

EXPLOSIVES

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In 2001, U.S. explosives production was 2.38 million metric tons (Mt), 7% less than that in 2000; sales of explosives were reported in all States. Coal mining, with 69% of total consumption, continued to be the dominant use for explosives in the United States. Kentucky, West Virginia, Indiana, Wyoming, and Virginia, in descending order, were the largest consuming States, with a combined total of 46% of U.S. sales.

Legislation and Government Programs

After completing an investigation into dumping of ammonium nitrate from Ukraine that was begun in 2000, the U.S. International Trade Commission (ITC) issued its final determination in August 2001. The ITC determined that imports of ammonium nitrate from Ukraine were sold in the United States at less than fair market value and that critical circumstances did not exist with regard to these imports. As a result of the negative determination regarding critical circumstances, the duties will not be retroactive and will only apply to ammonium nitrate that has been imported since March 5, 2001. The antidumping duty of 156.29% ad valorem that was finalized by the International Trade Administration in July will be applied (U.S. Department of Commerce, International Trade Administration, 2001; U.S. International Trade Commission, 2001).

Production

Sales of ammonium-nitrate-based explosives (blasting agents and oxidizers) were 2.34 Mt, which was an 8% decrease from that of 2000, and accounted for 98% of U.S. industrial explosives sales. Sales of permissibles and other high explosives increased slightly (table 1). Figure 1 shows how sales for consumption have changed since 1992. Data for 2001 are not exactly comparable to the 2000 data. One company, Nelson Brothers LLC, did not provide data to the Institute of Makers of Explosives (IME) in 2001, and no estimate for its sales was included in the totals.

Companies contributing data to this report, including those that are not members of the IME, are as follows:

Accurate Energetic Systems LLC
Apache Nitrogen Products Inc. *¹
Austin Powder Co.
Baker Atlas International
Coastal Chem Inc. *
Daveyfire Inc.
Douglas Explosives Inc.

Dyno Nobel Inc.
El Dorado Chemical Co.
The Ensign-Bickford Co.
Explosives Technologies International Inc. (ETI)
D.C. Guelich Explosives Co.
General Dynamics Armament Systems
Jet Research Center
LaRoche Industries Inc. *
Mining Services International Corp.
Nitram Inc. *
Nitrochem LLC
Orica USA Inc.
Owen Oil Tools Inc.
PCS Nitrogen Corp. *
St. Lawrence Explosives Corp.
Schlumberger Perforating Center
Senex Explosives Inc.
Slurry Explosives Corp.
Vet's Explosives Inc.
Viking Explosives and Supply Co.
W.A. Murphy Inc.

El Dorado Chemical Co. (a subsidiary of LSB Industries Inc.) announced that it would supply Orica USA Inc. with ammonium nitrate from its Arkansas plant for at least a 5-year period. As part of the agreement, El Dorado would implement some of Orica's proprietary ammonium nitrate technology at the plant. In a separate agreement, Cherokee Nitrogen Co. (a subsidiary of El Dorado) will supply Nelson Brothers with its entire requirements for 83% ammonium nitrate solution from its Alabama plant for at least 5 years. El Dorado also has sold some of its explosives distribution sites to Orica and Nelson Brothers. LSB Industries planned to use the proceeds from the sales to reduce its debt (Green Markets, 2001).

Consumption

Coal mining, with 69% of total explosives consumption, remained the largest application for explosives in the United States (table 2). Coal production increased to a record level in 2001 according to preliminary data from the U.S. Energy Information Administration. Production in 2001 rose by 4% from 2000 to 1,017 Mt, just slightly above the prior record level set in 1998. The additional production was used to replenish the depleted stockpiles that had resulted after 2 years of declining coal production and increasing coal consumption (Fremer, 2002²). Production in all three coal-producing

¹Companies denoted by an asterisk are not members of the IME.

