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EXPLOSIBILITY OF METAL POWDERS

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

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
1964

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EXPLOSIBILITY OF METAL POWDERS

by

Murray Jacobson,[1] Austin R. Cooper,[2] and John Nagy[3]

ABSTRACT

Data obtained in the Bureau's study of dust explosions of 313 elemental metals, alloys, catalysts, and ores comprising 54 types of material are summarized. Information is given on ignition temperature, spark energy for ignition, minimum explosion concentration, explosion pressure, rate of pressure rise, and in some instances, the admixed inert dust and oxygen concentration in an atmosphere required to prevent ignition of dust dispersions. The effects of particle diameter on explosibility and pyrophoricity are also discussed.

INTRODUCTION

Explosion hazards of numerous dusts have been evaluated during the past 25 years by the Bureau of Mines. These data are being grouped according to type of material and are being made available to industry. Publications on agricultural[4] and plastics[5] dusts have been released. The present report lists laboratory data on 313 metal, alloy, catalyst, and ore samples comprising 54 separate types of material; it supersedes earlier reports in which limited

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[3]Chief, Branch of Dust Explosions, Health and Safety Research and Testing Center, Bureau of Mines, Pittsburgh, Pa.

[4]Jacobson, Murray, John Nagy, Austin R. Cooper, and Frank J. Ball. Explosibility of Agricultural Dusts. BuMines Rept. of Inv. 5753, 1960, 23 pp.

[5]Jacobson, Murray, John Nagy, and Austin R. Cooper. Explosibility of Dusts Used in the Plastics Industry. BuMines Rept. of Inv. 5971, 1962, 30 pp.

Work on manuscript completed March 1964.

data on metals were published.[6] The equipment and procedures used in dust explosibility evaluation have been described previously.[7]

SAMPLE DESCRIPTION AND REPORTING PROCEDURES

A description of the samples tested is contained in the appendix. The particle size of a dust is shown as the percentage smaller than a given diameter (in microns),[8] and when available, the average particle diameter determined by the Fisher subsieve analyzer[9] is included.

An empirical explosibility index is used in rating the hazard of a dust. This index is not derived from theoretical considerations, but is consistent with observations in research and from experience. The index of explosibility is related to ignition sensitivity and explosion severity. Ignition sensitivity is assumed to be a function of ignition temperature, minimum ignition energy, and minimum explosive concentration. Explosion severity is assumed to be a function of maximum explosion pressure and rate of pressure rise. The ignition sensitivity, explosion severity, and explosibility index are defined as unity for a dust having ignition and explosion characteristics similar to that of Pittsburgh seam coal and are calculated as follows:

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

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

Index of explosibility = Ignition sensitivity x explosion severity.

---

[6] Hartmann, Irving. The Explosion Hazard of Metal Powders and Preventive Measures. Metals Handbook. Am. Soc. Metals, 1948, pp. 52-54.
Hartmann, Irving, and Harold P. Greenwald. The Explosibility of Metal Powder Dust Clouds. Min. and Met., v. 26, July 1945, pp. 331-335.
Hartmann, Irving, John Nagy, and Hylton R. Brown. Inflammability and Explosibility of Metal Powders. BuMines Rept. of Inv. 3722, 1943, 44 pp.
Hartmann, Irving, John Nagy, and Murray Jacobson. Explosive Characteristics of Titanium, Zirconium, Thorium, Uranium, and Their Hydrides. BuMines Rept. of Inv. 4835, 1951, 16 pp.

[7] Dorsett, Henry G., Jr., Murray Jacobson, John Nagy, and Roger P. Williams. Laboratory Equipment and Test Procedures for Evaluating Explosibility of Dusts. BuMines Rept. of Inv. 5624, 1960, 21 pp.

[8]

Sieve No.	Size, microns	Sieve No.	Size, microns
20	840	270	53
100	149	325	44
140	105	400	37
200	74		

[9] Reference to specific brands is made to facilitate understanding and does not imply endorsement of such items by the Bureau of Mines.

The relative hazard of a dust is also given by adjective ratings of none, fire, weak, moderate, strong, and severe. These ratings are correlated with the index of explosibility as follows:

Relative explosion hazard index	Index of explosibility
None..........................	0
Weak..........................	<.1
Moderate......................	0.1 - 1.0
Strong........................	1.0 - 10.0
Severe........................	>10

Materials that are not ignited by electric spark or in the furnace are considered to present no explosion hazard. A notation of <<0.1 designates materials that ignite in the furnace but not by the spark or flame source.

In calculating explosion severity, the explosion pressure and maximum rate of pressure rise developed at a dust concentration of 0.50 oz/cu ft are used except for the aluminum-iron alloy, cadmium, and gold bronze; the dust concentrations of these materials were 1.0, 1.0, and 2.0 oz/cu ft, respectively. Two techniques were used in obtaining explosion pressure and rate of pressure rise in the studies on metal dusts. Before 1950, dust was dispersed by an airblast from an 80-cubic-inch reservoir charged to 14-psig pressure (technique A). Since then, dispersion is accomplished by air flowing from a 3-cubic-inch reservoir charged to 100-psig pressure (technique B). To eliminate differences in observed explosion severity and index of explosibility from data obtained by each of these two methods, conversion factors are applied to the data obtained by technique A to make them similar to those from technique B. The conversion factors for maximum pressures and the rates of pressure rise obtained by technique A are 1.4 to 2.0, respectively, at dust concentrations ranging from 0.10 to 2.00 oz/cu ft. These factors were obtained from regression analysis of data from duplicate tests, using both techniques on more than 100 samples that included metal powders.

DISCUSSION OF EXPLOSIBILITY DATA

Table 1 summarizes the ignition and explosion characteristics of the 54 materials studied. Complete data for all the samples are given in the appendix. In addition to the data for computing the explosibility indexes, the appendix contains information on the ignition temperature and minimum igniting energy of the dust layer, the relative flammability (percent added inert dust required to prevent ignition by spark and by heated surface), the terminal oxygen concentration in the atmosphere to prevent ignition by spark and by the heated surface, and the maximum pressure and rate of pressure rise developed by explosions of dust clouds at concentrations from 0.1 to 2.0 oz/cu ft. In the discussions, samples are identified with those in the appendix by line number shown parenthetically.

TABLE 1. - Ignition and explosibility of metal powders

Material	Line No.	Ignition temperature,[1] ° C		Minimum explosive concen-tration, oz/cu ft	Minimum[1] igniting energy for dust cloud, millijoules	Maximum pressure, psig	Maximum rate of pressure rise, psi/sec	Index of explo-sibility
		Cloud	Layer					
Severe								
Aluminum, atomized	1	650	760	0.045	50	73	20,000+	>10
Aluminum-magnesium alloy	249	430	480	.020	80	86	10,000	>10
Magnesium	159	620	490	.040	40	90	9,000	>10
Thorium hydride	191	260	20	.080	3	60	6,500	>10
Zirconium	228	20	190	.045	[2]15	55	6,500	>10
Uranium hydride	212	20	20	.060	[2]5	43	6,500	>10
Titanium	194	330	510	.045	25	70	5,500	>10
Uranium	211	20	[2]100	.060	[2]45	53	3,400	>10
Thorium	190	270	280	.075	5	48	3,300	>10
Strong								
Titanium hydride	205	480	540	0.070	60	96	12,000	6.0
Zirconium hydride	232	350	270	.085	60	69	9,000	3.7
Aluminum-silicon alloy	258	670	-	.040	60	74	7,500	3.6
Calcium silicide	267	540	540	.060	150	73	13,000	2.0
Iron, carbonyl	126	320	310	.105	20	41	2,400	1.6
Ferrotitanium	281	370	400	.140	80	53	9,500	1.3
Coal, Pittsburgh seam	-	610	180	.055	60	83	2,300	1.0
Moderate								
Silicon	184	-	790	0.110	100	82	12,000	0.9
Boron	98	470	400	<.100	60	90	2,400	.8
Aluminum-nickel alloy	253	950	540	.190	80	79	10,000	.6
Aluminum-lithium alloy	244	470	400	<.100	140	96	3,700	.6
Aluminum-cobalt alloy	236	950	570	.180	100	78	8,500	.4
Ferromanganese	272	450	290	.130	80	47	4,200	.4
Aluminum-copper alloy	237	-	830	.100	100	68	2,600	.3
Chromium	107	580	400	.230	140	55	4,000	.1
Manganese	170	460	240	.125	305	48	2,800	.1
Tantalum	186	630	300	<.200	120	50	2,600	.1
Tin	193	630	430	.190	80	37	1,300	.1
Zirconium alloy	289	420	340	-	30	43	300	-
Weak								
Aluminum-iron alloy	241	870	750	-	720	62	1,800	-
Zinc	217	680	460	0.500	960	48	1,800	<0.1
Gold bronze	284	370	190	1.000	-	44	1,300	-
Ferrosilicon	278	860	-	.425	400	50	700	<.1
Vanadium	213	500	490	.220	60	48	600	<.1
Antimony	90	420	330	.420	1,920	8	100	<.1
Cadmium	101	570	250	-	4,000	7	100	-
Iron ore, pyrite	305	420	-	-	-	-	-	-
Ferrovanadium	282	440	400	1.300	400	-	-	<.1
Ferrochromium	269	790	670	2.000	-	-	-	-
Lead	138	710	270	-	-	-	-	<<0.1
Manganese ore (sulfide)	312	320	300	-	-	-	-	<< .1
Tellurium	189	550	340	-	-	-	-	<< .1
Nickel ore (sulfide)	313	-	340	-	-	-	-	<< .1
Molybdenum	171	720	360	-	-	-	-	<< .1
Cobalt	109	760	370	-	-	-	-	<< .1
Copper ore (sulfide)	299	-	390	-	-	-	-	<< .1
Tungsten	208	730	470	-	-	-	-	<< .1
Lead ore (sulfide)	308	-	<500	-	-	[3]9	200	<< .1
Beryllium	95	910	540	-	-	-	-	<< .1
Copper	110	700	-	-	-	-	-	<< .1
None								
Aluminum-bronze alloy	234	-	990	-	-	-	-	-
Beryllium-copper alloy	259	-	-	-	-	-	-	-
Manganese-bronze alloy	285	-	910	-	-	-	-	-
Nickel	172	-	-	-	-	-	-	-
Selenium	174	-	-	-	-	-	-	-
Stainless steel	286	-	-	-	-	-	-	-

[1] These data apply to relatively coarse dust (through a No. 200 sieve) but not to submicron powder.
[2] In this test less than 1 gram of powder was used. Larger quantities ignited spontaneously.
[3] Ignition by guncotton flame; electrical spark source used for ignition of other metals.

Values of electrical spark energy for ignition of dust clouds and dust layers are given in the appendix. Little correlation exists between the energies for ignition of the dispersed and undispersed dusts, primarily because of differences in experimental techniques used, as was previously discussed.[10]

The materials in table 1 are listed in decreasing order of explosibility. The relative position of each material is determined by the sample within the group having the highest index of explosibility. The arrangement is approximate because of the wide range of indexes within the group. Variation in explosibility index for a given material is attributed to differences in composition, particle size, particle shape, and to the variation in reproducibility with the test equipment.

Information on variation of explosibility for similar dusts prepared to a given specification is obtained from data for nine samples of No. 101 atomized aluminum (lines 23 through 31). Six of these nine samples (received from two manufacturers over a 12-year period) have an average index of explosibility of 0.97 with a range from 0.6 to 1.4. Comparison of the variances calculated for the indexes of explosibility from these 6 samples of aluminum and from 10 samples of a cornstarch[11] prepared from a single lot shows no significant difference at the 95-percent confidence level. This indicates that the spread of the indexes for the aluminum samples is not significantly different from that expected for samples taken from a single lot. Relatively slight variation exists in a given ignition or explosion parameter of aluminum No. 101. For example, the average value of minimum explosive concentration for the nine samples is 0.051 oz/cu ft with a range from 0.045 to 0.060 oz/cu ft; the average explosion pressure at 0.5-oz/cu ft concentration is 73.4 psig with a range from 69 to 78 psig.

The atomized aluminum, with some exceptions, does not ignite in the furnace but ignites by a high-voltage spark; the natural oxidation coating on the particles probably prevents initiation of the reaction in the furnace but has little influence on initiation by spark. The flaked aluminum, having a stearic acid or other protective coating on the particles is readily ignited by both sources. Data shown in figure 1 for explosion pressure and rate of pressure rise are average values for 15 of the finest atomized and flaked aluminums studied. Both the pressure and the rate of pressure rise values are higher for the flaked than for the atomized aluminum, and the explosibility index for the flaked aluminum is about twice that for the atomized aluminum. The higher rates of pressure rise for the flaked aluminum are attributed to the greater surface area of the particles. The maximum pressures developed by the two types of aluminum were expected to be nearly the same; the higher pressures obtained with the flaked aluminum are attributed to more complete chemical reaction with the available oxygen and to a smaller heat loss during the shorter reaction time.

[10]Work cited in footnote 7.
[11]Work cited in footnote 7.

