparatus	Spark	Furnace, 850° C.
55	1959	<0.1	400	330	1.280	0.250	90+	50	18	3
56	2093	<.1	380	-	.960	.200	90+	55	18	5
57	1846	2.1	390	340	.035	.070	90+	85	-	-
58	2040	.6	460	-	.160	.045	90+	65	-	-
59	2058	<<.1	670	[1]570	([2])	([3])	60	-	-	8
60	1834	<<.1	600	[1]720	([2])	([3])	75	-	-	-
61	2216	<<.1	600	-	([2])	([3])	55	-	-	-
62	2271	<<.1	620	-	([2])	([3])	55	-	-	-
63	2272	<<.1	670	-	([2])	([3])	10	-	-	-
64	1837	6.7	500	430	.020	.030	90+	90	13	6
65	1897	2.6	510	-	.030	.050	90+	85	-	-
66	2041	3.6	540	-	.030	.035	90+	85	-	-
67	2369	4.5	710	-	.025	.025	-	85	15	-
68	944	2.2	450	-	.080	.025	90+	-	15	8
69	1862	7.5	450	380	.030	.020	90+	90+	13	-
70	1971	-	410	-	-	-	90+	-	-	-
71	2015	4.0	420	-	.060	.020	90+	90+	12	7
72	2142	22.4	450	-	.010	.020	90+	90+	-	-
73	2345A	-	430	-	-	-	-	-	-	-
74	2345B	-	420	-	-	-	-	-	-	-
75	2347	7.2	400	-	.035	.020	-	-	13	-
76	2261	<.1	520	-	([2])	.325	90+	70	-	-
77	2262	.1	520	-	.640	.115	90+	70	-	-
78	2255	.3	460	-	.400	.035	90+	70	-	-
79	2256	5.8	460	-	.025	.030	90+	90	-	-
80	2257	.2	460	-	.400	.055	90+	80	-	-
81	2298	8.0	420	-	.030	.020	90+	90+	-	-
82	2342A	8.0	420	-	.030	.020	90+	90+	-	-
83	2342B	-	420	-	-	-	-	-	-	-
84	1673	.3	520	250	.240	.055	-	-	-	-
85	1674	.3	530	260	.240	.060	-	-	-	-
86	1675	.3	520	280	.240	.060	-	-	-	-
87	812	1.7	490	-	.120	.020	90+	90+	14	7
88	831	6.0	560	-	.040	.015	90+	90+	14	9
89	2241	5.0	500	-	.040	.020	-	-	-	-
90	1451	2.7	500	[1]470	.060	.025	90+	90	-	-
91	1931	13.4	500	[1]500	.015	.020	90+	90+	-	-
92	1508	6.3	460	[1]450	.035	.020	90+	90+	-	-
93	1509	-	460	[1]470	-	-	90+	90+	-	-
94	2266	3.8	500	-	.030	.035	90+	85	-	-
95	1584	2.5	510	[1]500	.080	.020	90+	90	-	-
96	1919	2.4	470	-	.060	.030	90+	90	-	-
97	2043	7.3	440	-	.025	.025	90+	90+	13	-
98	808	.6	550	-	.160	.040	90+	75	17	11
99	1637	.9	520	440	.120	.035	90+	85	-	-
100	807	25.8	390	-	.010	.020	90+	80	14	5
101	1352	<<.1	660	400	([2])	([3])	80	-	-	-
102	1353	<<.1	690	480	([2])	([3])	80	-	-	-
103	1354	<<.1	720	500	([2])	([3])	-	-	-	-
104	1355	<<.1	680	400	([2])	([3])	85	-	-	-
105	1512	<<.1	670	-	([2])	([3])	25	-	-	-
106	2281	<<.1	730	290	([2])	([3])	-	-	-	-
107	809	<<.1	690	-	([2])	([3])	5	-	-	15
108	810	<<.1	750	-	([2])	([3])	-	-	-	15

See footnotes at end of table, p. 26.

TABLE A-2. - Ignition sensitivity, relative flammability, and limiting oxygen concentration of atmosphere for dusts (Con.)

Line No.	Sample No.	Ignition sensitivity	Ignition temperature, ° C.		Minimum igniting energy for dust cloud, joule	Minimum explosive concentration, oz./cu.ft.	Relative flammability, percent inert		Limiting oxygen concentration, percent	
			Cloud	Layer			In furnace	In spark apparatus	Spark	Furnace, 850° C.
109	811	<<0.1	710	-	(2)	(3)	-	-	-	15
110	830	<<.1	690	-	(2)	(3)	5	-	-	15
111	1836	3.1	570	470	0.025	0.045	90+	70	-	-
112	1835	7.2	530	470	.015	.035	90+	90	15	-
113	1947	<.1	500	430	.960	.100	90+	30	-	-
114	1939	1.0	580	-	.060	.060	90+	70	-	-
115	1579	3.6	320	-	.050	.035	90+	70	-	-
116	1356	5.5	490	-	.030	.025	90+	90	-	-
117	1357	.9	550	460	.060	.070	90+	40	-	-
118	1491	<<.1	780	450	(2)	(3)	-	-	-	-
119	1490	<<.1	(4)	420	(2)	(3)	-	-	-	-
120	1452	<<.1	830	390	(2)	(3)	-	-	-	-
121	829	<<.1	900	-	(2)	(3)	-	-	-	-
122	1868	8.9	500	510	.015	.030	90+	90	11	-
123	2199C	9.5	530	-	.020	.020	90+	90+	-	-
124	2199D	9.5	530	-	.020	.020	90+	90+	-	-
125	2306	<.1	540	330	2.880	1.000	90+	5	-	-
126	2305A	.8	420	240	.140	.045	90+	70	-	-
127	2305B	1.4	410	220	.100	.035	90+	80	-	-
128	2367A	.2	500	270	.120	.155	90+	25	15	-
129	2367B	<<.1	510	270	(2)	(3)	90+	-	-	-
130	1111	5.6	510	-	.020	.035	90	85	13	4
131	1112	1.9	500	-	.060	.035	90	90	-	4
132	1130	<.1	540	-	1.600	.345	90+	35	-	-
133	2366A	.1	810	-	.320	.085	-	55	17	-
134	2366B	.8	790	-	.050	.065	-	70	15	-
135	801	<.1	530	-	1.280	.135	70	25	17	15
136	802	.1	510	-	.640	.070	85	50	17	13
137	803	.1	510	-	.960	.075	85	50	17	15
138	804	.8	470	-	.080	.070	85	60	17	11
139	825	.3	480	-	.080	.165	90+	70	17	11
140	826	.5	530	-	.080	.090	85	65	17	11
141	827	.4	450	-	.160	.075	90+	65	17	11
142	828	.6	460	-	.080	.085	90+	70	17	9
143	1638	.3	490	530	.160	.075	90+	75	-	-
144	1678	.4	530	240	.120	.085	90+	70	-	-
145	2230	3.6	530	-	.035	.030	90+	85	-	-
146	2242	12.4	540	-	.015	.020	90+	90	12	-
147	2244	3.8	510	-	.035	.030	90+	85	-	-
148	799	15.2	530	-	.010	.025	90+	90	14	11
149	2229	15.5	520	310	.010	.025	90+	90	-	-
150	797	9.3	580	-	.015	.025	90+	85	17	11
151	1159	3.4	670	-	.025	.035	-	90	-	-
152	1181	1.0	730	-	.080	.035	-	80	-	-
153	1213	3.3	700	-	.035	.025	-	90	-	-
154	1549	6.9	580	-	.020	.025	90+	90	-	-
155	800	<.1	630	-	(2)	.175	90+	50	19	15
156	796	<.1	580	-	3.840	.175	90+	75	-	13
157	1672	<.1	660	320	6.000	.200	90+	-	-	-
158	1161	2.7	620	-	.030	.040	-	85	-	-
159	792	7.9	640	-	.010	.040	90+	90	14	9
160	793	13.9	580	-	.010	.025	90+	90	14	9
161	794	7.7	580	-	.015	.030	90+	90	14	9
162	1162	3.2	590	-	.030	.035	90+	90	-	-

See footnotes at end of table, p. 26.