²References that include a section twist (§) are found in the Internet References Cited section.

regions—Appalachian, interior, and western—increased. Wyoming, West Virginia, and Kentucky, in descending order, led the Nation in coal production, accounting for 59% of the total, and were among the largest explosives-consuming States, accounting for 31% of total U.S. explosives sales.

Quarrying and nonmetal mining, the second-largest consuming industry, accounted for 13% of total explosives sales; metal mining, 8%; construction, 7%; and miscellaneous uses, 3%. Kentucky, West Virginia, Indiana, Wyoming, and Virginia, in descending order, were the largest consuming States, with a combined total of 46% of U.S. sales (table 3).

According to U.S. Census Bureau statistics, the value of new construction declined by less than 1% based on constant 1996 dollars (U.S. Census Bureau, 2002§). Federal Reserve Board indices indicated that the industry growth rate from 2000 to 2001 for metal mining was -13.4% and that the growth rate for stone and earth minerals was 1.1% (Federal Reserve Board, 2002§).

Classification of Industrial Explosives and Blasting Agents.—Apparent consumption of commercial explosives used for industrial purposes in this report is defined as sales as reported to the IME. Commercial explosives imported for industrial uses were included in sales.

The principal distinction between high explosives and blasting agents is their sensitivity to initiation. High explosives are cap sensitive, whereas blasting agents are not. Black powder sales were minor and were last reported in 1971. The production classifications used in this report are those adopted by the IME.

High Explosives.—Permissibles.—The Mine Safety and Health Administration approved grades by brand name as established by the National Institute of Occupational Safety and Health testing.

Other High Explosives.—These include all high explosives except permissibles.

Blasting Agents and Oxidizers.—These include (1) ammonium nitrate-fuel oil (ANFO) mixtures, regardless of density; (2) slurries, water gels, or emulsions; (3) ANFO blends containing slurries, water gels, or emulsions; and (4) ammonium nitrate in prilled, grained, or liquor (water solution) form. Bulk and packaged forms of these materials are contained in this category. In 2001, about 93% of the total blasting agents and oxidizers was in bulk form.

World Review

An explosion at Grande Paroisse S.A.'s Toulouse, France, ammonium nitrate plant in September destroyed the plant and killed 29 people. TotalFinaElf Group, which owns 80% of Grand Paroisse, began an investigation into the cause of the explosion but had made no determination by yearend. Three theories were being studied the closest to determine the cause—the contamination of ammonium nitrate by other chemicals produced on the site, the explosion of the ammonium nitrate plant leading to the scattering of a mass of metal on the stocks and their detonation, and the explosion of the ammonium nitrate stocks following anomalies in the power supply network (Atofina, 2002§). It is unlikely that the plant will be rebuilt.

Current Research and Technology

Researchers at the University of California in San Diego have demonstrated a trinitrotoluene (TNT) sensor made of nanowires. The sensor is made of silicon nanowires coated with a polymer that luminesces under ultraviolet light unless it comes in contact with TNT molecules or picric acid, another explosive. This happens because the TNT and picric acid molecules are electron-deficient, and so they take electrons from the silicon polymer whenever it is excited by UV light. This prevents the silicon nanowires from glowing. By monitoring the luminescence, the researchers detected TNT at 4 parts per billion (ppb) in air and 50 ppb in seawater and picric acid at 6 ppb in seawater. The material could be particularly useful because it is stable in air and water, and the nanowires can even be dissolved in paint or sprayed on to filter paper. It would then have the potential to detect explosive traces in the air or water that surrounds them, and results are instantaneous. This sensor also may be used to detect old unexploded weapons that emit trace quantities of explosives into the air (Photonics Spectra, 2001).