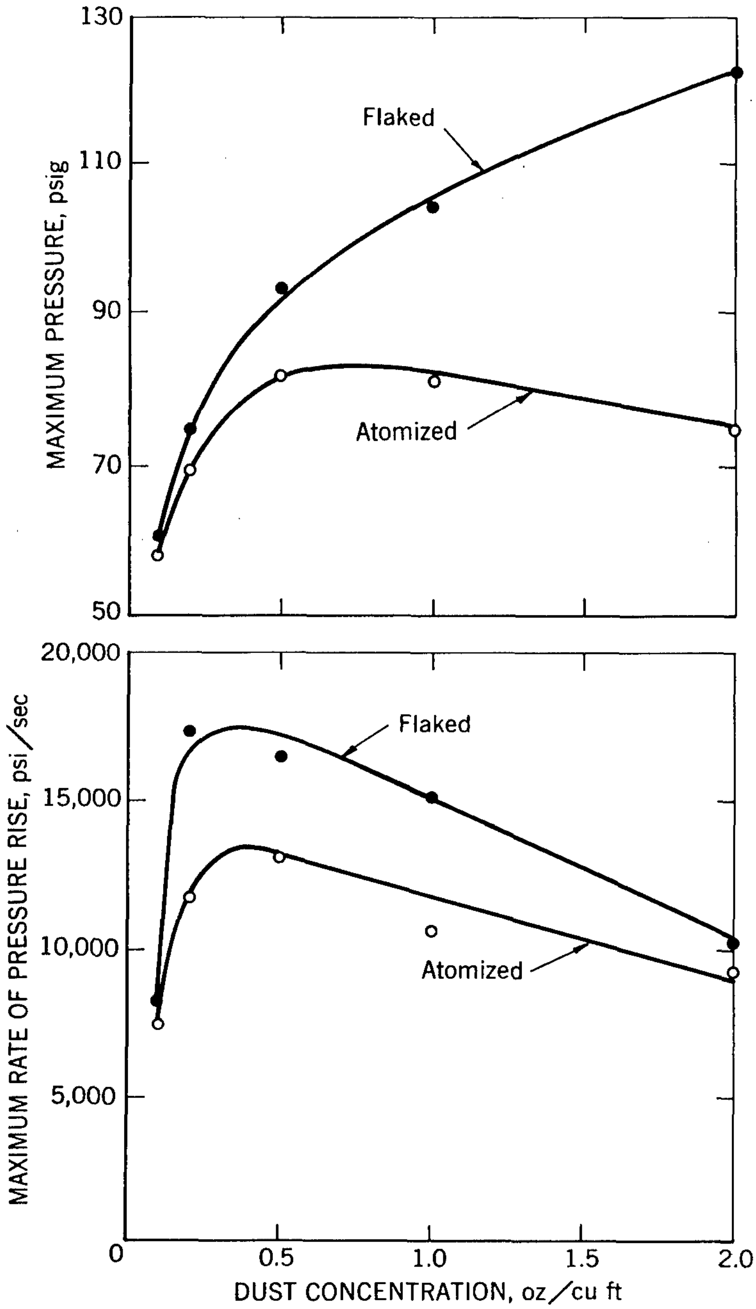

FIGURE 1. - Pressure and Rate of Pressure Rise Developed by Explosions of Flaked and Atomized Aluminums.

Difficulty was encountered in obtaining ignition and explosion with pure boron, although it has a high heat of combustion. Amorphous boron containing 15 percent contaminants did ignite; its explosibility index is 0.8. Beryllium, which also has a high heat of combustion, did not readily ignite; however, beryllium (95), having an average particle diameter of 1.2 microns, ignited in the furnace at 910° C, but not in the spark apparatus. Six other coarser beryllium powders did not ignite in the furnace. Ignition was not obtained by spark with 5 and 10 percent atomized aluminum mixed with the fine beryllium. Low dust concentrations (up to 0.5 oz/cu ft) of beryllium mixed with aluminum powder entered in the combustion reaction, but beryllium concentrations of 4 oz/cu ft behaved as an inert, preventing ignition of the aluminum.

The ignition and explosion characteristics of metal alloys appear to be related to those of the ingredients, although some exceptions were observed. The data in table 2 for aluminum alloys having nearly the same particle size distribution show that the explosibility of the alloy decreases as the explosibility of the alloying element decreases. One exception is an aluminum-nickel alloy (255) which ignited readily and developed high pressure and rate of pressure rise. Results for this alloy indicate the reported data for pure nickel (172, 173) may be incorrect and this element, if tested in finer particle size, would show a dust explosion hazard.

TABLE 2. - Ignition and explosion parameters of aluminum alloys

Alloying element	Aluminum content, percent	Ignition temperature, ° C	Minimum energy, millijoules	Minimum concentration, oz/cu ft	Maximum pressure,[1] psig	Maximum rate of pressure rise, psi/sec
None (1).......	100	650	50	0.045	84	14,000
Magnesium (248)	50	540	20	.050	80	6,000
Iron (241).....	50	870	720	-	62	1,800
Cobalt (235)...	60	950+	-	-	23	100
Copper (238)...	50	930	1,920	.280	55	800
Nickel (255)...	50	950+	300	.280	88	6,000

[1] Dust concentration of 1 oz/cu ft.

PARTICLE DIAMETER

The overall explosibility index of atomized aluminum increases as the average particle diameter decreases. These data are shown in figure 2; the numbers adjacent to the data points correspond to line numbers in appendix tables. A similar effect of particle diameter on index of explosibility was previously published for agricultural dusts.[12]

As shown in figure 3, the minimum energy for ignition increases and the rate of pressure rise decreases with increase in particle diameter. However, maximum pressure, and minimum concentration generally are unaffected when the average particle diameter is less than 37 microns.

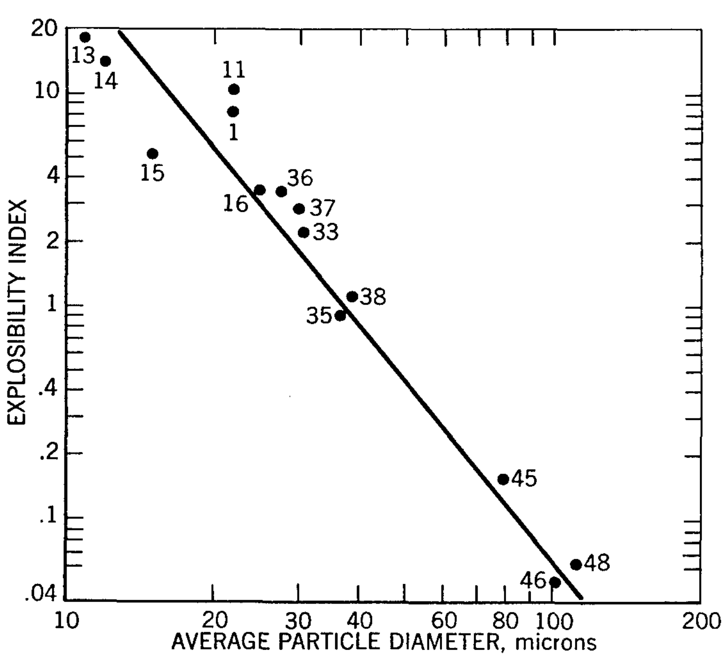

FIGURE 2. - Effect of Average Particle Diameter of Atomized Aluminum on Explosibility Index.

Small amounts of coarse, combustible particles do not affect the explosibility of fine dust particles. In one series of experiments, tear-drop-shaped aluminum pellets having cross-sectional diameters ranging from 590 to 2,000 microns were mixed with a fine atomized aluminum powder; the maximum pressure and rates of pressure rise developed were similar with or without the aluminum pellets. When fuller's earth (30 percent finer than 74 microns) was mixed with fine powder,

[12] Work cited in footnote 4.

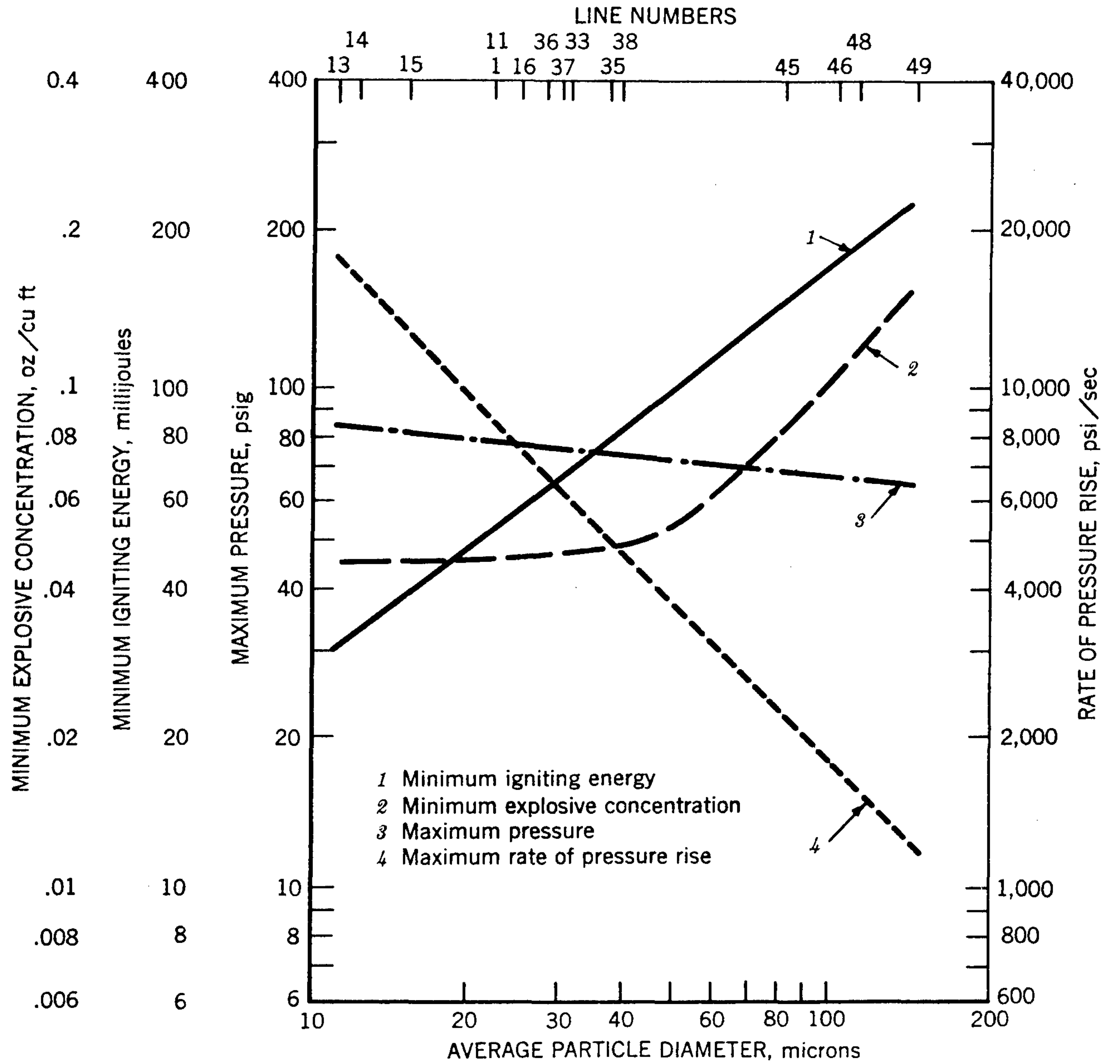

FIGURE 3. - Effect of Average Particle Diameter of Atomized Aluminum on Explosion Parameters.

the maximum pressure and the rate of pressure rise were reduced by 15 and 50 percent, respectively (table 3).

In 1943, one chromium sample (100 percent finer than 74 microns) was tested; this dust did not ignite by electric spark, and it was assumed that chromium presented a fire but little or no dust explosion hazard. In 1960, following an explosion in industry, six additional samples were tested. Dispersions of chromium dust having an average particle diameter of 3 microns ignited by the spark source and this material presents a moderate explosion hazard. These data emphasize that metal powders presenting little or no hazard in a given diameter may be hazardous if prepared in more finely divided form.

TABLE 3. - Effect of coarse, combustible particles on pressure and rates of pressure rise developed by atomized aluminum (33) dust explosions[1]

Additive	Maximum pressure, psig	Average rate of pressure rise, psi/sec	Maximum rate of pressure rise, psi/sec
None.........................	60	900	2,500
Aluminum pellets.............	62	1,000	2,100
Fuller's earth...............	50	500	1,100

[1]The dust concentration of the atomized aluminum and that of the additive were each 0.2 oz/cu ft.

IGNITION TEMPERATURE OF DUST LAYERS

Data obtained on the temperature for ignition or reaction of dust layers in an atmosphere of carbon dioxide and nitrogen are shown in table 4 with corresponding ignition temperatures in air. When ignition occurred, a visible glow or flame developed; when the dust reacted, it heated, changed color, and composition, but did not ignite.

PYROPHORICITY

Dusts of most metals, alloys and certain suboxides, carbides, hydrides, and nitrides that react exothermically with oxygen reportedly exhibit pyrophoric behavior. Pyrophoricity is characterized by rapid oxidation of the dust when exposed to air at room temperature and is related to surface activity. Methods of preparing finely divided metal powders and procedures for alleviating hazards have been published.[13]

Generally, pyrophoricity becomes evident when the particle diameter of a dust is less than 1 micron; however, uranium, uranium hydride, and zirconium having average particle diameters greater than 1 micron ignited at room temperature when dispersed in air. Quiescent layers of uranium, uranium hydride, and thorium hydride ignited within minutes on exposure to air. Pyrophoricity was not observed with the other dusts studied, probably because of coarseness of the particles or surface contamination.

[13]Boljen, Vera, and Bernard Kopelman. Pyrophoricity in Metal Powders and Alloys. Metallurgical Laboratories, Sylvania Electric Products, Inc., Bayside, N.Y., Rept. YE51-0413, Jan. 24, 1951, 24 pp.
Kopelman, Bernard, and Vera B. Compton. Spontaneous Combustion of Metal Powders. Metal Prog., v. 63, No. 2, February 1953, pp. 77-79.
Smith, Richard B. Pyrophoricity--A Technical Mystery Under Vigorous Attack. Nucleonics, v. 14, No. 12, December 1956, pp. 23-33.