TABLE A-2. - Ignition sensitivity, relative flammability, and limiting oxygen concentration of atmosphere for dusts (Con.)

Line No.	Sample No.	Ignition sensitivity	Ignition temperature, ° C.		Minimum igniting energy for dust cloud, joule	Minimum explosive concentration, oz./cu.ft.	Relative flammability, percent inert		Limiting oxygen concentration, percent	
			Cloud	Layer			In furnace	In spark apparatus	Spark	Furnace, 850° C.
163	2052	5.4	620	-	0.020	0.030	90+	85	-	-
164	2053	2.9	650	-	.030	.035	90+	80	-	-
165	2036	<.1	500	190	([2])	.250	90+	-	-	-
166	2037	<.1	490	180	([2])	.250	90+	-	-	-
167	1922	<.1	500	210	1.300	.200	90+	-	-	-
168	2228	14.6	550	300	.010	.025	90+	90	-	-
169	1511	5.4	600	-	.025	.025	90+	90	-	-
170	1114	<.1	460	-	([2])	.235	90+	-	-	-
171	1513	-	590	-	-	-	90+	75	-	-
172	1514	-	540	-	-	-	90+	-	-	-
173	798	<.1	500	-	3.840	.120	90+	75	19	13
174	824	13.7	490	-	.010	.030	90+	80	14	7
175	823	8.9	500	-	.015	.030	90+	80	14	9
176	947	-	440	-	-	-	90+	-	-	12
177	948	-	590	-	-	-	90+	-	-	12
178	949	-	500	-	-	-	90+	-	-	12
179	946	-	510	-	-	.070	90+	90	-	12
180	1733	16.0	420	290	.015	.020	90+	90	-	-
181	795	10.1	570	-	.010	.035	90+	90	14	9
182	1431	5.8	460	480	.025	.030	90+	90	14	10
183	1432	8.8	460	480	.020	.025	90+	90	14	10
184	1377	<<.1	640	430	([2])	([3])	60	-	-	-
185	2033	2.9	500	-	.035	.040	90+	85	13	-
186	2380	5.4	500	-	.025	.030	-	70	13	-
187	1875	2.0	440	360	.050	.045	90+	85	-	-
188	2361A	6.6	510	440	.020	.030	-	-	-	-
189	2361B	9.8	550	390	.015	.025	-	-	-	-
190	1196	7.2	560	-	.025	.020	90+	85	-	-
191	1199	6.9	580	-	.025	.020	90+	90	-	-
192	1385	6.3	510	[1]500	.025	.025	90+	90	-	-
193	1386	2.8	510	[1]550	.040	.035	90+	90+	-	-
194	817	24.4	550	-	.010	.015	90+	90+	14	11
195	818	25.8	520	-	.010	.015	90+	90+	14	11
196	2326	6.6	490	200	.025	.025	90+	90	14	-
197	2327	6.9	470	180	.025	.025	90+	90	14	-
198	1492	.7	500	260	.100	.060	90+	85	-	-
199	822	34.4	390	-	.010	.015	90+	90	14	9
200	1493	.2	520	240	.180	.100	90+	75	-	-
201	1489	6.2	360	[1]390	.030	.030	90+	90	-	-
202	1494	2.6	490	260	.045	.040	90+	85	-	-
203	805	.4	510	-	.160	.065	90+	55	17	13
204	806	5.6	450	-	.020	.040	90+	75	17	7
205	821	34.4	390	-	.010	.015	90+	90+	14	9
206	899	-	440	-	-	.055	90+	90+	17	10
207	820	25.2	400	-	.010	.020	90+	90+	14	9
208	1628	.7	380	[1]480	.160	.045	90+	90	16	-
209	1631	.8	380	[1]400	.160	.040	90+	90	14	-
210	1147	2.4	350	220	.060	.040	90+	90	17	-
211	1636	1.1	410	[1]520	.100	.045	90+	85	14	-
212	1643	1.3	440	490	.100	.035	90+	90	14	-
213	945	4.6	350	-	.050	.025	90+	90	15	13
214	837	7.0	320	-	.030	.030	90+	90+	15	11
215	2067	<<.1	940	290	([3])	([3])	-	-	-	-
216	1139	1.8	450	-	.050	.050	90+	85	-	-

See footnotes at end of table, p. 26.

TABLE A-2. - Ignition sensitivity, relative flammability, and limiting oxygen concentration of atmosphere for dusts (Con.)