Engineers in the Fuels and Lubricants Group of Shell Co. of Australia developed a technique to blend waste oil with ANFO for a product that can be used in blasting. Mines throughout the world produce thousands of liters of waste fuel oil that needs to be disposed of in an environmentally safe manner. By using the fuel oil in a blasting compound, transporting the waste oil is eliminated, the quantity of fuel oil needed for blasting is reduced, and potentially toxic hydrocarbons in waste oil can be destroyed by the high blast temperature. Shell tested the ANFO-waste oil blend at Hamersley Iron's Marandoo mine site, and found that the ratio of waste oil to ANFO blend could be as much as 50-50 without any detrimental effect to the final blasting performance (Mining Engineering, 2001).

Outlook

The U.S. Department of Energy (DOE) projects a 1.2% decrease in coal production in 2002 followed by a slight increase in production in 2003. Production is projected to decrease in 2002 and 2003 in the Appalachian and interior regions and to increase in the western region. According to the DOE projections, stocks will continue to be drawn down in 2002 to meet consumption needs (U.S. Energy Information Administration, 2002§). Based on the coal production projections, explosives consumption is expected to decline in 2002 and 2003. Although production is expected to increase slightly in 2003, all the increase will be in the western region, which consumes fewer explosives per ton of coal produced because of a lower overburden-to-matrix ratio. The slight gain in production will not outweigh the lower consumption of explosives per ton of coal produced. Aberrations in weather patterns, however, could have a substantial impact on U.S. coal demand, because most of it is used for electricity production.

In the construction and quarrying sectors, a gradual increase in demand for construction aggregates is anticipated on the basis of the expected volume of work on the U.S. infrastructure that will be financed by the Transportation Equity Act for the 21st Century (TEA-21). This work will occur if additional

funding is allocated. TEA-21 Federal budget authorization is linked to revenues, and the revenues decreased in 2001, so budgeting for TEA-21 may decline (U.S. Department of Transportation, Federal Highway Administration, 1998§).

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TABLE 1
SALIENT STATISTICS OF INDUSTRIAL EXPLOSIVES
AND BLASTING AGENTS SOLD FOR CONSUMPTION
IN THE UNITED STATES 1/

(Metric tons)

Class	2000	2001
Permissibles	1,530	1,640
Other high explosives	33,900	34,300
Blasting agents and oxidizers	2,530,000	2,340,000
Total	2,570,000	2,380,000

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

Source: Institute of Makers of Explosives.

TABLE 2
ESTIMATED INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION
IN THE UNITED STATES, BY CLASS AND USE 1/ 2/

(Thousand metric tons)

Class	Coal mining	Quarrying and nonmetal mining	Metal mining	Construction work	All other purposes	Total
2000:						
Permissibles	2	(3/)	(3/)	(3/)	--	2
Other high explosives	4	15	1	12	1	34
Blasting agents and oxidizers	1,720	332	235	182	70	2,530
Total	1,720	347	236	194	71	2,570
2001:						
Permissibles	2	(3/)	(3/)	(3/)	--	2
Other high explosives	5	15	1	12	2	34
Blasting agents and oxidizers	1,620	303	184	168	63	2,340
Total	1,630	318	185	179	65	2,380

-- Zero.

1/ Distribution of industrial explosives and blasting agents by consuming industry estimated from indices of industrial production and economies as reported by the U.S. Department of Energy, the Federal Reserve Board the U.S. Department of Transportation, and the U.S. Census Bureau.

2/ Data are rounded to no more than three significant digits; may not add to totals shown.

3/ Less than 1/2 unit.

TABLE 3
INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, BY STATE AND CLASS 1/

(Metric tons)