TABLE 4. - Ignition and reaction temperatures of metal-powder layers in an air, carbon dioxide, or nitrogen atmosphere

Line No.	Sample No.	Material	Ignition temperature, ° C			Reaction temperature, ° C	
			Air	Carbon dioxide	Nitrogen	Carbon dioxide	Nitrogen
35	701	Aluminum, atomized	900	-	-	900	750
21	897	do.	490	540	-	-	800
80	702	Aluminum, flake...	590	660	-	-	700
102	705	Chromium..........	670	-	-	(1)	700
110	706	Copper............	270	-	-	-	700
120	712	Iron, hydrogen-reduced.	290	-	-	(1)	200
136	716	Lead..............	210	-	-	870	400
151	725	Magnesium.........	490	630	530	-	-
154	727	do.	510	-	510	-	-
156	729	do.	520	-	520	-	-
157	730	do.	490	-	500	-	-
159	1020	do.	490	600	550	-	-
164	734	do.	480	-	490	-	-
165	733	do.	480	-	500	-	-
168	736	do.	420	-	-	700	900
176	737	Silicon...........	950	-	-	1,000	1,000
190	1652	Thorium...........	280	450	500	-	-
191	1653	Thorium hydride...	20	340	330	-	-
193	739	Tin...............	430	-	900	720	-
195	1555	Titanium..........	480	900	900	-	-
198	740	do.	460	680	-	-	900
199	1556	Titanium, copper-coated.	430	900	900	-	-
201	864	Titanium..........	470	470	500	-	-
204	1649	Titanium hydride..	500	710	750	-	-
211	1625	Uranium...........	100	350	410	-	-
212	1626	Uranium hydride...	20	360	210	-	-
217	744	Zinc..............	460	480	-	-	600
225	745	Zirconium.........	210	560	530	-	-
228	1632	do.	190	620	790	-	-
229	1633	do.	300	710	-	-	-
233	1627	Zirconium hydride.	340	650	-	-	-
247	1021	Aluminum-magnesium	460	660	550	-	-
248	746	do.	470	700	550	-	-
249	748	do.	480	670	630	-	-

[1]No reaction at 850° C.

PREVENTION OF IGNITION AND EXPLOSION

The explosion hazard of metal powders can be reduced by good housekeeping, preventing dust dissemination, eliminating igniting sources, using inert atmospheres, and venting. Details for elimination of igniting sources, inerting, and control of dust explosions are published by the National Fire Protection Association.[14]

[14]National Fire Protection Association. Combustible Solids, Chemicals and Explosives. National Fire Codes, v. II, 1960-61.

TABLE A-1. - Description, explosibility index, and particle size of dusts

Line	Sample	Explo-sibility index	Material	Particle size, percent passing opening (microns) 149	104	74	53	44	Subsieve sizer, microns
			Metals						
1	1712	>10	Aluminum, atomized, collector fines	-	-	-	-	100	-
2	1035	-	do	-	-	100	-	-	-
3	1146	1.4	do	100	-	93	-	-	-
4	1221	1.4	do	100	-	99	-	-	-
5	1267	3.6	do	98	98	96	-	-	-
6	1480	6.9	do	100	-	94	-	-	-
7	1663	8.7	do	100	100	97	-	-	-
8	1664	8.4	do	100	100	95	-	-	-
9	1770	-	do	100	100	100	-	-	-
10	1854	-	do	-	-	-	-	100	-
11	2126	>10	Aluminum, atomized, commercial-purity fines	-	-	-	-	100	6
12	1416	8.5	Aluminum, atomized, MD105, 92.8 percent Al	99	-	97	-	-	-
13	2372	-	Aluminum, atomized, R400	-	-	-	-	100	-
14	2373	-	Aluminum, atomized, R1-131	-	-	-	-	100	-
15	2374	-	Aluminum, atomized, R1-511	-	-	-	-	99	-
16	2375	-	Aluminum, atomized, R200	-	-	-	-	89	-
17	2376	-	Aluminum, atomized, RS-6558-A, spherical	-	-	-	-	98	-
18	1597	2.6	Aluminum, atomized	-	-	100	-	-	-
19	2403	3.8	Aluminum, atomized, AC-SAX-14, 99.6 percent Al	-	-	-	-	93	-
20	910	-	Aluminum, atomized, grade B	-	-	100	-	71	-
21	897	.9	Aluminum, atomized, extra-fine	-	-	100	-	-	-
22	1067	.7	Aluminum, atomized, 100-mesh, 92.5 percent Al	-	-	96	-	82	-
23	1102	-	Aluminum, atomized, A101	-	-	91	-	80	-
24	1127	-	do	-	-	93	-	80	-
25	2077	-	Aluminum, atomized, A101, no lubricant	-	-	95	-	85	-
26	1068	.6	Aluminum, atomized, MD101	100	-	90	-	80	-
27	1081	1.1	do	100	98	91	85	78	-
28	1082	1.4	do	100	98	91	87	81	-
29	1022	.9	do	100	99	95	92	85	-
30	1094	1.1	Aluminum, atomized, MD101, 96 percent Al	100	-	95	91	85	-
31	1095	.7	Aluminum, atomized, MD101, 98 percent Al	100	-	90	83	75	-
32	1852	-	Aluminum, atomized, A104	-	-	93	-	85	-
33	2356	1.2	Aluminum, atomized, R120	100	-	96	-	87	-
34	2217	-	Aluminum, atomized, A201	100	-	100	-	85	-
35	701	.9	Aluminum, atomized, MD201, 97 percent Al	-	-	95	92	85	-
36	2130	2.4	Aluminum, atomized, high purity	-	-	-	-	87	18
37	2129	1.8	Aluminum, atomized, commercial purity	-	-	-	-	82	18
38	2128	1.1	do	-	-	-	-	78	19
39	1080	.9	Aluminum, atomized	100	98	91	85	77	-
40	1078	.8	Aluminum, atomized, S1000 Navy, 97.3 percent Al	100	98	92	85	78	-
41	1079	1.3	Aluminum, atomized, S1000 Navy, 92.8 percent Al	98	93	87	82	77	-
42	1769	-	Aluminum, atomized, commercial size	84	-	62	-	-	-
43	1151	-	Aluminum, atomized, 40-mesh	74	63	52	-	-	-
44	1152	-	do	74	63	52	-	-	-
45	1153	-	do	77	65	53	-	-	-
46	2127	-	Aluminum, atomized, commercial purity	-	-	-	-	35	20
47	1100	-	Aluminum, atomized, 40-mesh, Navy	-	-	58	-	38	-
48	1274	-	Aluminum, atomized, 40-mesh, A120	-	-	52	-	33	-
49	1853	-	Aluminum, atomized, 40-mesh, A124	-	-	53	-	39	-
50	1101	-	Aluminum, atomized, 12-mesh, Navy	-	-	37	-	24	-
51	2290	-	Aluminum, atomized, coarse	-	-	37	-	19	-
52	2289	-	do	-	-	17	-	8	-
53	1266	-	Aluminum, atomized, coarse, A120	-	-	9	-	2	-
54	2282	-	Aluminum, atomized, coarse, A125	-	-	2	-	1	-
55	1005	-	Aluminum, atomized, grade A, Navy, 110, no added fines	-	-	100	-	-	-
56	1004	-	Aluminum, atomized, grade A, Navy, 110, 5 percent added fines	-	-	100	-	-	-
57	787	-	Aluminum, grained	97	-	89	87	-	-
58	1069	.6	do	100	-	88	-	64	-
59	1070	.3	do	99	-	80	-	53	-
60	1771	-	Aluminum, plating from cooling chamber	-	-	100	-	-	-
61	1772	-	Aluminum, from cooling chamber ducts	-	-	100	-	-	-
62	884	>10	Aluminum, flake, A422, extra-fine lining, polished	-	-	-	-	100	-
63	1927	>10	Aluminum, flake, A422, extra-fine lining, polished,4.28 percent stearic acid.	-	-	-	-	100	-
64	2080	-	Aluminum, flake, A422, extra-fine lining, polished, 4.25 percent stearic acid.	-	-	-	-	100	-
65	883	-	Aluminum, Flake, A408, standard lining, polished	-	-	-	-	99	-
66	1437	>10	do	100	-	99	-	99	-
67	1926	>10	Aluminum, flake, A408, standard lining, polished, 3.09 percent stearic acid.	-	-	-	-	99	-
68	2079	-	Aluminum, flake, A408, standard lining, polished, 3.00 percent stearic acid.	-	-	-	-	99	-
69	1421	>10	Aluminum, flake, A552, lining litho, polished, 1.0 percent oleic acid	100	-	99	-	98	-
70	2081	-	do	-	-	-	-	97	-
71	1929	>10	Aluminum, flake, A552, lining litho, polished, 0.75 percent stearic acid	-	-	-	-	99	-
72	1930	>10	Aluminum, flake, A552, lining litho, special grease free	-	-	-	-	92	-
73	1925	9.5	Aluminum, flake, A322, standard varnish, polished, 2.74 percent stearic acid	-	-	-	-	94	-
74	2078	-	Aluminum, flake, A322, standard varnish, polished, 2.75 percent stearic acid	-	-	-	-	95	-
75	882	-	Aluminum, flake, A301, extra brilliant varnish	-	-	-	-	95	-
76	1195	4.8	Aluminum, flake, A606, standard unpolished	100	-	98	-	86	-
77	1928	>10	Aluminum, flake, A606, standard unpolished, 0.65 percent stearic acid	-	-	100	-	86	-
78	881	-	Aluminum, flake	-	-	100	-	-	-
79	1182	5.7	do	100	-	99	-	-	-
80	702	4.4	do	-	-	85	80	-	-
81	2057	-	Aluminum, flake, MD1100, 7 percent--mica, 83 percent	-	-	41	-	-	-
82	2071	-	Aluminum, flake, MD1100, coarse litho, polished	2	-	1	-	-	-
83	1647	3.1	Aluminum, milled, D021, unpolished	-	-	97	-	-	-
84	1444	3.9	Aluminum, fluid milled	-	-	-	-	-	5
85	1443	-	do	-	-	-	-	-	15
86	1442	-	do	-	-	-	-	-	26

TABLE A-1. - Description, explosibility index, and particle size of dusts--Continued

Line	Sample	Explosibility index	Material	Particle size, percent passing opening (microns) 149	104	74	53	44	Subsieve sizer, microns
			Metals--Continued						
87	1447	>10	Aluminum, fluid milled, 1.5 percent stearic acid	-	-	-	-	-	1
88	1446	4.4	do.	-	-	-	-	-	3
89	1445	.8	do.	-	-	-	-	-	11
90	703	<.1	Antimony, milled, 96 percent Sb	-	-	91	88	-	-
91	2464	-	Beryllium, 2.4 percent oxide	-	-	-	-	-	5
92	2465	-	Beryllium, 1.2 percent oxide	-	-	-	-	-	5
93	2466	-	Beryllium, 1.9 percent oxide	-	-	-	-	-	3
94	2467	-	Beryllium	-	-	-	-	-	2
95	2468	-	Beryllium, 8.1 percent oxide	-	-	-	-	-	1
96	2398A	-	Beryllium	-	-	100	-	-	-
97	2398B	-	do.	-	-	-	-	-	4
98	1838	.8	Boron, amorphous, commercial, 85 percent B	100	-	100	-	100	-
99	2003	-	Boron	-	-	-	-	100	-
100	2006	-	Boron, grade D, 96.66 percent B	-	-	-	-	100	-
101	704	-	Cadmium, atomized, 98 percent Cd	-	-	100	82	-	-
102	705	-	Chromium, milled, 97 percent Cr	-	-	100	99	-	-
103	2351A	-	Chromium, electrolytic, milled, 97 percent Cr	94	-	80	75	67	13
104	2351B	-	do.	98	-	83	78	69	17
105	2329	-	do.	98	-	88	-	-	6
106	2351C	-	do.	100	-	100	99	92	4
107	2351D	.1	do.	100	-	100	99	98	3
108	2351E	-	do.	100	-	100	100	99	3
109	857	-	Cobalt, milled, 97.8 percent Co	-	-	-	-	100	-
110	706	-	Copper, reduced, 94 percent Cu	-	-	-	-	98	-
111	856	-	Copper, electrolytic, type C, 99.5 percent Cu	-	-	99	99	-	-
112	708	-	Iron, milled, 94 percent Fe, 2 percent Si	45	-	19	-	-	-
113	709	-	do.	80	-	39	-	-	-
114	710	-	do.	98	-	94	92	-	-
115	855	<.1	Iron, electrolytic, annealed, 99.5 percent Fe	-	-	-	-	100	-
116	1654	<.1	Iron, electrolytic	-	-	100	-	100	-
117	1974	-	Iron, Oxweld grade	100	-	77	-	-	-
118	1693	<.1	Iron, electric furnace	-	-	100	-	-	-
119	711	-	Iron, hydrogen reduced, 97 percent Fe	-	-	-	100	-	-
120	712	.3	Iron, hydrogen reduced, 98 percent Fe	-	-	-	100	-	-
121	1291	-	Iron, hydrogen reduced, MD132	99	72	48	37	28	-
122	1292	-	Iron, hydrogen reduced, MD8593	100	94	85	76	68	-
123	713	-	Iron, carbon reduced, 96 percent Fe	92	-	61	53	-	-
124	714	<.1	do.	99	-	94	91	-	-
125	715	<.1	do.	100	-	97	96	-	-
126	707	1.6	Iron, carbonyl, 99 percent Fe	-	-	100	99	-	-
127	1766	.5	Iron, carbonyl, ammonia treated	-	-	100	-	100	-
128	1767	.7	Iron, carbonyl, untreated	-	-	100	-	100	-
129	1920	-	Iron, carbonyl, type E, processed, contains lacquer	-	-	100	-	-	-
130	879	-	Iron, sponge, 99 percent Fe	98	-	38	-	-	-
131	1655	<.1	Iron, sponge	-	-	100	-	-	-
132	1288	-	Iron, sponge, domestic	100	93	75	60	49	-
133	1295	-	do.	100	81	54	37	26	-
134	1293	-	Iron, sponge, Swedish	100	76	45	31	22	-
135	1294	-	do.	98	74	49	35	25	-
136	716	-	Lead, atomized	-	-	100	-	-	-
137	717	-	do.	-	-	100	99	-	-
138	718	-	Lead, atomized, 99 percent Pb	-	-	-	100	-	-
139	1163	-	Lead, atomized	-	-	100	-	-	-
140	1164	-	do.	-	-	100	-	-	-
141	719	-	Lead, stamped, 94 percent Pb, 5 percent Sn	100	-	94	89	-	-
142	1074	-	Magnesium, atomized	2	-	-	-	-	-
143	1075	<.1	do.	92	58	21	10	4	-
144	1076	.6	do.	-	100	100	95	81	-
145	1666	-	Magnesium, atomized, spherical	36	-	16	-	-	-
146	1677	1.3	do.	100	-	100	-	-	-
147	720	-	Magnesium, milled, coarse	4	-	3	0	-	-
148	722	-	Magnesium, milled	-	-	-	-	-	-
149	723	.6	Magnesium, milled, 99 percent Mg	100	-	40	32	-	-
150	724	.3	do.	98	-	77	67	-	-
151	725	4.0	Magnesium, milled, No. 2, 99 percent Mg	100	-	92	86	-	-
152	728	<.1	Magnesium, milled, FLDG-2C	8	-	1	1	-	-
153	726	.7	Magnesium, milled, FLDG-2A	57	-	15	13	-	-
154	727	7.2	Magnesium, milled, FLDG-2B, 98 percent Mg	100	-	87	78	-	-
155	731	-	Magnesium, milled, MCUS-C	1	-	0	-	-	-
156	729	<.1	Magnesium, milled, MCUS-A	50	-	14	11	-	-
157	730	8.8	Magnesium, milled, MCUS-B, 98 percent Mg	100	-	93	84	-	-
158	860	7.4	Magnesium, milled, grade B	-	-	100	-	-	-
159	1020	>10	Magnesium, milled	-	-	100	-	-	-
160	1285	>10	Magnesium, milled, grade B	100	-	100	-	-	-
161	1228	1.6	do.	100	99	84	76	-	-
162	1148	.5	do.	95	81	52	-	-	-
163	732	.7	Magnesium, stamped, V-1-A	68	-	20	16	-	-
164	734	>10	Magnesium, stamped, 81-B	99	-	93	87	-	-
165	733	>10	Magnesium, stamped, V-1-B, 98 percent Mg	100	-	97	96	-	-
166	735	-	Magnesium, Permanente process, partially oxidized	83	-	54	49	-	-
167	849	<.1	Manganese, electrolytic	-	-	100	-	-	-
168	736	<.1	Manganese, milled, 97 percent Mn	-	-	100	92	-	-
169	1032	<.1	Manganese	-	-	100	-	-	-
170	1657	.1	do.	-	-	100	-	100	-
171	858	-	Molybdenum, hydrogen reduced, 99.8 percent Mo	-	-	100	-	-	-