Line No.	Sample No.	Ignition sensitivity	Ignition temperature, ° C.		Minimum igniting energy for dust cloud, joule	Minimum explosive concentration, oz./cu.ft.	Relative flammability, percent inert		Limiting oxygen concentration, percent	
			Cloud	Layer			In furnace	In spark apparatus	Spark	Furnace, 850° C.
217	2165	5.3	420	160	0.030	0.030	90+	85	15	-
218	819	<<.1	840	-	([2])	([3])	-	-	-	-
219	1019	1.5	570	-	.060	.040	90+	65	16	13
220	1485	<<.1	([4])	450	([2])	([3])	-	-	-	-
221	1855	5.0	450	290	.030	.030	90+	85	-	-
222	1945	<.1	620	290	([2])	.570	80	-	-	-
223	1946	<.1	610	450	([2])	.165	80	-	-	-
224	2240	6.4	350	-	.030	.030	90+	90	12	5
225	2258A	1.0	540	-	.040	.095	90+	70	[5]11	-
226	2258B	5.4	500	-	.010	.075	90+	90	[5]11	-
227	1671	2.9	470	420	.050	.030	90+	90+	-	-
228	1600	7.1	470	490	.020	.030	90+	90+	-	-
229	1601	1.8	500	500	.050	.045	90+	85	-	-
230	1602	.2	400	420	.240	.105	90+	50	-	-
231	2029	<<.1	610	290	([2])	([3])	60	-	-	-
232	2115	<<.1	590	290	([2])	([3])	70	-	-	-
233	2116	<<.1	590	320	([2])	([3])	65	-	-	-
234	2117	<<.1	590	290	([2])	([3])	75	-	-	-
235	2259	10.2	220	-	.020	.045	90+	85	-	-
236	1554	.1	490	200	.180	.250	90+	40	-	-
237	1936	6.0	560	-	.020	.030	90+	90	-	-
238	1711	1.7	550	-	.060	.035	90+	85	-	-
239	1524	6.2	370	[1]360	.035	.025	90+	85	15	7
240	2286	35.8	150	-	.015	.025	90+	90+	-	-
241	2287	18.6	160	-	.015	.045	90+	90+	-	-
242	2284	5.5	490	-	.015	.050	90+	85	-	-
243	2285	9.3	360	-	.015	.040	90+	90	-	-
244	2363	5.3	610	-	.025	.025	-	-	14	-
245	1453	12.5	430	[1]350	.025	.015	90+	90+	-	-
246	2243	11.8	570	-	.015	.020	90+	90+	12	-
247	839	1.4	520	-	.060	.045	90	35	17	7
248	2108	2.7	560	180	.030	.045	90+	80	13	-
249	2303	15.9	420	-	.030	.015	90+	90+	-	-
250	2377	9.3	580	-	.015	.025	-	85	13	-
251	1924	5.9	570	-	.020	.030	90+	90+	12	6
252	2045	10.7	470	-	.020	.020	90+	90	14	12
253	2104	9.4	430	-	.025	.020	90+	90+	-	-
254	2183	21.3	420	-	.015	.015	90+	90+	13	9
255	2091	1.2	450	-	.050	.075	90+	75	-	-
256	2238	1.3	520	-	.035	.085	90+	80	-	-
257	2283	4.3	360	250	.020	.065	90+	85	12	9
258	2368	5.4	430	220	.025	.035	90+	90	13	-
259	838	32.7	410	-	.010	.015	90+	90+	14	11
260	2362	3.3	700	-	.025	.035	-	-	14	-
261	1317	1.8	570	240	.050	.040	90+	85	15	11
262	2335A	.4	460	-	.140	.075	90+	80	-	-
263	2335B	3.3	390	-	.045	.035	90+	90	-	-
264	1808	5.0	270	-	.060	.025	90+	90+	-	-
265	1809	3.2	310	-	.080	.025	90+	80	-	-
266	1810	1.1	310	-	.100	.060	90	80	-	-
267	1811	.3	350	-	.100	.200	85	65	-	-
268	1896	6.1	410	-	.020	.040	90+	90	12	-
269	1345	<.1	460	[1]330	([2])	.420	85	-	-	-
270	1344	<.1	450	[1]320	([2])	.180	85	-	-	-

See footnotes at end of table, p. 26.

TABLE A-2. - Ignition sensitivity, relative flammability, and limiting oxygen concentration of atmosphere for dusts (Con.)

Line No.	Sample No.	Ignition sensitivity	Ignition temperature, ° C.		Minimum igniting energy for dust cloud, joule	Minimum explosive concentration, oz./cu.ft.	Relative flammability, percent inert		Limiting oxygen concentration, percent	
			Cloud	Layer			In furnace	In spark apparatus	Spark	Furnace, 850° C.
271	1321	<<0.1	540	[1] 380	([2])	([3])	75	-	-	-
272	1322	<<.1	550	[1] 380	([2])	([3])	75	-	-	-
273	1268	17.7	380	430	0.015	0.020	90+	90+	-	-
274	2051	4.3	620	-	.030	.025	90+	90	-	-
275	2105	7.2	560	-	.025	.020	90+	90+	-	-
276	841	14.9	450	-	.010	.030	90+	90	14	7
277	661	-	400	-	-	.035	90+	85	[5] 13	-
278	1085	-	-	-	-	.030	-	-	14	7
279	1086	-	-	-	-	.045	-	-	14	7
280	1963	4.7	680	-	.025	.025	90+	90	-	-
281	840	13.8	650	-	.015	.015	90+	90	14	11
282	662	-	590	-	-	.025	90+	85	[5] 13	-
283	1575	<<.1	600	360	([2])	([3])	90+	-	-	-
284	1692	<.1	630	450	5.000	.350	85	15	-	-
285	1023	.5	510	-	.040	.180	70	80	15	13
286	1024	.1	550	-	.320	.200	10	55	15	13
287	2378	3.0	680	-	.020	.050	-	80	15	-
288	1874	<<.1	900	-	([2])	([3])	-	-	-	-
289	1448	1.0	480	270	.080	.055	90+	80	13	-
290	845	.9	480	-	.080	.060	90+	85	17	7
291	1968	2.2	410	310	.045	.050	90+	85	-	-
292	1969	2.7	410	300	.040	.045	90+	85	-	-
293	2153	2.3	460	260	.035	.055	90+	85	13	-
294	2154	1.1	460	290	.060	.065	90+	80	13	-
295	2155	1.7	460	280	.040	.065	90+	80	13	-
296	2344A	-	420	-	-	-	-	-	-	-
297	1247	1.1	460	310	.080	.050	90+	80	-	-
298	1882	1.0	440	260	.080	.055	90+	80	-	-
299	844	3.4	470	-	.025	.050	90+	75	17	7
300	2097	<.1	520	-	1.920	.500	90+	-	18	5
301	1341	.8	490	280	.100	.050	90+	80	-	-
302	1867	2.7	470	230	.045	.035	90+	85	-	-
303	1889	2.7	470	-	.045	.035	90+	85	-	-
304	1340	3.7	450	250	.060	.020	90+	90+	-	-
305	1072	3.1	540	270	.040	.030	90+	90+	-	-
306	1073	3.1	540	270	.040	.030	90+	90+	-	-
307	1180	3.6	470	300	.030	.040	90+	85	-	-
308	843	4.7	430	-	.020	.050	90+	80	17	7
309	842	2.8	450	-	.040	.040	90+	80	17	7
310	1577	3.1	470	260	.040	.035	90+	85	-	-
311	847	0	([4])	-	([2])	([3])	-	-	-	-
312	846	0	([4])	-	([2])	([3])	-	-	-	-
313	848	0	([4])	-	([2])	([3])	-	-	-	-
314	-	1.0	610	-	.060	.055	-	-	-	-

[1] Ignition denoted by flame, all others glow.
[2] No ignition to 8.32 joules, the highest tried.
[3] No ignition to 2.00 oz./cu.ft., the highest tried.
[4] No ignition to 1,000° C., the highest tried.
[5] Air-N_2 atmosphere, all others air-CO_2.