State	Class							
	2000				2001			
	Fixed high explosives		Blasting agents and oxidizers	Total	Fixed high explosives		Blasting agents and oxidizers	Total
Permissibles	Other high explosives	Permissibles			Other high explosives			
Alabama	33	603	59,400	60,000	32	486	47,800	48,400
Alaska	--	50	12,100	12,200	--	59	5,420	5,480
Arizona	20	548	112,000	112,000	34	152	113,000	113,000
Arkansas	--	201	11,200	11,400	--	180	12,400	12,600
California	(2/)	522	41,600	42,100	1	817	72,600	73,400
Colorado	58	3,070	71,600	74,700	44	5,400	60,300	65,700
Connecticut	--	1,580	17,700	19,200	--	340	4,040	4,380
Delaware	--	--	81	81	--	--	76	76
Florida	--	235	16,800	17,000	--	202	15,700	15,900
Georgia	--	806	57,000	57,900	--	821	46,400	47,200
Hawaii	--	11	1,320	1,330	--	(2/)	1,040	1,040
Idaho	11	535	12,800	13,400	3	253	11,100	11,400
Illinois	--	1,650	42,300	44,000	(2/)	627	39,400	40,100
Indiana	9	546	37,900	38,400	--	1,030	204,000	205,000
Iowa	--	923	16,700	17,700	--	563	9,910	10,500
Kansas	--	440	18,900	19,300	--	436	5,370	5,800
Kentucky	806	2,720	499,000	502,000	991	2,350	314,000	317,000
Louisiana	--	131	2,000	2,130	--	191	1,750	1,940
Maine	--	20	270	290	--	18	49	67
Maryland 3/	2	103	5,430	5,540	1	214	5,910	6,130
Massachusetts	--	418	3,450	3,870	--	546	4,410	4,950
Michigan	--	265	10,100	10,300	--	79	18,700	18,700
Minnesota	(2/)	204	63,700	63,900	5	156	53,800	54,000
Mississippi	--	22	1,400	1,420	--	377	38	415
Missouri	2	1,280	116,000	117,000	4	2,930	124,000	127,000
Montana	19	145	21,100	21,200	14	274	17,100	17,400
Nebraska	--	121	1,860	1,980	--	73	398	471
Nevada	4	1,710	75,300	77,000	--	1,180	105,000	106,000
New Hampshire	--	439	5,720	6,160	--	889	8,250	9,140
New Jersey	--	150	5,890	6,040	--	211	28,900	29,100
New Mexico	2	233	36,200	36,400	5	258	25,100	25,300
New York	1	825	13,500	14,400	(2/)	684	16,000	16,700
North Carolina	--	1,560	52,500	54,100	--	897	23,300	24,200
North Dakota	--	9	601	610	--	26	--	26
Ohio	6	539	74,100	74,600	4	483	51,600	52,100
Oklahoma	1	249	17,900	18,100	2	316	9,960	10,300
Oregon	--	142	4,980	5,120	--	121	1,180	1,300
Pennsylvania	88	1,980	139,000	141,000	64	1,860	134,000	136,000
Rhode Island	--	20	568	589	13	59	812	885
South Carolina	--	174	11,200	11,300	--	210	7,510	7,720
South Dakota	--	12	1,010	1,020	--	3	2,640	2,650
Tennessee	3	1,460	48,600	50,100	17	1,590	31,000	32,600
Texas	3	716	39,000	39,700	2	806	47,600	48,400
Utah	87	385	50,900	51,300	35	290	56,200	56,500
Vermont	8	35	238	281	10	147	469	626
Virginia	206	2,690	231,000	234,000	257	2,400	148,000	150,000
Washington	--	1,110	14,600	15,700	--	1,010	15,200	16,200
West Virginia	117	1,240	220,000	221,000	63	1,050	261,000	262,000
Wisconsin	--	503	15,400	15,900	--	516	13,900	14,500
Wyoming	44	635	223,000	224,000	39	703	164,000	165,000
Total	1,530	33,900	2,530,000	2,570,000	1,640	34,300	2,340,000	2,380,000

-- Zero.

1/ Data are rounded to no more than three significant digits; may not add to totals shown.

2/ Less than 1/2 unit.

3/ Includes the District of Columbia.

Source: Institute of Makers of Explosives.

FIGURE 1
SALES FOR CONSUMPTION OF U.S. INDUSTRIAL EXPLOSIVES