Line	Sample	Explosibility index	Material	Particle size, percent passing opening (microns) 149	104	74	53	44	Subsieve sizer, microns
			Metals--Continued						
172	854	-	Nickel, milled, 99 percent Ni, 0.7 percent Co	-	100	-	-	-	-
173	1656	-	Nickel	-	-	100	-	100	-
174	782	-	Selenium, milled, precipitated from sulfate	-	-	99	70	-	-
175	2425	-	Silicon, G120	-	-	100	-	-	-
176	737	<0.1	Silicon, milled, 96 percent Si	100	-	91	86	-	-
177	1087	<.1	Silicon	-	-	97	-	-	-
178	1033	<.1	Silicon	-	-	94	-	-	-
179	1658	<.1	do	-	-	100	-	-	-
180	1951	-	Silicon, plant cyclone fines	98	-	97	-	-	-
181	2019	-	Silicon, fines from cyclone	100	-	94	-	-	-
182	2018	-	Silicon, from bag filter before fire	100	-	100	-	-	-
183	2020	-	Silicon, from filter with dry chemical extract	100	-	100	-	-	-
184	2021	-	Silicon, regular, from bag filter before grinding	100	-	100	-	-	-
185	2022	-	Silicon, regular, from cyclone before grinding	100	-	100	-	-	-
186	2341A	.1	Tantalum	100	-	100	-	100	-
187	2341B	-	Tantalum, heat treated	100	-	100	-	100	-
188	2341C	<.1	Tantalum, hydrided and ground	100	-	100	-	100	-
189	783	-	Tellurium, electrolytic, 99 percent Te	-	-	-	-	100	-
190	1652	>10	Thorium, contains 1.2 percent O_2	-	-	-	-	-	7
191	1653	>10	Thorium hydride, contains 0.94 percent H_2	-	-	-	-	-	3
192	738	-	Tin, atomized, 98 percent Sn	100	-	98	97	-	-
193	739	.1	Tin, atomized, 96 percent Sn, 2 percent Pb	100	-	97	96	-	-
194	1648	>10	Titanium, 99 percent Ti	-	94	-	-	-	10
195	1555	>10	Titanium, 96.3 percent Ti	-	-	-	-	100	-
196	1605	-	Titanium, 96 percent Ti	-	-	-	-	100	-
197	1996	-	Titanium	-	-	-	-	100	-
198	740	.4	Titanium, milled, 97 percent Ti	-	-	100	-	-	-
199	1556	>10	Titanium, copper coated, 88.2 percent Ti, 7 percent Cu	-	-	-	-	100	-
200	1606	-	Titanium, copper coated, 85.6 percent Ti, 12.7 percent Cu	-	-	-	-	100	-
201	864	<.1	Titanium, 68.7 percent Ti, 8 percent Al, 2.5 percent Si, 3.5 percent Fe, 1 percent Cu.	-	-	100	-	50	-
202	1962	<.1	Titanium, machine turnings, from collector	-	-	90	-	-	-
203	2017	-	Titanium, plant dust, contains contaminants	100	-	96	-	-	-
204	1649	4.9	Titanium hydride, 97 percent Ti, 2.8 percent H_2	-	-	-	-	100	5
205	1428	6.0	Titanium hydride, 95 percent Ti, 3.8 percent H_2	-	-	-	-	98	-
206	2452	-	Tungsten, purified	-	-	-	-	99	15
207	1404	-	Tungsten, hydrogen reduced	-	-	-	-	100	-
208	859	-	do	-	-	99	91	-	-
209	1390	-	Tungsten bearing, 51 percent W	-	-	100	-	-	-
210	1391	-	Tungsten bearing, 40 percent W	-	-	100	-	-	-
211	1625	>10	Uranium	-	-	-	-	-	10
212	1626	>10	Uranium hydride	-	-	-	-	-	3
213	1008	<.1	Vanadium, 86.4 percent V	-	-	100	-	-	-
214	741	<.1	Zinc, condensed, 97 percent Zn, 2 percent Pb	-	-	-	-	95	-
215	742	-	do	-	-	-	-	99	-
216	743	-	Zinc	100	-	100	-	-	-
217	744	<.1	Zinc, 97 percent Zn, 2 percent Pb	100	-	100	-	-	-
218	764	-	Zinc	-	-	-	99	-	-
219	1413	-	do	-	-	-	-	100	-
220	1659	-	Zinc, raw feed	-	-	100	-	-	-
221	2034	-	Zinc, from galvanizing unit	-	-	100	-	-	-
222	534	-	Zinc, from dust collector at galvanizing pot	-	-	100	-	-	-
223	535	-	Zinc, from roof of lean-to	-	-	100	-	-	-
224	2035	-	Zinc, wet for 24 hours	-	-	100	-	-	-
225	745	4.1	Zirconium, milled, 97 percent Zr	-	-	-	-	100	-
226	1028	>10	Zirconium	-	-	-	-	100	-
227	1029	>10	do	-	-	-	-	100	-
228	1632	>10	Zirconium, extra fine, contains 3 percent O_2	-	-	-	-	-	3
229	1633	1.3	Zirconium, prepared from hydride, contains 0.3 percent O_2	-	-	-	-	100	18
230	1557	>10	Zirconium, 98.7 percent Zr	-	-	-	-	100	-
231	1558	>10	Zirconium, copper coated, 90.5 percent Zr, 4.4 percent Cu	-	-	-	-	100	-
232	1429	3.7	Zirconium hydride, 93.6 percent Zr, 2.1 percent H_2	-	-	-	-	98	-
233	1627	.7	Zirconium hydride	-	-	-	-	-	5
			Alloys and Compounds						
234	1844	-	Aluminum-bronze alloy, AMPCO-18	-	-	-	-	100	-
235	1793	-	Aluminum-cobalt alloy (60-40)	-	-	100	-	-	-
236	1895	.4	do	-	-	-	-	89	-
237	1430	.3	Aluminum-copper alloy, MD8764 (50-50)	-	-	-	-	100	-
238	2254	<.1	Aluminum-copper alloy (50-50)	-	-	100	-	-	-
239	2082	-	Aluminum-iron alloy (50-50)	-	-	100	-	-	-
240	1383	-	do	100	100	100	-	99	-
241	1269	-	do	-	-	-	-	80	-
242	1975	-	Aluminum-iron alloy (30-70)	96	-	70	-	38	-
243	2196	-	Aluminum-lithium alloy, 15 percent Li	5	-	-	-	-	-
244	2197	.6	Aluminum-lithium alloy, 15 percent Li	100	-	-	-	-	-
245	1077	.2	Aluminum-magnesium alloy, atomized (50-50)	100	94	82	75	67	-
246	747	2.0	Aluminum-magnesium alloy, milled (50-50)	-	-	-	-	96	-
247	1021	3.0	do	-	-	-	100	94	-
248	746	7.6	do	100	-	-	-	-	62
249	748	>10	Aluminum-magnesium alloy, milled, Dowmetal	-	-	-	-	100	-
250	2408	4.2	Aluminum-magnesium alloy, 6 percent Mg	-	-	-	-	95	-
251	2065	3.0	Aluminum-magnesium alloy, 5 percent Mg, MD9455	-	-	100	-	-	-
252	2125	1.7	Aluminum-magnesium alloy, 5 percent Mg	-	-	100	-	-	16
253	1894	.6	Aluminum-nickel alloy (58-42)	-	-	-	-	85	-
254	2102	<.1	Aluminum-nickel alloy, catalyst (58-42)	-	-	100	-	-	-
255	1893	-	Aluminum-nickel alloy (50-50)	-	-	-	-	88	-

TABLE A-1. - Description, explosibility index, and particle size of dusts--Continued

Line	Sample	Explo-sibility index	Material	Particle size, percent passing opening (microns) 149	104	74	53	44	Subsieve sizer, microns
			Alloys and Compounds--Continued						
256	2114A	-	Aluminum-nickel alloy (50-50)........	-	-	-	-	83	-
257	2114B	-	........do........	-	-	-	-	79	-
258	2404	3.6	Aluminum-silicon alloy, 12 percent Si........	-	-	-	-	93	-
259	1845	-	Beryllium copper, Berylco-25........	-	-	-	-	100	-
260	672	-	Calcium silicide........	100	-	71	-	-	-
261	671	-	........do........	100	-	78	-	-	-
262	675	-	........do........	-	-	100	-	-	-
263	681	-	........do........	-	-	100	-	-	-
264	683	-	........do........	-	-	100	-	-	-
265	684	-	........do........	-	-	100	-	-	-
266	1982	0.2	........do........	-	-	-	-	100	17
267	1981	2.0	........do........	-	-	-	-	-	2
268	871	-	Ferrochromium, low carbon, 69.7 percent Cr, 29.4 percent Fe, 0.1 percent C..	-	-	100	-	50	-
269	872	-	Ferrochromium, high carbon, 69.4 percent Cr, 24.3 percent Fe, 4.7 percent C.	-	-	100	-	95	-
270	1822	-	Ferromanganese........	-	-	-	-	80	-
271	850	-	Ferromanganese, low iron........	-	-	69	-	-	-
272	1482	.4	Ferromanganese, medium carbon........	100	-	100	-	-	-
273	870	-	Ferrosilicon, 50 percent Si, 50 percent Fe........	-	-	100	-	95	-
274	1840	-	Ferrosilicon, 75 percent Si, from ball mill........	-	-	100	-	-	-
275	1841	-	Ferrosilicon, 75 percent Si, from chute leading to ball mill........	-	-	100	-	-	-
276	2030	-	Ferrosilicon, 80 to 85 percent Si........	100	-	100	-	-	-
277	2031	-	Ferrosilicon, 85 to 90 percent Si........	100	-	100	-	-	-
278	869	<.1	Ferrosilicon, 88 percent Si, 9 percent Fe........	-	-	100	-	92	-
279	2032	-	Ferrosilicon, 90 to 95 percent Si........	100	-	100	-	-	-
280	865	-	Ferrotitanium, high carbon, 17.8 percent Ti, 70 percent Fe, 7.0 percent C...	-	-	100	-	80	-
281	868	1.3	Ferrotitanium, low carbon, 19.0 percent Ti, 74.1 percent Fe, 0.06 percent C.	-	-	100	-	85	-
282	866	-	Ferrovanadium, crucible grade, 40.4 percent V, 56 percent Fe........	-	-	100	-	92	-
283	867	-	Ferrovanadium, open hearth grade, 37.45 percent V, 46.25 percent Fe, 11 percent Si.	-	-	100	-	90	-
284	1521	-	Gold bronze, MD Greengold 650, 71 percent Cu, 29 percent Zn........	100	-	100	100	-	-
285	1843	-	Manganese bronze........	-	-	-	-	100	-
286	1842	-	Steel, stainless, AISI347........	-	-	-	-	100	-
287	2353	-	Zircaloy-2, mechanically attrited........	-	-	65	-	-	27
288	2354A	-	Zircaloy-2, hydride--dehydrided........	-	-	100	-	-	20
289	2354B	-	........do........	-	-	50	-	-	29
290	2354C	-	........do........	100	-	-	-	-	>74
			Ores and Catalysts						
291	1155	-	Catalyst, 0.68 percent C (aluminum-silicate)........	-	-	100	-	-	-
292	1154	-	Catalyst, 1.10 percent C, spent (aluminum-silicate)........	-	-	100	-	-	-
293	1156	-	Catalyst, 8.32 percent C (aluminum-silicate)........	-	-	69	-	-	-
294	1952	-	Catalyst, 60 to 70 percent Cu, 30 to 40 percent Cu_2O........	100	-	100	-	-	-
295	1953	-	Catalyst, 10 percent Cu-Cu_2O, 90 percent Si........	-	-	57	-	-	-
296	1950	-	Catalyst, contains Cu, Cu_2O and Si, bed sample........	-	-	55	-	-	-
297	1949	-	Catalyst, contains Cu, Cu_2O and Si, removed by cyclone........	100	-	99	-	-	-
298	1948	-	Catalyst, contains Cu, Cu_2O and Si, through cyclone........	-	-	100	-	-	-
299	1832	-	Copper ore, sulfide, Mexico........	-	-	100	-	-	-
300	1873	-	Iron ore, magnetite........	-	-	100	-	-	-
301	2075	-	Iron ore, pyrite........	-	-	100	-	-	-
302	2076	-	........do........	-	-	100	-	-	-
303	749	-	Iron ore, sulfide, Tennessee, after explosion........	-	-	100	-	-	-
304	750	-	........do........	-	-	100	-	-	-
305	751	-	........do........	-	-	100	-	-	-
306	752	-	........do........	-	-	100	-	-	-
307	1660	-	Iron pyrite, micronized........	-	-	100	-	-	-
308	2427	-	Lead ore, sulfide, galena........	-	-	100	-	-	-
309	780	-	Manganese ore........	100	-	92	-	-	-
310	781	-	........do........	-	-	92	-	-	-
311	1820	-	Manganese ore, sulfide........	90	-	-	-	-	-
312	1821	-	........do........	-	-	-	-	90	-
313	2073	-	Nickel ore, concentrate........	-	-	100	-	-	-
314	-	1.0	Pittsburgh coal, high-volatile A, bituminous........	-	-	100	-	-	-