TABLE A-3. - Explosion severity, pressures, and rates of pressure rise of dust explosions

Line No.	Sample No.	Explosion severity	Concentration															
			0.10 oz./cu.ft.			0.20 oz./cu.ft.			0.50 oz./cu.ft.			1.00 oz./cu.ft.			2.00 oz./cu.ft.		
			Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.	
				Average	Maximum		Average	Maximum		Average	Maximum		Average	Maximum		Average	Maximum
1	2382	1.9	30	250	450	66	1,100	2,800	89	1,600	4,100	105	1,500	3,600	113	1,100	2,900
2	2158	.9	34	150	250	54	400	1,200	84	900	2,000	75	500	1,100	67	350	900
3	832	1.0	44	600	1,200	-	-	-	101	450	1,800	-	-	-	-	-	-
4	[1]833	.8	38	100	200	-	-	-	80	800	1,800	-	-	-	-	-	-
5	2162	2.7	67	1,400	5,000	70	2,000	6,000	85	1,500	6,000	85	1,300	3,900	79	800	2,200
6	2392	2.0	56	1,200	3,600	74	1,600	4,700	77	1,800	5,000	87	1,000	3,500	78	600	1,000
7	2325	1.7	61	1,100	2,800	64	1,400	3,400	75	1,400	4,400	90	1,200	3,200	76	600	1,500
8	2163	1.4	62	1,500	3,900	68	1,700	4,700	76	1,300	3,400	87	1,100	3,100	74	700	1,900
9	2393	1.5	61	1,100	2,900	73	1,500	4,300	83	1,300	3,500	84	1,200	3,100	80	800	1,500
10	1639	.6	7	100	100	33	200	400	82	700	1,500	97	900	1,800	-	-	-
11	[1]1193	1.0	46	1,200	1,600	74	1,800	2,800	73	1,600	2,500	55	1,600	2,400	-	-	-
12	2269	.6	49	600	1,200	65	900	2,500	74	900	1,600	85	700	1,200	70	400	700
13	2268	-	-	-	-	-	-	-	-	-	-	9	100	100	13	100	100
14	1859	2.3	65	2,600	7,000	75	3,200	11,000	89	2,000	5,000	77	800	3,000	-	-	-
15	2312	2.4	61	1,600	3,900	71	1,700	4,800	77	1,900	6,000	85	1,300	2,600	76	800	1,600
16	2184	3.0	72	2,500	15,000	87	3,200	13,000	83	1,900	7,000	76	1,000	3,100	67	500	1,500
17	813	1.6	41	600	1,400	-	-	-	85	1,300	3,600	-	-	-	-	-	-
18	814	.9	41	600	1,200	-	-	-	78	900	2,200	-	-	-	-	-	-
19	[1]1119	2.5	34	400	700	-	-	-	94	1,800	5,000	-	-	-	-	-	-
20	[1]1120	2.3	36	500	900	-	-	-	88	2,200	5,000	-	-	-	-	-	-
21	1258	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	1259	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	[2]1296	3.0	46	900	2,100	80	2,000	6,000	135	2,400	5,000	135	1,800	4,000	130	1,200	3,000
24	1304	3.2	43	600	1,400	69	1,400	3,500	110	2,500	5,500	120	1,800	2,900	-	-	-
25	1358	2.2	47	900	1,400	79	1,300	2,600	98	1,500	4,200	116	1,600	5,000	-	-	-
26	[1]1454	2.1	46	700	1,700	74	1,400	3,500	98	1,400	4,000	95	1,400	3,600	-	-	-
27	1479	2.9	42	800	1,500	57	1,100	2,500	112	1,700	5,000	121	1,500	4,700	-	-	-
28	1550	2.4	42	900	1,800	67	1,100	2,400	101	2,200	4,500	118	2,200	5,000	-	-	-
29	1586	3.7	41	1,200	3,200	72	2,100	5,500	108	2,200	6,500	114	1,800	5,000	-	-	-
30	1985	3.2	39	500	900	67	1,500	4,100	103	1,900	6,000	107	1,600	6,000	96	900	2,200
31	2074	3.1	47	700	1,500	72	1,000	3,100	99	1,500	6,000	120	1,600	6,000	113	1,000	2,200
32	[2]906	1.5	35	500	1,000	-	-	-	80	1,200	3,500	-	-	-	-	-	-
33	834	.9	40	400	800	-	-	-	90	1,000	1,900	-	-	-	-	-	-
34	816	1.2	36	400	800	-	-	-	89	1,200	2,600	-	-	-	-	-	-
35	1986	1.9	46	800	1,600	71	1,300	4,300	84	1,600	4,300	102	1,400	3,900	107	1,200	2,000
36	815	1.2	42	600	1,100	-	-	-	85	1,100	2,700	-	-	-	-	-	-
37	905	1.5	44	500	1,200	-	-	-	81	1,400	3,500	-	-	-	-	-	-
38	835	1.1	49	500	1,400	-	-	-	81	1,000	2,700	-	-	-	-	-	-
39	[1]907	2.8	39	600	1,100	-	-	-	90	2,400	6,000	-	-	-	-	-	-
40	1122	2.6	37	600	1,000	-	-	-	105	1,600	4,700	-	-	-	-	-	-
41	[1]1121	1.8	42	700	1,200	-	-	-	88	2,200	4,000	-	-	-	-	-	-
42	1096	2.9	51	900	1,900	-	-	-	100	1,600	5,500	-	-	-	-	-	-
43	1585	3.4	54	1,800	4,700	72	2,400	5,500	101	2,800	6,500	120	2,200	5,500	-	-	-
44	1703	3.6	62	1,700	3,500	74	2,200	4,700	98	2,600	7,000	112	2,200	4,500	-	-	-
45	836	3.2	47	800	1,700	-	-	-	102	2,100	6,000	-	-	-	-	-	-
46	1702	3.1	40	800	1,600	64	1,400	3,100	99	1,900	6,000	133	2,400	5,500	-	-	-
47	[1]1038	.2	-	-	-	-	-	-	63	400	700	48	200	400	-	-	-
48	[1]1318	.2	-	-	-	22	100	200	62	400	700	98	500	900	-	-	-
49	[1]1319	2.7	46	900	1,800	84	1,800	4,000	114	1,600	4,500	130	1,600	5,000	-	-	-
50	[1]1376	.5	-	-	-	20	200	300	81	600	1,200	126	800	1,600	-	-	-
51	2094	.2	-	-	-	-	-	-	58	250	500	77	250	500	-	-	-
52	2095	.2	-	-	-	-	-	-	66	250	600	86	350	800	-	-	-
53	2096	<.1	-	-	-	-	-	-	38	100	250	89	400	800	-	-	-
54	[1]1381	.2	-	-	-	-	-	-	55	400	700	78	400	700	-	-	-
55	1959	.1	-	-	-	-	-	-	50	150	200	90	300	700	96	300	700
56	2093	.3	-	-	-	11	100	100	74	350	800	83	350	600	-	-	-
57	1846	.8	20	200	300	41	600	1,100	76	800	1,900	110	1,400	4,000	107	1,100	3,000
58	2040	.3	23	200	350	40	400	700	66	500	1,000	79	900	1,900	88	500	1,200
59	2058	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	1834	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	2216	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	2271	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	2272	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
64	1837	1.8	57	1,000	2,100	67	1,000	2,200	85	1,200	4,000	95	1,500	3,600	67	450	1,000
65	1897	3.3	50	1,000	3,100	68	1,500	4,800	89	1,500	7,000	94	1,500	6,500	81	600	1,500
66	2041	1.1	39	200	400	73	600	1,500	95	1,000	2,200	98	800	1,900	82	600	1,300
67	2369	1.9	56	900	2,400	64	1,400	3,700	78	1,600	4,700	96	1,400	3,300	91	900	2,000
68	[2]944	1.1	62	700	1,400	-	-	-	83	1,000	2,500	72	300	600	-	-	-
69	1862	1.4	64	1,000	2,600	78	1,700	4,000	81	1,500	3,400	72	800	2,000	-	-	-
70	1971	.8	-	-	-	79	800	2,200	85	700	1,900	-	-	-	-	-	-
71	2015	1.0	61	500	1,500	72	1,100	2,100	82	1,100	2,300	87	1,000	2,000	69	600	1,000
72	2142	2.3	67	2,100	7,500	73	1,900	6,500	80	1,600	5,500	68	900	5,500	53	400	1,100
73	2345A	1.4	65	1,200	3,200	67	1,300	3,200	81	1,100	3,400	80	900	1,900	63	600	1,300
74	2345B	2.2	61	1,600	4,400	71	2,000	6,500	83	1,400	5,000	78	900	2,600	69	600	1,100
75	2347	.8	60	900	2,000	72	1,100	3,000	74	900	2,100	71	800	2,000	71	600	1,300
76	2261	2.0	-	-	-	-	-	-	70	1,600	5,500	66	1,000	2,000	57	500	1,000
77	2262	.2	-	-	-	21	100	200	53	400	800	76	700	1,200	63	200	450
78	2255	.2	24	100	150	38	150	200	59	250	500	72	300	450	61	200	400
79	2256	.4	40	200	350	54	350	700	71	500	1,000	72	600	1,300	65	450	900
80	2257	.1	28	100	150	38	100	150	54	200	300	59	250	400	55	200	300
81	2298	1.0	63	1,500	3,900	63	1,500	3,600	69	900	2,800	67	600	1,300	64	400	700
82	2342A	2.0	64	1,600	4,800	66	1,800	5,500	76	1,500	5,000	74	1,200	3,600	62	300	900
83	2342B	1.7	61	1,400	4,400	66	1,800	5,500	70	1,400	4,700	72	700	1,700	61	500	800
84	1673	.8	-	-	-	29	150	250	88	800	1,700	107	700	1,500	-	-	-
85	1674	.4	-	-	-	26	100	200	86	450	800	96	400	800	-	-	-
86	1675	.3	-	-	-	29	100	250	86	250	600	92	300	700	-	-	-
87	[1]812	.5	35	300	600	-	-	-	62	700	1,500	-	-	-	-	-	-
88	831	2.0	37	500	1,000	-	-	-	77	1,500	5,000	-	-	-	-	-	-
89	2241	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90	[1]1451	1.5	45	800	1,800	71	1,800	3,600	73	1,500	4,000	74	900	2,200	-	-	-

See footnotes at end of table, p. 30.

TABLE A-3. - Explosion severity, pressures, and rates of pressure rise of dust explosions (Con.)

Line No.	Sample No.	Explosion severity	Concentration															
			0.10 oz./cu.ft.			0.20 oz./cu.ft.			0.50 oz./cu.ft.			1.00 oz./cu.ft.			2.00 oz./cu.ft.		
			Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.		Maximum pressure, p.s.i.g.	Rate of pressure rise, p.s.i./sec.	
				Average	Maximum		Average	Maximum		Average	Maximum		Average	Maximum		Average	Maximum
91	1931	3.3	67	2,300	5,000	79	2,800	7,000	91	2,400	7,000	100	1,700	5,000	80	600	1,100
92	1508	2.1	54	1,500	3,000	67	2,200	4,900	83	1,500	4,900	91	1,500	4,700	51	250	300
93	1509	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94	2266	.5	27	150	300	49	350	600	71	600	1,400	-	-	-	-	-	-
95	1584	2.3	62	1,200	3,000	87	1,400	3,500	97	1,500	4,500	85	1,200	3,800	-	-	-
96	1919	.6	45	200	250	49	400	900	80	500	1,400	88	700	1,300	90	700	1,700
97	2043	1.7	46	1,100	2,200	68	1,300	3,300	82	1,400	3,900	92	1,300	3,300	88	1,200	3,100
98	[1]808	.4	27	200	400	-	-	-	69	500	1,000	-	-	-	-	-	-
99	1637	1.2	20	300	500	59	900	1,700	75	1,300	3,100	89	1,200	3,000	-	-	-
100	[1]807	.9	42	300	700	-	-	-	84	1,000	2,000	-	-	-	-	-	-
101	[1]1352	<.1	-	-	-	-	-	(a)	20	100	200	28	100	200	-	-	-
102	[1]1353	<.1	-	-	-	-	-	(a)	15	100	200	46	100	200	-	-	-
103	[1]1354	<.1	-	-	-	-	-	(a)	8	100	200	17	100	200	-	-	-
104	[1]1355	<.1	-	-	-	-	-	(a)	20	100	200	21	100	200	-	-	-
105	[1]1512	<.1	-	-	-	-	-	(a)	17	200	500	38	250	500	-	-	-
106	2281	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
107	[1]809	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	[1]810	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109	[1]811	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110	[1]830	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
111	1836	.6	49	600	1,200	70	1,200	3,200	71	800	1,600	81	700	1,200	74	300	450
112	1835	2.0	62	1,700	5,000	77	2,700	7,500	87	1,700	4,400	95	1,100	3,300	81	500	900
113	1947	.1	-	-	-	16	100	200	37	200	500	62	400	1,000	79	500	1,000
114	1939	.9	39	400	1,100	60	800	2,700	71	700	2,400	85	600	1,600	71	300	600
115	1579	.8	48	1,000	2,600	49	1,100	2,700	65	900	2,300	72	900	2,300	-	-	-
116	[1]1356	1.7	45	1,000	1,700	71	2,200	4,000	90	1,800	3,500	83	1,000	2,200	-	-	-
117	[1]1357	.3	20	150	350	48	600	1,000	56	600	1,000	77	600	1,000	-	-	-
118	[1]1491	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
119	[1]1490	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120	[1]1452	-	-	-	-	-	-	-	-	-	(a)	11	100	200	-	-	-
121	[1]829	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
122	1868	3.0	59	1,500	4,400	80	2,400	7,000	95	2,100	6,000	109	1,700	5,500	93	500	1,000
123	2199C	1.6	66	1,500	3,400	69	1,700	4,700	79	1,500	3,900	85	1,200	3,000	72	1,100	2,200
124	2199D	2.2	63	1,700	5,500	69	1,800	6,000	71	1,900	6,000	84	1,700	5,500	79	1,100	3,400
125	2306	-	-	-	-	-	-	-	-	-	-	12	100	100	40	150	300
126	2305A	.3	15	100	150	43	300	600	64	500	1,000	63	350	600	65	300	600
127	2305B	.7	56	700	1,800	71	1,300	2,900	72	800	1,800	78	600	1,200	71	300	900
128	2367A	<.1	-	-	-	-	-	-	15	100	150	27	100	150	40	150	300
129	2367B	-	(a)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130	[1]1111	3.6	42	700	1,300	-	-	-	91	3,000	7,500	-	-	-	-	-	-
131	1112	6.7	42	800	1,400	-	-	-	106	2,800	12,000	-	-	-	-	-	-
132	[1]1130	.2	-	-	-	-	-	-	34	500	1,000	60	400	800	-	-	-
133	2366A	.2	9	100	100	14	100	100	61	300	700	81	350	800	59	300	700
134	2366B	.9	25	200	350	44	350	700	91	800	1,800	93	700	1,500	82	450	1,000
135	[1]801	.1	6	100	100	-	-	-	52	200	500	-	-	-	-	-	-
136	[1]802	.4	16	100	150	-	-	-	60	500	1,200	-	-	-	-	-	-
137	[1]803	.8	6	100	100	-	-	-	91	600	1,600	-	-	-	-	-	-
138	[1]804	.6	11	100	100	-	-	-	59	700	1,800	-	-	-	-	-	-
139	825	.2	-	-	-	-	-	-	45	350	700	-	-	-	-	-	-
140	826	1.1	3	100	100	-	-	-	91	900	2,300	-	-	-	-	-	-
141	827	.9	3	100	100	-	-	-	82	800	2,100	-	-	-	-	-	-
142	828	1.7	20	100	200	-	-	-	89	1,300	3,600	-	-	-	-	-	-
143	1638	.9	-	-	-	22	200	400	86	900	2,000	91	700	1,500	-	-	-
144	1678	.6	8	100	100	21	150	250	70	600	1,700	84	600	1,400	-	-	-
145	2230	2.0	57	700	1,500	59	900	2,100	81	1,500	4,700	92	800	2,300	83	450	800
146	2242	2.7	56	1,900	4,700	74	2,600	8,500	86	2,000	6,000	94	1,800	5,000	64	500	1,400
147	2244	.5	43	500	900	52	600	1,100	68	800	1,500	85	1,000	2,200	76	500	1,200
148	799	3.9	45	1,000	1,900	-	-	-	88	2,000	8,500	-	-	-	-	-	-
149	2229	4.0	64	1,400	4,400	70	1,800	6,500	90	2,000	8,500	87	1,400	5,500	86	900	2,900
150	[1]797	1.4	43	800	1,400	-	-	-	77	1,600	3,500	-	-	-	-	-	-
151	1159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
152	[1]1181	1.9	38	700	1,200	60	3,000	4,500	77	2,200	4,500	83	2,600	3,600	-	-	-
153	[1]1213	1.7	40	900	2,000	67	2,500	5,500	81	1,600	4,000	-	-	-	-	-	-
154	1549	3.9	69	1,700	5,000	83	2,700	9,000	105	2,000	7,000	103	1,400	5,500	-	-	-
155	800	.1	-	-	-	-	-	-	40	300	600	-	-	-	-	-	-
156	796	.1	-	-	-	-	-	-	47	250	450	-	-	-	-	-	-
157	1672	.1	-	-	-	7	100	100	40	150	250	62	150	450	-	-	-
158	1161	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
159	792	5.3	33	600	1,300	-	-	-	92	3,000	11,000	-	-	-	-	-	-
160	793	4.0	41	800	1,500	-	-	-	89	2,200	8,500	-	-	-	-	-	-
161	794	4.1	31	450	1,200	-	-	-	82	2,800	9,500	-	-	-	-	-	-
162	1162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
163	2052	2.5	46	1,100	2,600	65	2,000	4,700	78	1,700	6,000	93	1,300	4,500	95	1,000	4,200
164	2053	.8	41	600	1,000	56	800	1,800	78	800	1,900	95	1,200	2,600	94	1,000	2,200
165	2036	.2	-	-	-	-	-	-	73	200	500	81	300	600	-	-	-
166	2037	.3	-	-	-	-	-	-	76	350	700	88	450	900	-	-	-
167	1922	<.1	-	-	-	-	-	-	15	100	100	35	100	150	61	100	250
168	2228	2.7	69	1,900	7,500	72	2,300	11,000	80	1,600	6,500	85	1,100	4,400	83	1,000	2,900
169	1511	3.5	61	2,400	5,500	69	2,800	6,500	95	2,300	7,000	110	2,300	6,500	-	-	-
170	[1]1114	<.1	-	-	-	-	-	-	18	100	200	79	400	800	-	-	-
171	1513	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	1514	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
173	[1]798	.1	-	-	-	-	-	-	45	200	500	-	-	-	-	-	-
174	824	5.3	46	800	1,500	-	-	-	92	2,300	11,000	-	-	-	-	-	-
175	823	4.7	47	700	1,700	-	-	-	94	2,100	9,500	-	-	-	-	-	-
176	[1]947	-	-	-	-	-	-	-	-	-	-	83	500	1,400	-	-	-
177	[1]948	-	-	-	-	-	-	-	-	-	-	27	100	200	-	-	-
178	[1]949	-	-	-	-	-	-	-	-	-	-	105	800	3,000	-	-	-
179	[1]946	.1	3	100	200	-	-	-	56	200	500	77	500	1,000	-	-	-
180	1733	2.8	63	1,400	3,600	72	1,600	4,400	96	1,700	5,500	103	1,600	6,000	-	-	-