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

Line	Sample	Ignition sensitivity	Ignition temperature, ° C		Minimum igniting energy for dust, millijoules		Minimum explosive concentration, oz/cu ft	Relative flammability, percent inert		Limiting oxygen concentration,[1] percent	
			Cloud	Layer	Cloud	Layer		In furnace	In spark apparatus	Spark	Furnace, 850° C
1	1712	1.4	650	760	50	16	0.045	30	90	C 2	-
2	1035	-	-	-	20	8	-	-	-	-	-
3	1146	.5	640	-	120	7	.055	55	85	-	-
4	1221	.6	800	780	80	32	.055	-	85	-	-
5	1267	.7	550	840	100	240	.050	65	90	-	-
6	1480	.8	700	740	60	2	.060	25	90	-	-
7	1663	1.3	640	770	50	16	.050	25	90	-	-
8	1664	1.2	640	750	60	16	.045	30	90	-	-
9	1770	.9	660	-	80	-	.045	-	-	-	-
10	1854	-	-	-	15	-	.045	-	-	-	-
11	2126	1.0	820	720	50	32	.050	-	90+	-	-
12	1416	1.0	790	860	40	24	.065	-	90	-	-
13	2372	-	-	-	30	16	.045	-	-	-	-
14	2373	-	-	-	30	16	-	-	-	-	-
15	2374	-	-	-	40	56	-	-	-	-	-
16	2375	-	-	-	60	240	-	-	-	-	-
17	2376	-	-	-	60	720	.040	-	-	-	-
18	1597	.7	650	-	80	24	.060	10	90	N 7	-
19	2403	1.3	660	-	60	240	.040	-	-	-	-
20	910	-	([2])	([2])	80	100	.080	-	33	-	-
21	897	.3	670	490	160	4	.075	68	83	-	-
22	1067	.6	670	-	120	160	.045	5	70	N 7	-
23	1102	-	([2])	-	80	160	.050	-	55	-	-
24	1127	-	([2])	-	200	7	.055	-	60	-	-
25	2077	-	-	-	-	-	-	-	-	C 7 N 9	-
26	1068	.5	750	([2])	120	160	.050	-	68	N 7	-
27	1081	.8	830	([2])	60	240	.050	-	55	-	-
28	1082	.7	840	([2])	80	240	.045	-	65	-	-
29	1022	.7	830	900	80	50	.045	-	73	-	-
30	1094	.8	890	-	60	160	.050	-	65	-	-
31	1095	.6	880	-	60	160	.060	-	55	-	-
32	1852	-	-	-	60	-	.065	-	-	-	-
33	2356	.7	700	830	80	320	.050	-	-	C 5	-
34	2217	-	([2])	-	120	800	.070	-	70	-	-
35	701	.5	700	900	160	20	.040	10	78	C <3 N 9	-
36	2130	.7	930	([2])	60	160	.050	-	80	-	-
37	2129	.7	950	([2])	60	160	.050	-	75	-	-
38	2128	.5	950	([2])	80	320	.055	-	75	-	-
39	1080	.8	740	([2])	80	240	.045	-	55	-	-
40	1078	.7	700	([2])	80	240	.050	3	60	-	-
41	1079	1.0	700	([2])	60	160	.050	3	65	-	-
42	1769	.1	950	-	200	-	.140	-	-	-	-
43	1151	-	([2])	-	240	160	.070	-	40	-	-
44	1152	-	([2])	-	160	160	.090	-	35	-	-
45	1153	-	([2])	-	240	160	.090	-	35	-	-
46	2127	-	([2])	([2])	200	320	.140	-	50	-	-
47	1100	-	([2])	-	160	240	.125	-	30	-	-
48	1274	-	([2])	-	160	800	.165	-	40	-	-
49	1853	-	([2])	-	140	-	.120	-	-	-	-
50	1101	-	([2])	-	320	320	.145	-	15	-	-
51	2290	-	-	-	-	-	.600	-	-	-	-
52	2289	-	-	-	-	-	([2])	-	-	-	-
53	1266	-	([2])	([2])	([2])	-	([2])	-	([2])	-	-
54	2282	-	([2])	([2])	-	([2])	([2])	-	5	-	-
55	1005	-	([2])	([2])	50	400	.050	-	63	-	-
56	1004	-	([2])	([2])	50	400	.050	-	60	-	-
57	787	-	770	-	-	-	.045	-	63	-	-
58	1069	.6	690	([2])	100	240	.050	5	55	N 7	-
59	1070	.2	880	([2])	160	240	.060	-	55	N 7	-
60	1771	.2	860	-	140	-	.070	-	-	-	-
61	1772	.5	660	-	80	-	.085	-	-	-	-
62	884	3.4	650	400	20	2	.045	78	90	C 6	C<3
63	1927	7.3	610	320	10	2	.045	85	90+	-	-
64	2080	-	-	-	-	-	-	-	-	C 6 N 9	-
65	883	2.8	650	400	25	3	.045	70	85	-	-
66	1437	4.2	710	470	15	4	.045	-	90	-	-
67	1926	4.1	650	510	15	3	.050	80	90	-	-
68	2079	-	-	-	-	-	-	-	-	C 6 N 9	
69	1421	2.1	700	560	30	24	.045	-	90	-	-

See footnotes at end of table.

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

Line	Sample	Ignition sensitivity	Ignition temperature, ° C		Minimum igniting energy for dust, millijoules		Minimum explosive concentration, oz/cu ft	Relative flammability, percent inert		Limiting oxygen concentration,[1] percent	
			Cloud	Layer	Cloud	Layer		In furnace	In spark apparatus	Spark	Furnace, 850° C
70	2081	-	-	-	-	-	-	-	-	C 4 N 9	-
71	1929	4.1	650	520	15	4	0.050	75	90	-	-
72	1930	1.3	630	530	50	24	.050	75	85	-	-
73	1925	1.1	640	550	50	16	.060	65	85	-	-
74	2078	-	-	-	-	-	-	-	-	C 6 N 9	-
75	882	.7	790	-	80	40	.045	-	75	-	-
76	1195	1.0	650	-	80	2	.040	55	85	-	-
77	1928	1.0	660	540	60	32	.050	60	85	-	-
78	881	-	([2])	([2])	-	800	([2])	-	0	-	-
79	1182	.6	670	550	100	2	.050	70	85	-	-
80	702	.9	650	590	100	40	.035	60	80	-	-
81	2057	-	([2])	980	([2])	([2])	([2])	-	([2])	-	-
82	2071	-	([2])	870	([2])	-	([2])	-	([2])	-	-
83	1647	.5	690	540	120	16	.045	65	90	-	-
84	1444	.8	550	630	100	24	.045	55	80	-	-
85	1443	-	([2])	([2])	180	24	.085	-	65	-	-
86	1442	-	([2])	([2])	390	240	.140	-	45	-	-
87	1447	1.3	550	390	50	6	.055	85	90	-	-
88	1446	1.4	550	460	60	6	.045	40	85	-	-
89	1445	.4	770	580	100	40	.060	-	80	-	-
90	703	<.1	420	330	1,920	2,560	.420	65	18	C 16	-
91	2464	-	([2])	680	-	-	-	-	-	-	-
92	2465	-	([2])	650	-	-	-	-	-	-	-
93	2466	-	([2])	700	-	-	-	-	-	-	-
94	2467	-	([2])	600	-	-	-	-	-	-	-
95	2468	-	910	540	-	-	-	-	-	-	-
96	2398A	-	([2])	-	-	-	([2])	-	-	-	-
97	2398B	-	([2])	640	-	-	([2])	-	-	-	-
98	1838	.7	470	400	60	-	<.100	90	70	-	-
99	2003	-	880	510	([2])	-	([2])	-	([2])	-	-
100	2006	-	730	390	-	-	([2])	-	([2])	-	-
101	704	-	570	250	4,000	-	-	35	0	-	-
102	705	-	900	670	([2])	1,280	-	-		-	-
103	2351A	-	([2])	-	-	-	([2])	-	-	-	-
104	2351B	-	900	-	-	-	-	-	-	-	-
105	2329	<.1	660	490	5,120	-	.770	15	25	C 14	-
106	2351C	-	-	-	-	-	-	-	-	-	-
107	2351D	.1	580	400	140	240	.230	-	-	-	-
108	2351E	-	900	-	-	-	-	-	-	-	-
109	857	-	760	370	-	-	-	-	0	-	-
110	706	-	700	-	([2])	([2])	-	3	0	-	-
111	856	-	900	-	-	-	-	-	0	-	-
112	708	-	900	590	([2])	([2])	-	-	0	-	-
113	709	-	880	550	([2])	([2])	-	-	0	-	-
114	710	-	780	460	([2])	([2])	-	-	0	-	-
115	855	.3	430	390	80	32	.170	88	40	C 13	-
116	1654	.1	320	170	240	7	.200	90	60	-	-
117	1974	-	560	380	-	-	-	45	0	-	-
118	1693	<.1	500	280	640	([2])	<.500	45	10	-	-
119	711	-	430	370	-	-	.120	83	55	C 13	-
120	712	.7	320	290	80	160	.120	83	50	C 11	-
121	1291	-	530	-	-	-	-	-	-	-	-
122	1292	-	600	-	-	-	-	-	-	-	-
123	713	-	450	500	1,920	1,120	-	90+	15	C 17	-
124	714	.1	450	530	320	800	.270	90+	43	C 17	-
125	715	.1	430	390	320	800	.250	90+	15	C 14	-
126	707	3.0	320	310	20	80	.105	85	60	C 10	-
127	1766	.3	460	260	120	160	.120	60	40	-	-
128	1767	.5	420	230	100	160	.105	65	50	-	-
129	1920	<.1	580	230	560	-	<1.000	65	25	-	-
130	879	<.1	580	500	400	480	.610	90	25	C 17	-
131	1655	.1	440	270	305	72	<.200	85	55	-	-
132	1288	-	540	-	-	-	-	-	-	-	-
133	1295	-	530	-	-	-	-	-	-	-	-
134	1293	-	570	-	-	-	-	-	-	-	-
135	1294	-	580	-	-	-	-	-	-	-	-
136	716	-	790	290	([2])	([2])	-	-	0	-	-
137	717	-	780	380	([2])	([2])	-	-	0	-	-
138	718	-	710	270	([2])	([2])	-	-	0	-	-
139	1163	-	800	460	-	-	-	-	0	-	-
140	1164	-	750	300	-	-	-	-	0	-	-

See footnotes at end of table.