See footnotes at end of table, p. 30.

TABLE A-3. - Explosion severity, pressures, and rates of pressure rise of dust explosions (Con.)

Urethane foam

Line No.	Sample No.	Explosion severity	0.10 oz./cu.ft. Maximum pressure, p.s.i.g.	0.10 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	0.10 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	0.20 oz./cu.ft. Maximum pressure, p.s.i.g.	0.20 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	0.20 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	0.50 oz./cu.ft. Maximum pressure, p.s.i.g.	0.50 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	0.50 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	1.00 oz./cu.ft. Maximum pressure, p.s.i.g.	1.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	1.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	2.00 oz./cu.ft. Maximum pressure, p.s.i.g.	2.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	2.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum
181	795	5.1	27	450	1,100	-	-	-	81	2,800	12,000	-	-	-	-	-	-
182	[1]1431	1.0	55	1,700	3,600	90	3,500	9,000	84	800	2,200	81	700	1,600	-	-	-
183	[1]1432	3.6	48	1,200	2,900	78	3,400	7,500	105	2,500	6,500	84	1,200	2,500	-	-	-
184	[1]1377	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
185	2033	2.6	35	600	1,400	63	1,000	2,500	91	1,600	5,500	98	1,300	4,600	65	300	1,000
186	2380	.9	43	350	800	54	500	1,000	79	800	2,200	87	800	2,300	69	600	1,100
187	1875	2.6	50	1,000	2,400	72	1,600	5,500	84	2,200	6,000	91	1,400	5,000	79	600	1,700
188	2361A	1.5	59	1,000	3,000	69	1,300	2,700	84	1,300	3,400	87	1,300	3,700	77	700	1,500
189	2361B	1.7	53	900	1,800	64	1,200	3,400	88	1,400	3,700	96	1,100	3,000	76	600	1,200
190	1196	1.8	-	-	-	65	1,800	4,200	89	1,200	3,800	-	-	-	-	-	-
191	[1]1199	1.7	42	600	1,200	65	1,800	4,600	79	1,800	4,000	-	-	-	-	-	-
192	[1]1385	2.3	52	1,000	2,300	77	2,200	4,800	94	2,200	4,600	90	1,400	3,600	-	-	-
193	[1]1386	2.2	53	1,200	2,500	77	2,500	5,000	85	2,500	5,000	70	800	1,600	-	-	-
194	817	5.4	43	1,400	2,600	-	-	-	93	2,800	11,000	-	-	-	-	-	-
195	818	3.7	44	900	1,900	-	-	-	83	2,800	8,500	-	-	-	-	-	-
196	2326	1.7	55	1,300	2,600	63	1,600	3,600	81	1,500	4,000	83	1,200	3,200	66	600	1,600
197	2327	1.8	59	1,500	3,900	67	1,600	4,400	85	1,500	4,000	85	1,300	3,200	78	700	1,500
198	[1]1492	1.4	44	600	1,000	77	1,200	2,400	91	1,600	3,000	117	1,600	3,000	-	-	-
199	822	3.9	45	1,100	2,100	-	-	-	87	1,800	8,500	-	-	-	-	-	-
200	[1]1493	1.5	-	-	-	56	600	1,000	112	1,200	2,500	116	1,000	1,800	-	-	-
201	[1]1489	2.8	47	1,100	2,600	70	2,400	5,000	89	2,400	6,000	85	1,000	2,000	-	-	-
202	[1]1494	2.9	41	500	1,000	83	1,600	3,200	110	2,200	5,000	123	1,600	3,400	-	-	-
203	805	2.0	23	100	200	-	-	-	80	1,700	4,700	-	-	-	-	-	-
204	806	2.7	36	700	1,100	-	-	-	102	1,900	5,000	-	-	-	-	-	-
205	821	5.5	43	1,200	2,600	-	-	-	87	2,800	12,000	-	-	-	-	-	-
206	899	3.2	44	700	1,300	-	-	-	82	1,900	7,500	-	-	-	-	-	-
207	820	1.4	58	700	1,700	58	1,200	2,700	73	1,400	3,600	71	1,100	2,700	-	-	-
208	1628	1.4	38	200	300	76	1,400	3,300	82	1,000	3,300	88	1,000	2,200	-	-	-
209	1631	1.8	54	400	1,100	90	1,300	3,200	94	1,500	3,600	99	1,200	2,800	-	-	-
210	[1]1147	1.1	50	900	1,700	-	-	-	84	1,400	2,600	-	-	-	-	-	-
211	1636	.9	27	250	600	72	800	1,700	89	900	2,000	93	1,200	2,600	-	-	-
212	1643	.8	46	300	900	70	700	1,700	81	800	2,000	80	700	2,000	-	-	-
213	945	1.6	46	1,100	2,200	-	-	-	80	1,200	3,800	-	-	-	-	-	-
214	837	1.5	39	600	1,200	74	1,100	2,800	93	1,100	3,100	93	1,100	2,600	-	-	-
215	2067	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
216	[1]1139	.7	38	100	250	-	-	-	68	1,200	2,000	-	-	-	-	-	-
217	2165	2.4	56	2,600	13,000	70	2,200	13,000	76	1,600	6,000	81	900	3,100	57	500	1,100
218	[1]819	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
219	[1]1019	.7	31	300	700	-	-	-	70	800	2,000	-	-	-	-	-	-
220	[1]1485	-	([a])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221	1855	1.5	48	150	600	71	800	1,800	72	1,600	4,000	62	700	3,300	-	-	-
222	1945	-	-	-	-	-	-	-	-	-	([a])	21	100	100	27	100	100
223	1946	.1	-	-	-	22	100	100	44	150	300	66	250	600	77	250	500
224	2240	.9	20	150	350	53	400	800	89	1,000	2,000	106	1,200	2,100	103	900	2,000
225	2258A	.2	-	-	-	13	100	100	51	350	700	67	600	1,300	75	500	1,000
226	2258B	5.9	14	100	100	66	1,400	4,100	70	2,700	16,000	70	600	2,700	36	200	500
227	1671	1.6	58	900	1,700	66	1,100	2,200	80	1,600	3,900	108	2,200	6,000	-	-	-
228	1600	4.1	49	1,100	2,900	70	2,100	4,300	82	2,300	9,500	96	700	1,100	-	-	-
229	1601	.6	11	100	100	51	450	1,000	63	700	1,700	88	700	1,600	-	-	-
230	1602	.6	-	-	-	31	200	300	85	600	1,400	93	600	1,300	-	-	-
231	2029	<.1	-	-	-	-	-	([a])	7	100	100	26	100	150	51	200	250
232	2115	<.1	-	-	-	-	-	([a])	10	100	200	29	150	300	58	200	300
233	2116	<.1	-	-	-	-	-	([a])	9	100	250	30	100	200	69	200	300
234	2117	<.1	-	-	-	-	-	([a])	14	100	200	31	150	350	53	200	300
235	2259	8.7	39	2,000	6,500	64	2,700	19,000	104	3,500	16,000	147	3,100	16,000	236	2,700	16,000
236	1554	.2	-	-	-	-	-	-	59	500	700	71	450	700	-	-	-
237	1936	1.8	59	1,500	4,600	63	1,500	4,600	71	1,800	4,800	90	1,200	4,600	67	900	2,900
238	1711	1.1	34	250	700	62	1,100	2,600	76	1,200	2,700	84	900	2,300	-	-	-
239	[1]1524	1.7	39	800	1,800	77	2,000	6,000	93	1,600	3,500	119	1,400	3,200	-	-	-
240	2286	4.9	49	1,400	6,000	75	2,400	8,500	99	2,900	9,500	131	3,900	14,000	174	2,200	8,000
241	2287	.7	33	200	350	63	800	2,100	90	1,100	2,500	100	1,000	3,200	135	900	2,100
242	2284	3.3	37	800	2,200	59	1,700	5,000	90	2,200	7,000	114	2,200	8,500	142	1,900	6,000
243	2285	1.6	35	700	1,500	59	1,100	3,200	83	1,200	3,700	96	1,100	4,300	105	1,000	2,600
244	2363	1.2	59	1,100	3,200	63	1,300	4,700	67	1,100	3,500	76	1,000	2,900	75	500	1,400
245	[1]1453	4.3	54	1,200	3,000	78	2,400	6,000	102	2,800	8,000	134	2,600	6,000	-	-	-
246	2243	2.5	58	2,200	5,500	64	2,400	8,500	73	2,300	6,500	89	1,600	4,200	61	400	1,100
247	839	.3	9	100	100	27	100	150	66	400	1,000	73	350	800	-	-	-
248	2108	2.5	40	1,300	4,700	56	1,400	5,000	74	1,600	6,500	90	1,400	5,000	85	1,000	2,700
249	2303	3.8	66	2,300	5,500	80	3,100	9,500	83	2,600	8,500	88	2,200	7,500	89	1,300	4,700
250	2377	2.9	53	1,400	6,000	65	2,100	8,000	79	1,800	7,000	84	1,800	5,500	80	1,700	4,700
251	1924	5.8	54	2,200	9,000	69	2,700	11,000	92	3,100	12,000	93	1,900	6,000	105	1,600	5,000
252	2045	3.9	64	3,200	13,000	69	3,500	19,000	82	2,400	9,000	96	2,200	8,000	91	1,600	4,300
253	2104	3.9	56	2,200	6,500	71	2,700	8,500	78	2,900	9,500	83	2,100	7,500	82	1,100	5,500
254	2183	3.9	63	2,200	8,500	66	2,500	13,000	79	2,500	9,500	77	1,500	7,000	76	1,200	4,400
255	2091	.7	-	-	-	44	300	800	83	700	1,600	106	1,000	3,000	101	700	1,600
256	2238	1.2	11	150	250	38	500	1,100	79	1,000	2,900	89	1,100	3,000	103	900	2,500
257	2283	3.7	14	200	400	52	1,600	3,700	83	2,400	8,500	110	1,600	7,000	104	1,100	5,000
258	2368	3.0	52	1,200	3,700	71	1,700	5,500	87	1,600	6,500	107	1,300	4,100	103	900	2,200
259	838	5.6	51	900	1,900	-	-	-	98	2,400	11,000	-	-	-	-	-	-
260	2362	1.2	49	800	2,300	56	1,100	3,100	75	1,200	3,100	78	900	2,300	65	700	1,400
261	[1]1317	1.8	48	500	1,100	84	1,600	3,000	97	1,600	3,500	97	800	2,200	-	-	-
262	2335A	1.0	23	400	1,100	59	1,100	4,200	61	1,100	3,200	68	900	2,800	64	350	600
263	2335B	2.7	44	1,100	3,700	61	1,400	5,500	74	2,200	7,000	76	1,400	4,400	70	800	2,500
264	1808	8.3	-	-	-	-	-	-	125	3,600	13,000	175	4,200	15,000	-	-	-
265	1809	.3	-	-	-	-	-	-	95	450	700	145	1,100	2,200	-	-	-
266	1810	.6	-	-	-	-	-	-	75	600	1,400	90	900	2,200	-	-	-
267	1811	.1	-	-	-	-	-	-	64	200	400	113	700	1,700	-	-	-
268	1896	6.9	44	1,000	3,100	81	2,200	9,500	102	2,500	13,000	132	2,200	9,500	133	1,700	6,500
269	[1]1345	-	-	-	-	-	-	-	-	-	-	82	800	2,000	-	-	-
270	[1]1344	.7	-	-	-	-	-	-	74	900	1,800	80	800	1,700	-	-	-