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

Line	Sample	Ignition sensitivity	Ignition temperature, ° C		Minimum igniting energy for dust, millijoules		Minimum explosive concentration, oz/cu ft	Relative flammability, percent inert		Limiting oxygen concentration,[1] percent	
			Cloud	Layer	Cloud	Layer		In furnace	In spark apparatus	Spark	Furnace, 850° C
141	719	-	580	300	(2)	(2)	-	20	0	-	-
142	1074	-	800	520	-	1,920	2.000	-	-	-	-
143	1075	0.1	720	520	500	800	.070	-	15	C 4	-
144	1076	.5	600	520	240	50	.030	80	70	C <3	-
145	1666	-	660	-	-	-	-	15	10	-	-
146	1677	.6	600	490	120	40	.045	75	80	-	-
147	720	-	790	560	(2)	(2)	-	-	0	-	-
148	722	-	620	520	160	480	-	70	50	-	-
149	723	.5	640	530	160	320	.040	90	85	-	-
150	724	.3	620	520	320	120	.040	90	85	-	-
151	725	1.8	570	490	80	40	.025	90	88	-	-
152	728	<.1	630	540	1,920	160	.125	90+	58	[3]C N 3	-
153	726	.4	540	520	160	120	.060	90+	83	[3]C N 3	-
154	727	2.3	540	510	80	30	.020	90+	90	[3]C N 2	-
155	731	-	740	540	(2)	320	.500	-	50	-	-
156	729	.1	620	520	320	120	.125	55	55	[3]C N 3	-
157	730	3.3	610	490	40	8	.025	85	88	[3]C N 3	-
158	860	1.3	550	480	80	.8	.035	90+	88	-	-
159	1020	3.3	620	490	40	40	.025	90+	88	-	-
160	1285	3.0	560	430	40	16	.030	90+	90	-	-
161	1228	1.0	570	530	120	72	.030	90+	85	-	-
162	1148	.2	600	490	320	-	.045	90+	65	-	-
163	732	.7	560	530	80	40	.065	90+	88	[3]C N 3	-
164	734	7.7	520	480	20	.24	.025	90+	90	[3]C N 2	-
165	733	4.7	540	480	40	20	.020	90+	90+	[3]C N 3	-
166	735	-	670	520	(2)	2,880	.160	60	45	-	-
167	849	.2	450	470	120	12	.245	43	25	C 17	-
168	736	.1	450	420	320	80	.210	40	25	C 15	-
169	1032	.2	520	340	80	16	.245	40	38	-	-
170	1657	.1	460	240	305	3	.125	80	60	-	-
171	858	-	720	360	-	-	-	-	0	-	-
172	854	-	(2)	(2)	-	-	-	-	0	-	-
173	1656	-	(2)	(2)	(2)	(2)	(2)	-	(2)	-	-
174	782	-	(2)	-	-	-	-	-	(2)	-	-
175	2425	-	(2)	-	320	-	.160	-	-	-	-
176	737	<.1	780	950	960	(2)	.160	-	33	C 15	-
177	1087	<.1	850	900	400	3,200	.245	-	38	-	-
178	1033	<.1	850	900	400	3,200	.245	-	38	-	-
179	1658	<.1	(2)	-	480	(2)	.150	-	50	-	-
180	1951	-	(2)	(2)	80	5,440	.125	-	60	-	-
181	2019	-	(2)	-	-	-	-	-	60	-	-
182	2018	-	(2)	760	80	800	<.100	-	70	C 12 N 11	-
183	2020	-	830	780	-	-	-	-	60	-	-
184	2021	-	(2)	790	100	800	.110	-	70	C 12 N 11	-
185	2022	-	(2)	-	-	-	-	-	75	-	-
186	2341A	.1	630	300	120	3.2	<.200	-	-	-	-
187	2341B	-	630	-	-	-	-	-	-	-	-
188	2341C	<.1	660	-	320	72	<.500	-	-	-	-
189	783	-	550	340	-	-	-	90+	(2)	-	-
190	1652	>10	270	280	5	.004	.075	-	-	[3]C N 2 A 2 H 5	-
191	1653	>10	260	20	3	[4].0064	.080	-	-	C 6 N 5 A 4 H 5	-
192	738	-	660	520	-	-	.220	10	28	C 15	-
193	739	.2	630	430	80	1,280	.190	10	30	C 16	-
194	1648	5.4	330	510	25	.024	.045	-	-	[3]C N 6 A 4 H 7	-

See footnotes at end of table.

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

Line	Sample	Ignition sensitivity	Ignition temperature, ° C		Minimum igniting energy for dust, millijoules		Minimum explosive concentration, oz/cu ft	Relative flammability, percent inert		Limiting oxygen concentration,[1] percent	
			Cloud	Layer	Cloud	Layer		In furnace	In spark apparatus	Spark	Furnace, 850° C
195	1555	6.4	470	480	15	0.008	0.045	90	85	[3]C N 4	[3]C
196	1605	3.4	480	460	25	.04	.050	-	-	-	-
197	1996	-	-	-	140	8	.055	-	-	-	-
198	740	.6	480	460	160	4	.045	55	78	[3]C N 7	-
199	1556	8.8	460	430	10	.2	.050	90	85	[3]C N 6	[3]C N 0
200	1606	1.8	590	380	30	.08	.065	-	-	-	-
201	864	.1	530	470	120	3	.305	25	38	C 17	-
202	1962	.1	380	660	160	-	.300	55	45	N 10	-
203	2017	-	(2)	320	-	-	(2)	-	(2)	-	-
204	1649	1.0	440	500	60	1.6	.080	-	-	C 13 N 10 A 8 H 8	-
205	1428	1.0	480	540	60	24	.070	80	70	C 13	C 3
206	2452	-	(2)	420	-	-	(2)	-	(2)	-	-
207	1404	-	(2)	430	-	-	-	-	(2)	-	-
208	859	-	730	470	-	-	-	-	(2)	-	-
209	1390	-	(2)	500	-	-	-	-	(2)	-	-
210	1391	-	(2)	550	-	-	-	-	(2)	-	-
211	1625	>10	20	100	45	.004	.060	-	-	[3]C N 1 A 2 H 2	-
212	1626	>10	20	20	5	[4].032	.060	-	-	[3]C N 2 A 2 H 4	-
213	1008	.3	500	490	60	8	.220	25	35	C 13	C 10
214	741	<.1	690	540	960	1,280	.480	15	25	N 9	-
215	742	<.1	600	480	960	1,280	.480	23	40	C 9	-
216	743	-	-	-	-	-	-	35	45	-	-
217	744	<.1	680	460	960	800	.500	30	35	C 10 N 10	-
218	764	-	700	440	-	-	.490	-	23	C 11	-
219	1413	-	600	-	-	-	-	-	-	-	-
220	1659	-	(2)	310	-	-	(2)	-	(2)	-	-
221	2034	<.1	760	420	640	-	.550	-	25	-	-
222	534	-	700	-	-	-	-	25	10	-	-
223	535	-	700	-	-	-	-	-	(2)	-	-
224	2035	<.1	880	490	720	-	1.250	-	15	-	-
225	745	5.7	20	210	<40	<.004	.160	90+	90+	[3]C N 2	-
226	1028	>10	20	260	15	.0004	.040	90+	90+	-	-
227	1029	>10	20	290	25	.0008	.070	90+	90+	-	-
228	1632	>10	20	190	15	.0064	.045	-	-	[3]C N 3 A 3 H 5	-
229	1633	1.1	350	300	120	.24	.045	-	-	[3]C N 4 A 3 H 5	-
230	1557	>10	20	220	5	.001	.045	90+	90+	[3]C [3]N	[3]C [3]N
231	1558	4.7	480	320	15	.03	.060	90	90	[3]C N 4	[3]C N 0
232	1429	1.1	350	270	60	.32	.085	85	80	C 8	C 3
233	1627	.4	430	340	100	.064	.120	-	-	C 11 N 8 A 6 H 8	-
234	1844	-	(2)	990	(2)	(2)	-	-	-	-	-
235	1793	-	(2)	(2)	(2)	160	-	-	(2)	-	-
236	1895	.1	950	570	100	40	.180	-	55	-	-
237	1430	-	(2)	830	100	-	.100	-	50	-	-
238	2254	<.1	930	-	1,920	1,600	.280	-	-	-	-
239	2082	-	(2)	740	(2)	(2)	-	-	(2)	-	-
240	1383	-	(2)	770	-	-	-	-	-	-	-
241	1269	-	870	900	720	160	-	-	30	-	-
242	1975	-	550	450	-	-	-	30	(2)	-	-
243	2196	-	500	450	(2)	16	(2)	-	-	-	-
244	2197	.3	470	400	140	16	<.100	-	-	-	-
245	1077	.2	580	420	160	70	.090	70	63	C <3	-

See footnotes at end of table.

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

Line	Sample	Ignition sensitivity	Ignition temperature, ° C		Minimum igniting energy for dust, millijoules		Minimum explosive concentration, oz/cu ft	Relative flammability, percent inert		Limiting oxygen concentration,[1] percent	
			Cloud	Layer	Cloud	Layer		In furnace	In spark apparatus	Spark	Furnace, 850° C
246	747	0.4	580	460	160	80	0.050	80	78	[3]C N 5	-
247	1021	.8	600	460	80	50	.050	83	75	-	-
248	746	3.7	540	470	20	160	.050	80	75	[3]C N 5	-
249	748	2.9	430	480	80	20	.020	90	90	[3]C	-
250	2408	1.3	660	-	60	240	.040	-	-	-	-
251	2065	.9	830	700	50	240	.055	-	80	-	-
252	2125	.8	900	650	60	320	.050	-	80	-	-
253	1894	.1	950	540	80	40	.190	-	55	-	-
254	2102	<.1	940	550	2,240	1,280	.285	-	10	-	-
255	1893	-	(2)	650	300	56	.280	-	45	-	-
256	2114A	-	-	-	-	-	-	-	-	C 14	-
257	2114B	-	-	-	-	-	-	-	-	C 14	-
258	2404	1.3	670	-	60	320	.040	-	-	-	-
259	1845	-	(2)	(2)	(2)	(2)	-	-	-	-	-
260	672	-	700	-	-	-	-	10	30	N 13	-
261	671	-	870	-	-	-	.285	-	25	N 14	N 15
262	675	-	660	-	-	-	-	-	-	-	-
263	681	-	-	780	-	-	-	33	53	N 8	-
264	683	-	670	-	-	-	-	18	45	N<10	-
265	684	-	700	-	-	-	-	-	50	N<10	-
266	1982	.2	690	800	220	-	.090	5	70	-	-
267	1981	.4	540	540	150	-	.060	75	85	-	-
268	871	-	(2)	640	-	-	-	-	(2)	-	-
269	872	-	790	670	-	2,560	2.000	-	15	C 19	-
270	1822	-	560	420	(2)	720	(2)	35	(2)	-	-
271	850	-	700	480	-	-	-	-	(2)	-	-
272	1482	.4	450	290	80	8	.130	65	65	-	-
273	870	-	(2)	(2)	-	-	-	-	(2)	-	-
274	1840	-	(2)	(2)	400	-	.400	-	50	-	-
275	1841	-	(2)	(2)	280	-	.400	-	50	-	-
276	2030	-	(2)	800	1,600	-	.335	-	25	C 17 N 17	-
277	2031	-	(2)	920	1,280	-	.260	-	30	C 17 N 17	-
278	869	<.1	860	-	400	(2)	.425	-	53	C 19	-
279	2032	-	(2)	980	1,280	-	.240	-	40	C 16 N 15	-
280	865	-	580	330	-	-	-	40	(2)	-	-
281	868	.5	370	400	80	4	.140	38	35	C 13	-
282	866	<.1	440	400	400	36	1.300	90	35	C 17	-
283	867	-	530	380	-	-	(2)	55	(2)	-	-
284	1521	-	370	190	-	-	1.000	65	-	-	-
285	1843	-	(2)	910	(2)	(2)	-	-	-	-	-
286	1842	-	(2)	(2)	(2)	(2)	-	-	-	-	-
287	2353	-	480	300	60	16	-	-	-	A 3	-
288	2354A	-	420	290	40	3.2	-	-	-	A 3	-
289	2354B	-	420	340	30	16	-	-	-	A 3	-
290	2354C	-	630	500	800	400	-	-	-	-	-
291	1155	-	790	-	-	-	-	-	-	-	-
292	1154	-	770	-	-	-	-	-	-	-	-
293	1156	-	600	470	-	-	-	55	(2)	-	-
294	1952	-	(2)	340	-	-	-	-	(2)	-	-
295	1953	-	(2)	910	-	-	-	-	(2)	-	-
296	1950	-	(2)	920	-	-	-	-	(2)	-	-
297	1949	-	(2)	400	-	-	-	-	(2)	-	-
298	1948	-	(2)	360	-	-	-	-	(2)	-	-
299	1832	-	(2)	390	(2)	-	(2)	-	(2)	-	-
300	1873	-	930	-	-	-	-	-	(2)	-	-
301	2075	-	470	350	(2)	(2)	(2)	85	(2)	-	-
302	2076	-	460	330	(2)	(2)	(2)	85	(2)	-	-
303	749	-	430	-	-	-	-	90	(2)	-	-
304	750	-	460	-	-	-	-	90	(2)	-	-
305	751	-	420	-	-	-	-	90	(2)	-	-
306	752	-	420	-	-	-	-	90	(2)	-	-
307	1660	<.1	380	280	8,200	1,000	1.000	90+	25	-	-
308	2427	-	-	<500	(2)	-	(2)	-	(2)	-	-
309	780	-	(2)	(2)	-	-	-	-	(2)	-	-
310	781	-	(2)	(2)	-	-	-	-	(2)	-	-
311	1820	-	330	350	(2)	(2)	(2)	65	-	-	-
312	1821	-	320	300	(2)	(2)	(2)	75	(2)	-	-
313	2073	-	(2)	340	-	-	-	-	(2)	-	-
314	-	1.0	610	-	60	-	.055	-	-	-	-

[1] Prefix letter denotes diluent gas: C = carbon dioxide; N = nitrogen; A = argon; H = helium.
[2] No ignition.
[3] Ignition in pure diluent gas.
[4] Less than 1 gram of dust used in this test; higher weights ignited spontaneously.