See footnotes at end of table, p. 30.

TABLE A-3. - Explosion severity, pressures, and rates of pressure rise of dust explosions (Con.)

Line No.	Sample No.	Explosion severity	0.10 oz./cu.ft. Maximum pressure, p.s.i.g.	0.10 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	0.10 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	0.20 oz./cu.ft. Maximum pressure, p.s.i.g.	0.20 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	0.20 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	0.50 oz./cu.ft. Maximum pressure, p.s.i.g.	0.50 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	0.50 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	1.00 oz./cu.ft. Maximum pressure, p.s.i.g.	1.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	1.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum	2.00 oz./cu.ft. Maximum pressure, p.s.i.g.	2.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Average	2.00 oz./cu.ft. Rate of pressure rise, p.s.i./sec. Maximum
271	[1]1321	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
272	[1]1322	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
273	[1]1268	2.4	48	1,900	2,900	81	3,000	6,500	77	2,000	6,000	-	-	-	-	-	-
274	2051	2.1	70	1,800	6,000	80	2,500	11,000	85	1,500	4,700	94	1,500	3,800	92	1,000	3,800
275	2105	2.8	51	1,400	3,800	72	1,800	5,500	82	1,700	6,500	88	1,500	5,000	77	1,000	2,700
276	841	4.5	43	700	1,400	-	-	-	90	1,700	9,500	-	-	-	-	-	-
277	[1]661	-	42	-	-	62	-	-	63	-	-	-	-	-	-	-	-
278	1085	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
279	1086	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
280	1963	1.5	60	2,000	8,000	69	2,100	10,000	68	1,900	4,300	75	1,500	3,200	67	900	2,700
281	840	1.6	39	1,000	1,400	-	-	-	72	1,300	4,200	-	-	-	-	-	-
282	[1]662	-	23	-	-	43	-	-	46	-	-	-	-	-	-	-	-
283	[1]1575	-	-	-	-	-	-	([3])	22	-	-	31	-	-	71	-	-
284	1692	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
285	[1]1023	1.5	-	-	-	18	100	200	71	1,200	4,000	64	800	2,200	-	-	-
286	[1]1024	.7	-	-	-	4	100	200	71	600	1,800	76	700	2,000	-	-	-
287	2378	2.3	33	500	2,000	65	1,900	8,000	73	1,700	6,000	84	1,400	3,700	77	600	1,200
288	1874	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
289	[1]1448	2.8	32	450	900	73	1,600	4,200	119	1,800	4,500	130	1,600	3,800	-	-	-
290	[1]845	1.3	13	100	150	-	-	-	84	1,000	3,000	-	-	-	-	-	-
291	1968	3.2	42	800	1,900	69	1,100	5,500	103	1,500	6,000	113	1,300	3,500	103	700	2,000
292	1969	4.0	47	800	2,600	75	1,500	6,000	106	1,700	8,000	117	1,200	4,100	96	600	1,400
293	2153	3.8	49	1,100	3,000	72	1,700	5,000	103	2,000	7,000	112	1,700	7,000	98	700	1,500
294	2154	1.3	24	100	200	58	1,000	2,100	87	1,300	2,900	102	1,000	2,200	94	1,000	2,200
295	2155	2.7	49	1,000	2,800	67	1,800	4,500	94	1,900	5,500	92	800	1,800	70	300	800
296	2344A	1.4	30	250	600	59	450	1,000	98	1,000	2,800	115	1,300	3,300	100	700	1,600
297	[1]1247	1.7	31	400	1,100	71	1,200	3,200	91	1,200	3,500	92	900	2,800	-	-	-
298	1882	1.6	30	400	800	66	700	2,700	100	900	3,100	105	900	3,100	103	800	2,900
299	[1]844	3.0	29	350	600	-	-	-	94	1,800	6,000	-	-	-	-	-	-
300	2097	<.1	-	-	-	-	-	-	48	100	150	73	250	400	-	-	-
301	1341	2.5	46	700	1,800	79	1,400	4,000	97	1,500	5,000	117	1,400	2,500	-	-	-
302	1867	2.9	66	1,900	4,700	82	2,200	6,000	101	2,000	5,500	111	1,700	4,400	96	600	900
303	1889	3.6	64	1,600	4,500	80	2,300	7,000	99	2,100	7,000	108	1,800	4,800	97	1,000	2,600
304	[1]1340	1.8	50	1,300	3,200	81	2,600	7,500	98	1,600	3,500	103	1,200	3,200	-	-	-
305	[1]1072	1.6	44	700	1,500	-	-	-	83	1,400	3,600	-	-	-	-	-	-
306	[1]1073	1.6	42	450	900	-	-	-	84	1,600	3,600	-	-	-	-	-	-
307	1180	2.6	40	600	1,100	71	1,400	3,600	101	1,500	5,000	100	1,100	3,100	-	-	-
308	843	4.2	37	700	1,300	-	-	-	94	1,900	8,500	-	-	-	-	-	-
309	842	3.8	41	600	1,100	-	-	-	97	2,300	7,500	-	-	-	-	-	-
310	1577	3.2	49	700	1,400	86	1,800	4,400	110	1,700	5,500	113	1,500	4,900	-	-	-
311	[1]847	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
312	[1]846	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
313	[1]848	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
314	-	1.0	-	-	-	-	-	-	83	800	2,300	-	-	-	-	-	-

[1]Conversion factors applied to these data, obtained by dust dispersion technique A to equate them to values obtained by technique B.
[2]No ignition obtained by standard igniting sources.
[3]Dust not ignited by electric spark, initiation obtained by flame source.