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

Line	Sample	Explosion severity	0.10 oz/cu ft: Maximum pressure, psig	0.10 oz/cu ft: Rate of pressure rise, psi/sec: Average	0.10 oz/cu ft: Rate of pressure rise, psi/sec: Maximum	0.20 oz/cu ft: Maximum pressure, psig	0.20 oz/cu ft: Rate of pressure rise, psi/sec: Average	0.20 oz/cu ft: Rate of pressure rise, psi/sec: Maximum	0.50 oz/cu ft: Maximum pressure, psig	0.50 oz/cu ft: Rate of pressure rise, psi/sec: Average	0.50 oz/cu ft: Rate of pressure rise, psi/sec: Maximum	1.00 oz/cu ft: Maximum pressure, psig	1.00 oz/cu ft: Rate of pressure rise, psi/sec: Average	1.00 oz/cu ft: Rate of pressure rise, psi/sec: Maximum	2.00 oz/cu ft: Maximum pressure, psig	2.00 oz/cu ft: Rate of pressure rise, psi/sec: Average	2.00 oz/cu ft: Rate of pressure rise, psi/sec: Maximum
1	1712	7.7	56	3,400	13,000	65	7,500	19,000	73	8,000	20,000+	84	3,100	14,000	-	-	-
2	1035	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	[1]1146	3.0	63	2,200	4,300	76	4,900	7,000	81	5,500	7,000	81	4,300	6,000	-	-	-
4	1221	2.5	55	2,500	6,500	55	2,500	7,000	69	2,500	7,000	75	2,900	6,500	-	-	-
5	[1]1267	4.9	73	2,100	4,500	83	4,000	9,500	94	3,700	10,000	90	2,300	9,000	-	-	-
6	1480	8.7	60	3,000	11,000	72	3,500	16,000	92	3,600	18,000	84	3,400	11,000	-	-	-
7	1663	6.9	60	3,000	11,000	64	3,000	13,000	82	3,300	16,000	80	3,200	9,500	-	-	-
8	1664	7.2	56	3,100	11,000	60	3,100	14,000	86	3,500	16,000	88	3,500	11,000	-	-	-
9	1770	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	1854	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	2126	10.6	59	5,000	13,000	71	5,500	19,000	81	5,500	20,000+	91	5,500	19,000	77	5,500	19,000
12	[1]1416	8.5	62	2,500	7,000	87	4,700	20,000+	85	4,000	19,000	77	3,700	7,500	-	-	-
13	2372	8.0	54	2,100	14,000	68	3,100	14,000	76	5,000	20,000	67	2,300	20,000+	67	1,400	16,000
14	2373	6.0	57	1,800	7,500	66	2,300	14,000	72	4,300	16,000	62	2,100	14,000	66	1,300	8,000
15	2374	3.3	55	1,200	2,700	63	1,500	5,000	83	2,400	7,500	75	1,900	9,500	67	1,200	4,700
16	2375	2.4	40	450	1,000	71	1,000	2,500	83	2,000	5,500	84	2,000	7,000	88	1,900	5,000
17	2376	1.7	38	600	1,200	56	1,000	3,300	70	1,300	4,700	72	1,600	8,000	71	1,400	5,000
18	1597	4.0	-	-	-	-	-	-	81	3,000	9,500	92	3,100	9,500	-	-	-
19	2403	3.0	55	1,100	2,500	67	1,600	4,300	77	2,500	7,500	89	1,800	5,000	84	1,200	3,300
20	[1]910	-	17	-	-	-	-	-	63	-	-	-	-	-	-	-	-
21	[1]897	3.4	56	1,900	3,300	-	-	-	87	5,000	7,500	-	-	-	-	-	-
22	[1]1067	1.2	43	700	1,000	-	-	-	74	1,300	3,100	-	-	-	-	-	-
23	[1]1102	1.4	41	600	1,000	76	1,800	4,000	71	2,000	3,700	70	1,800	3,400	-	-	-
24	[1]1127	1.3	60	900	1,800	77	1,800	3,300	78	1,800	3,100	74	1,100	2,900	-	-	-
25	2077	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	[1]1068	1.3	46	600	1,100	-	-	-	70	1,500	3,500	-	-	-	-	-	-
27	[1]1081	1.4	32	800	1,200	-	-	-	76	1,900	3,500	-	-	-	-	-	-
28	[1]1082	2.0	49	1,000	1,700	-	-	-	77	2,600	5,000	-	-	-	-	-	-
29	[1]1022	1.3	43	600	1,100	-	-	-	69	1,500	3,500	-	-	-	-	-	-
30	[1]1094	1.5	41	500	900	-	-	-	73	2,400	3,900	-	-	-	-	-	-
31	[1]1095	1.2	28	300	500	-	-	-	73	1,800	3,000	-	-	-	-	-	-
32	1852	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	2356	1.6	12	100	250	60	900	2,500	87	1,400	3,600	85	1,400	4,000	80	1,200	3,400
34	2217	1.3	-	-	-	69	1,100	3,000	84	1,100	2,900	-	-	-	-	-	-
35	[1]701	2.0	45	500	1,000	67	1,100	2,200	81	2,100	4,600	71	1,100	2,800	64	900	2,000
36	2130	3.3	29	300	700	74	1,300	3,100	90	1,800	7,000	93	2,500	9,500	93	1,900	6,500
37	2129	2.6	6	100	100	64	1,400	4,200	81	2,200	6,000	84	2,100	6,500	92	1,700	4,500
38	2128	2.3	5	100	100	61	900	2,100	86	1,600	5,000	91	2,000	8,500	94	2,200	8,000
39	[1]1080	1.2	39	600	900	-	-	-	78	2,100	2,900	-	-	-	-	-	-
40	[1]1078	1.1	49	600	1,000	-	-	-	78	1,300	2,700	-	-	-	-	-	-
41	[1]1079	1.3	43	700	1,000	-	-	-	70	1,700	3,600	-	-	-	-	-	-
42	1769	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	[1]1151	1.2	-	-	-	42	350	600	92	1,000	2,500	-	-	-	-	-	-
44	[1]1152	1.3	-	-	-	36	400	600	94	1,100	2,600	-	-	-	-	-	-
45	[1]1153	1.1	-	-	-	44	500	800	78	700	2,600	-	-	-	-	-	-
46	2127	.7	-	-	-	-	-	-	67	900	2,100	86	1,000	2,300	84	800	2,200
47	[1]1100	.8	-	-	-	32	350	600	74	1,000	2,100	69	700	1,200	-	-	-
48	[1]1274	.7	-	-	-	-	-	-	73	700	1,800	87	900	2,200	-	-	-
49	1853	.2	-	-	-	13	100	100	51	400	800	73	800	1,900	-	-	-

50	[1]1101	.1	-	-	-	-	-	-	49	150	200	52	600	1,300	-	-	-
51	2290	-	-	-	-	-	-	-	-	-	-	23	100	100	39	100	100
52	2289	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	1266	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	2282	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	[1]1005	1.3	36	400	900	-	-	-	69	1,700	3,700	-	-	-	-	-	-
56	[1]1004	2.2	55	900	1,900	-	-	-	76	1,800	5,500	-	-	-	-	-	-
57	787	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	[1]1069	1.1	35	200	450	-	-	-	78	900	2,700	-	-	-	-	-	-
59	[1]1070	1.1	32	200	450	-	-	-	78	900	2,700	-	-	-	-	-	-
60	1771	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	1772	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	[1]884	4.6	67	2,400	9,000	-	-	-	88	6,500	10,000	-	-	-	-	-	-
63	1927	10.2	60	3,500	8,000	76	8,000	20,000+	97	11,000	20,000+	121	6,000	20,000+	127	4,600	18,000
64	2080	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	[1]883	-	67	3,800	9,000	-	-	-	-	-	-	-	-	-	-	-	-
66	[1]1437	10.1	63	4,400	13,000	87	6,500	20,000+	95	4,400	20,000+	84	4,000	19,000	-	-	-
67	1926	9.1	55	3,400	8,000	70	8,000	20,000+	87	8,000	20,000+	89	6,000	20,000	126	3,200	13,000
68	2079	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
69	[1]1421	7.0	69	3,400	13,000	85	4,400	19,000	102	4,400	13,000	85	4,400	8,000	-	-	-
70	2081	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	1929	9.9	57	3,700	13,000	68	7,000	20,000+	94	8,000	20,000+	109	7,000	20,000+	131	2,700	8,000
72	1930	9.2	59	4,400	11,000	66	8,000	20,000+	88	9,000	20,000+	105	8,000	20,000+	101	2,400	9,000
73	1925	9.0	53	2,200	5,000	70	9,000	20,000+	86	8,000	20,000+	99	5,000	15,000	136	1,900	10,000
74	2078	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
75	[1]882	-	64	1,400	2,800	-	-	-	-	-	-	-	-	-	-	-	-
76	[1]1195	4.9	60	2,600	4,000	80	5,000	10,000	94	4,600	10,000	125	4,400	6,000	-	-	-
77	1928	10.0	55	3,400	8,000	75	6,000	20,000+	95	6,000	20,000+	115	5,000	16,000	113	1,500	3,500
78	881	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	1182	9.4	59	2,800	7,000	74	3,100	15,000	90	4,500	20,000	105	3,900	13,000	-	-	-
80	[1]702	5.0	56	2,000	4,200	74	2,600	4,800	87	4,200	11,000	76	2,200	4,800	70	1,600	3,200
81	2057	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	2071	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	1647	5.8	59	1,700	4,700	59	2,200	8,000	100	3,500	11,000	105	3,700	10,000	-	-	-
84	[1]1444	4.8	66	2,000	4,200	83	2,500	6,500	91	3,700	10,000	90	3,700	13,000	-	-	-
85	[1]1443	2.9	42	600	1,000	71	1,400	3,300	91	2,400	6,000	94	2,700	6,000	-	-	-
86	[1]1442	1.3	-	-	-	39	300	800	92	1,200	2,600	83	1,000	3,000	-	-	-
87	[1]1447	10.3	69	2,500	7,000	87	4,000	11,000	98	4,000	20,000	92	3,700	14,000	-	-	-
88	[1]1446	3.2	64	2,100	4,700	78	2,600	6,500	94	4,500	6,500	91	4,000	9,500	-	-	-
89	[1]1445	1.8	39	700	1,400	78	1,700	4,900	88	1,700	3,900	90	1,700	5,500	-	-	-
90	[1]703	<.1	-	-	-	-	-	-	8	100	100	28	150	300	-	-	-
91	2464	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
92	2465	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
93	2466	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94	2467	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
95	2468	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
96	2398A	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
97	2398B	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
98	1838	1.1	24	100	200	72	700	1,700	90	900	2,400	93	1,000	3,300	-	-	-
99	2003	<.1	-	-	-	-	-	-	[3]27	100	150	41	150	200	-	-	-
100	2006	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	[1]704	-	-	-	-	-	-	-	-	-	-	7	100	100	-	-	-
102	705	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103	2351A	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
104	2351B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	2329	-	-	-	-	-	-	-	-	-	-	48	500	800	48	350	800

See footnotes at end of table.

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

Line	Sample	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, psig	Rate of pressure rise, psi/sec: Average	Maximum	Maximum pressure, psig	Rate of pressure rise, psi/sec: Average	Maximum	Maximum pressure, psig	Rate of pressure rise, psi/sec: Average	Maximum	Maximum pressure, psig	Rate of pressure rise, psi/sec: Average	Maximum	Maximum pressure, psig	Rate of pressure rise, psi/sec: Average	Maximum
106	2351C	1.0	-	-	-	7	100	150	51	1,400	3,700	51	1,700	4,800	55	1,400	4,200
107	2351D	1.2	-	-	-	-	-	-	55	1,300	4,000	56	1,400	5,000	49	1,400	5,000
108	2351E	1.2	-	-	-	-	-	-	56	1,500	4,200	59	1,200	3,400	51	1,800	4,000
109	857	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110	706	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
111	856	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112	708	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
113	709	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	[1]710	-	-	-	-	-	-	-	-	-	-	4	100	200	-	-	-
115	[1]855	<.1	-	-	-	-	-	-	22	100	200	45	800	1,400	-	-	-
116	1654	.2	-	-	-	20	300	700	44	600	1,000	47	900	2,200	51	800	2,100
117	[1]1974	<.1	-	-	-	[3]7	100	100	18	100	100	29	100	200	36	150	300
118	1693	<.1	-	-	-	-	-	-	4	100	100	6	100	100	31	100	200
119	711	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120	712	.4	-	-	-	18	150	200	46	800	1,800	61	1,000	2,200	-	-	-
121	1291	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
122	1292	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
123	[1]713	-	-	-	-	-	-	-	-	-	-	15	100	150	-	-	-
124	[1]714	.1	-	-	-	-	-	-	42	250	500	43	400	700	-	-	-
125	[1]715	.1	-	-	-	-	-	-	35	200	400	50	400	800	-	-	-
126	[1]707	.5	-	-	-	31	700	1,300	41	1,300	2,400	43	1,300	2,400	-	-	-
127	1766	1.8	8	100	100	34	900	2,800	50	1,600	7,000	55	1,800	5,000	-	-	-
128	1767	1.5	5	100	100	33	1,300	3,500	46	1,900	6,000	47	1,800	8,000	-	-	-
129	1920	-	-	-	-	-	-	-	-	-	-	27	100	200	52	250	500
130	[1]879	-	-	-	-	-	-	-	-	-	-	41	500	1,200	-	-	-
131	1655	.1	-	-	-	5	100	100	35	200	350	41	500	600	48	300	400
132	1288	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	1295	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
134	1293	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	1294	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
136	716	-	-	-	-	-	-	-	-	-	-	[3]3	100	100	-	-	-
137	717	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
138	718	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
139	1163	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140	1164	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
141	719	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
142	1074	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
143	[1]1075	.1	-	-	-	-	-	-	45	200	400	-	-	-	-	-	-
144	[1]1076	1.3	42	600	1,000	-	-	-	80	1,500	3,000	-	-	-	-	-	-
145	1666	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
146	1677	2.0	31	450	900	66	1,000	2,500	78	2,000	5,000	87	1,600	6,500	-	-	-
147	720	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
148	[1]722	.8	-	-	-	50	300	600	77	1,300	2,000	87	1,300	3,300	-	-	-
149	[1]723	1.2	43	400	700	50	500	900	78	1,700	2,900	85	2,000	3,500	-	-	-
150	[1]724	1.2	46	450	1,000	57	1,000	1,700	91	1,700	2,500	91	2,800	5,000	-	-	-
151	[1]725	2.3	53	1,300	2,400	67	1,400	3,100	87	2,600	5,000	91	3,200	5,500	-	-	-
152	[1]728	.1	-	-	-	-	-	-	42	200	300	-	-	-	-	-	-
153	[1]726	1.8	53	900	1,700	-	-	-	90	1,500	3,900	-	-	-	-	-	-
154	[1]727	3.1	57	1,800	2,700	-	-	-	91	3,000	6,500	-	-	-	-	-	-

155	[1]731	<.1	-	-	-	-	-	-	3	100	100	50	200	400	-	-	-
156	[1]729	.5	-	-	-	-	-	-	78	300	1,100	-	-	-	-	-	-
157	[1]730	2.7	50	900	1,700	-	-	-	85	1,800	6,000	-	-	-	-	-	-
158	[1]860	5.7	-	-	-	-	-	-	98	2,800	11,000	-	-	-	-	-	-
159	[1]1020	4.2	53	800	1,800	-	-	-	90	2,600	9,000	-	-	-	-	-	-
160	1285	7.4	51	1,400	4,000	69	2,000	7,500	94	3,100	15,000	116	2,000	12,000	-	-	-
161	[1]1228	1.6	52	600	1,700	69	800	1,800	87	1,000	3,600	92	1,000	3,000	-	-	-
162	[1]1148	2.1	49	1,000	1,700	85	1,800	3,500	100	2,600	4,000	98	2,400	4,400	-	-	-
163	[1]732	1.0	45	400	800	-	-	-	87	700	2,100	-	-	-	-	-	-
164	734	4.5	57	1,600	2,900	-	-	-	78	3,400	11,000	-	-	-	-	-	-
165	[1]733	2.7	56	1,200	2,600	-	-	-	92	2,100	5,500	-	-	-	-	-	-
166	[1]735	.2	-	-	-	39	100	250	66	400	600	88	800	1,700	-	-	-
167	[1]849	.1	-	-	-	-	-	-	38	300	600	56	600	1,200	-	-	-
168	[1]736	.1	-	-	-	-	-	-	35	350	600	43	400	800	-	-	-
169	[1]1032	.2	-	-	-	-	-	-	41	300	700	56	800	2,000	-	-	-
170	1657	.7	-	-	-	19	250	400	48	1,300	2,800	53	2,100	4,900	48	1,100	2,600
171	858	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
172	854	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
173	1656	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
174	782	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
175	2425	.8	-	-	-	-	-	-	91	600	1,600	97	800	1,600	92	500	800
176	[1]737	1.1	-	-	-	39	300	700	87	900	2,400	87	800	1,900	84	400	1,200
177	[1]1087	.3	-	-	-	-	-	-	69	400	900	104	600	1,400	-	-	-
178	[1]1033	.3	-	-	-	-	-	-	69	400	900	104	600	1,400	-	-	-
179	1658	1.1	-	-	-	51	600	1,100	90	1,000	2,300	105	1,200	3,200	95	1,100	2,600
180	1951	6.7	-	-	-	86	1,300	4,300	106	2,000	12,000	107	1,500	8,000	81	700	3,000
181	2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
182	2018	5.9	53	1,900	4,800	85	4,600	12,000	86	2,000	13,000	94	2,300	10,000	87	900	3,900
183	2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
184	2021	5.2	38	600	1,400	85	3,900	11,000	82	3,500	12,000	81	1,800	10,000	91	1,000	6,000
185	2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
186	2341A	.7	-	-	-	10	100	150	50	900	2,600	51	1,400	4,400	55	1,300	4,200
187	2341B	1.0	-	-	-	5	100	150	51	1,100	3,700	53	1,400	4,400	57	1,200	4,800
188	2341C	<.1	-	-	-	-	-	-	27	100	100	57	350	700	58	250	450
189	783	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190	1652	.8	-	-	-	21	400	900	48	1,400	3,300	79	2,100	5,000	74	2,000	5,500
191	1653	2.0	-	-	-	29	600	1,400	60	2,100	6,500	73	2,900	9,000	81	3,100	12,000
192	738	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
193	739	.3	-	-	-	-	-	-	37	500	1,300	48	1,000	1,700	-	-	-
194	1648	2.0	35	800	1,500	56	2,000	5,000	70	2,600	5,500	65	2,300	6,000	57	2,100	5,500
195	1555	4.6	45	1,500	4,000	55	3,000	7,500	80	3,500	11,000	85	3,500	11,000	-	-	-
196	1605	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
197	1996	.5	13	100	150	40	300	500	71	700	1,300	92	1,200	3,100	87	1,100	2,400
198	[1]740	.7	36	500	900	57	900	1,600	62	1,400	2,200	73	1,400	3,200	-	-	-
199	1556	4.6	35	1,500	4,000	55	2,500	7,500	80	3,000	11,000	80	3,500	11,000	-	-	-
200	1606	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
201	864	.1	-	-	-	-	-	-	46	250	600	65	700	2,300	-	-	-
202	1962	.4	28	100	200	70	500	900	68	500	1,000	65	450	900	-	-	-
203	2017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
204	1649	5.2	11	200	300	64	2,400	10,000	90	2,600	11,000	97	2,900	9,500	123	2,100	6,000
205	1428	6.0	30	400	600	62	1,900	4,300	96	3,900	12,000	121	2,800	9,000	-	-	-
206	2452	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
207	1404	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208	859	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
209	1390	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
210	1391	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See footnotes at end of table.

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

Line	Sample	Explosion severity	Concentration: 0.10 oz/cu ft — Maximum pressure, psig	0.10 oz/cu ft — Rate of pressure rise, psi/sec: Average	0.10 oz/cu ft — Rate of pressure rise, psi/sec: Maximum	0.20 oz/cu ft — Maximum pressure, psig	0.20 oz/cu ft — Rate of pressure rise, psi/sec: Average	0.20 oz/cu ft — Rate of pressure rise, psi/sec: Maximum	0.50 oz/cu ft — Maximum pressure, psig	0.50 oz/cu ft — Rate of pressure rise, psi/sec: Average	0.50 oz/cu ft — Rate of pressure rise, psi/sec: Maximum	1.00 oz/cu ft — Maximum pressure, psig	1.00 oz/cu ft — Rate of pressure rise, psi/sec: Average	1.00 oz/cu ft — Rate of pressure rise, psi/sec: Maximum	2.00 oz/cu ft — Maximum pressure, psig	2.00 oz/cu ft — Rate of pressure rise, psi/sec: Average	2.00 oz/cu ft — Rate of pressure rise, psi/sec: Maximum
211	1625	0.9	-	-	-	25	750	1,500	53	1,700	3,400	64	1,900	4,200	69	1,900	5,000
212	1626	1.5	-	-	-	36	1,400	3,000	43	2,900	6,500	53	3,500	7,500	74	3,500	9,000
213	[1]1008	.2	-	-	-	-	-	-	48	300	600	57	500	1,000	-	-	-
214	[1]741	<.1	-	-	-	-	-	-	15	150	200	50	700	1,700	-	-	-
215	[1]742	-	-	-	-	-	-	-	-	-	-	49	1,400	2,700	-	-	-
216	743	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
217	744	.2	-	-	-	-	-	-	48	700	1,800	70	400	400	-	-	-
218	[1]764	<.1	-	-	-	-	-	-	8	100	100	32	300	600	-	-	-
219	1413	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
220	1659	-	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
221	2034	-	-	-	-	-	-	-	-	-	-	25	250	300	54	600	1,400
222	534	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
223	535	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
224	2035	-	-	-	-	-	-	-	-	-	-	-	-	-	15	100	150
225	[1]745	.7	-	-	-	20	200	300	43	700	3,200	59	1,200	5,000	-	-	-
226	1028	2.9	28	1,800	4,500	43	2,700	6,500	59	3,900	9,500	68	5,00	13,000	-	-	-
227	1029	2.1	22	800	1,400	42	2,100	5,000	57	3,200	7,000	62	4,300	9,500	-	-	-
228	1632	1.9	-	-	-	47	1,900	5,500	55	2,600	6,500	60	2,600	7,000	62	2,000	7,500
229	1633	1.2	11	100	150	35	350	800	75	1,000	3,000	90	1,400	4,000	84	1,600	4,900
230	1557	3.1	45	2,500	5,500	55	2,500	7,500	65	3,000	9,000	75	3,000	11,000	-	-	-
231	1558	2.8	35	1,500	3,000	50	2,500	6,500	60	2,500	9,000	75	3,000	11,000	-	-	-
232	1429	3.3	29	800	1,600	46	2,200	5,000	69	4,000	9,000	90	4,000	9,500	-	-	-
233	1627	1.8	-	-	-	11	200	700	80	1,800	4,200	100	2,900	7,000	118	2,900	8,500
234	1844	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
235	1793	<.1	-	-	-	-	-	-	5	100	100	23	100	100	13	100	100
236	1895	3.5	-	-	-	6	100	150	78	2,500	8,500	92	3,000	11,000	87	1,100	2,900
237	1430	.9	17	300	500	50	1,200	2,200	68	800	2,600	81	2,000	4,000	95	2,000	3,800
238	2254	.1	-	-	-	-	-	-	27	250	500	55	400	800	-	-	-
239	2082	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240	[1]1383	-	-	-	-	-	-	-	-	-	-	38	100	200	11	100	100
241	[1]1269	-	-	-	-	-	-	-	-	-	-	62	800	1,800	-	-	-
242	1975	<.1	-	-	-	3	100	100	21	100	100	30	100	200	36	150	300
243	2196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
244	2197	1.9	8	100	100	62	250	400	96	1,400	3,700	95	1,900	6,000	86	1,200	4,700
245	[1]1077	1.0	20	100	200	-	-	-	70	1,700	2,800	-	-	-	-	-	-
246	747	4.7	55	1,400	2,800	60	1,600	4,200	90	4,000	10,000	87	3,700	9,000	-	-	-
247	[1]1021	3.6	48	600	1,400	-	-	-	76	3,400	9,000	-	-	-	-	-	-
248	[1]746	2.0	41	450	700	62	800	1,500	78	3,500	5,000	80	3,000	6,000	-	-	-
249	748	4.5	36	800	1,100	45	800	1,100	86	3,600	10,000	73	2,500	3,600	-	-	-
250	2408	3.3	54	1,200	2,600	65	1,600	4,300	79	1,700	8,000	87	2,300	8,000	84	1,700	5,000
251	2065	3.4	33	450	700	63	1,800	4,500	82	2,700	8,000	98	2,100	5,500	105	2,400	5,500
252	2125	2.2	13	100	200	69	1,000	2,700	95	1,300	4,500	97	1,700	6,000	80	1,500	5,500
253	1894	4.1	-	-	-	8	150	250	79	2,600	10,000	95	2,500	10,000	96	1,600	4,800
254	2102	.5	-	-	-	-	-	-	51	700	1,700	80	800	2,000	87	900	2,200
255	1893	1.3	-	-	-	-	-	-	61	1,300	3,900	88	2,100	6,000	82	900	2,500
256	2114A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
257	2114B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
258	2404	2.9	55	900	2,200	67	1,400	3,600	74	2,100	7,500	84	2,300	7,500	85	1,100	3,100
259	1845	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

260	[1]672	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-	-
261	[1]671	-	-	-	-	-	-	-	59	-	-	-	-	-	-	-	-
262	675	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
263	681	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
264	683	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
265	684	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
266	1982	1.7	-	-	-	66	600	1,300	99	1,100	3,200	99	1,800	4,800	106	1,200	4,300
267	1981	5.0	51	2,200	8,000	64	2,500	10,000	73	3,900	13,000	86	3,200	20,000	75	1,900	11,000
268	871	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
269	872	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
270	1822	-	-	-	-	-	-	-	-	-	-	-	-	-	37	300	300
271	850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
272	1482	1.0	-	-	-	32	1,400	3,000	47	1,400	4,200	62	2,600	5,000	-	-	-
273	870	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
274	1840	.7	-	-	-	-	-	-	81	600	1,700	89	800	2,600	95	700	1,400
275	1841	1.6	-	-	-	-	-	-	87	1,500	3,600	91	1,600	4,400	93	1,000	3,800
276	2030	<.1	-	-	-	-	-	-	31	150	200	70	400	700	56	250	400
277	2031	.3	-	-	-	-	-	-	68	400	800	95	800	2,500	96	700	1,400
278	[1]869	.2	-	-	-	-	-	-	50	400	700	70	500	1,000	-	-	-
279	2032	.3	-	-	-	-	-	-	60	400	800	113	1,100	3,500	98	700	1,700
280	865	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
281	868	2.6	-	-	-	25	200	500	53	2,200	9,500	55	1,600	4,200	-	-	-
282	866	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
283	867	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
284	1521	-	-	-	-	-	-	-	-	-	-	-	-	-	44	400	1,300
285	1843	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
286	1842	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
287	2353	.1	-	-	-	-	-	-	54	200	400	-	-	-	-	-	-
288	2354A	.1	-	-	-	-	-	-	54	300	500	-	-	-	-	-	-
289	2354B	.1	-	-	-	-	-	-	43	200	300	-	-	-	-	-	-
290	2354C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
291	1155	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
292	1154	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
293	1156	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
294	1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
295	1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
296	1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
297	1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
298	1948	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
299	1832	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300	1873	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
301	2075	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
302	2076	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
303	749	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304	750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
305	751	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
306	752	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
307	1660	-	-	-	-	-	-	-	-	-	-	-	-	-	5	100	100
308	2427	-	-	-	-	-	-	-	-	-	-	-	-	-	[3]9	100	200
309	780	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
310	781	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
311	1820	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
312	1821	-	([2])	-	-	-	-	-	-	-	-	-	-	-	-	-	-
313	2073	-	([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.

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