

# EXPLOSIVES

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**Domestic survey tables were prepared by Feri Naghdi, statistical assistant.**

In 1998, U.S. explosives production was 2.89 million metric tons (Mt), a 9% increase from that of 1997; sales of explosives were recorded in all States. Coal mining, with 67% of total consumption, continued to be the dominant use for explosives in the United States. Kentucky, Wyoming, West Virginia, Virginia, and Indiana, in descending order, were the largest consuming States, with a combined total of 51% of U.S. sales.

Coal demand is forecast to increase in 1999, but most of the increase in demand is expected to be met by a drawdown in stocks, so total U.S. coal production is expected to decrease. The projected decline in coal production is expected to result in a decline in U.S. consumption of explosives.

## Legislation and Government Programs

Dyno Nobel Inc. agreed to pay \$43.75 million during a 3-year period to settle a class-action antitrust case that was brought by commercial buyers of explosives in U.S. District Court in Salt Lake City, UT. The litigation was initiated in 1995, and, in addition to Dyno Nobel, the defendants included ICI Explosives U.S.A. Inc., Mine Equipment & Mill Supply Co., Austin Powder Co., and Explosives Technologies International Inc. The suit alleged that the defendants conspired to fix, raise, maintain, and stabilize prices of commercial explosives in the United States and to allocate customers and accounts among themselves. As a result of the lawsuit, Dyno Nobel was dismissed with prejudice from liability to class members for claims relating to the purchase of explosives from January 1, 1985, to March 26, 1998 (Green Markets, 1998a).

As part of a response to the 1995 Oklahoma City bombing, The Fertilizer Institute (TFI) and the Bureau of Alcohol, Tobacco, and Firearms (ATF) formed a joint voluntary campaign called "Be Aware for America." The goal of this program is to provide fertilizer retailers with information to identify suspicious ammonium nitrate purchasers to help avoid intentional criminal use of this product (The Fertilizer Institute, [no date], Be aware for America, accessed July 26, 1999, at URL <http://www.tfi.org/beaware.htm>). To strengthen the program further, the ATF requested ammonium nitrate dealers to identify the local law enforcement agencies that would be most likely to be contacted because of theft or vandalism at the dealer's property. ATF then will contact the local law enforcement agencies to discuss their response to such incidents (Bureau of Alcohol, Tobacco, and Firearms, September 21, 1998, Remarks of Director John W. Magaw, accessed July 26, 1999, at URL <http://www.atf.treas.gov/about/speech/tfi.htm>).

The International Fertilizer Development Center (IFDC) was conducting a study of the potential of using the inherent

crystallographic, physical, and chemical characteristics of ammonium nitrate as a built-in identification system. If this can be used, then it would provide an economic and nondisruptive way of identifying ammonium nitrate fertilizer. The study was being conducted at the request of the ATF in response to the 1995 Oklahoma City bombing (Fertilizer Markets, 1998). A study that was conducted by the National Research Council at the request of Congress, completed in March, concluded that additives that improve the detection of explosives before detonation or after a blast (taggants) are not practical enough for broad use in the United States (Green Markets, 1998b). As a precursor to the IFDC's study, and as part of the TFI/ATF "Be Aware for America," IFDC tried to determine the extent of commingling of ammonium nitrate among producers and importers and how this will affect reliable identification of illegal ammonium nitrate users.

The New York and New Jersey Port Authority appealed the dismissal of the lawsuit that it brought against Hydro Agri North America Inc., Dyno Nobel, and Potash Corp. of Saskatchewan Inc. regarding the World Trade Center bombing in 1993. The Port Authority alleged that materials produced by one or more of these companies was used to produce the bomb that caused the explosion (Green Markets, 1998c).

## Production

Ammonium-nitrate-based explosives (blasting agents and oxidizers) sales were 2.86 Mt, a 9% increase from that of 1997 and accounted for 99% of U.S. industrial explosives sales. In 1998, production of permissibles decreased slightly, and other high explosives production increased by 3% (table 1). Figure 1 shows how sales for consumption have changed since 1989.

Companies contributing data to this report, including those not members of the Institute of Makers of Explosives (IME), are as follows (nonmembers are denoted by an asterisk):

Accurate Energetic Systems, LLC  
Apache Nitrogen Products Inc. \*  
Austin Powder Co.  
Coastal Chem Inc. \*  
Daveyfire Inc.  
Douglas Explosives Inc.  
Dyno Nobel Inc.  
El Dorado Chemical Co.  
Energetic Solutions Inc.  
The Ensign-Bickford Co.  
Explosives Technologies International Inc. (ETI)  
D.C. Guelich Explosives Co.  
Halliburton Energy Services

HITECH Inc.  
LaRoche Industries Inc.  
Mining Services International Corp.  
W.A. Murphy Inc.  
Nitram Inc. \*  
Nelson Brothers Inc.  
Nitrochem Corp.  
Owen Oil Tools Inc.  
PCS Nitrogen Corp.  
St. Lawrence Explosives Corp.  
Schlumberger Perforating Center  
Senex Explosives Inc.  
Sierra Chemical Co.  
Slurry Explosives Corp.  
Unocal Corp. \*  
Viking Explosives and Supply Co.

## Consumption

Coal mining, with 67% of total explosives consumption, remained the largest application for explosives in the United States. According to the U.S. Department of Energy (DOE), the U.S. coal industry produced a record quantity of coal in 1998—1.015 billion metric tons—a 2.3% increase from that of 1997 (F.L. Freme and B.D. Hong, 1999, US coal supply and demand—1998 review, accessed July 14, 1999, at URL [http://www.eia.doe.gov/cneaf/coal/cia/new\\_yr\\_revu/coalfeat.html](http://www.eia.doe.gov/cneaf/coal/cia/new_yr_revu/coalfeat.html)). The electric power industry consumed a record quantity of coal, 2.1% greater than that of 1997. Increased coal production was exclusively in the Western Region; coal production in the Appalachian and the Interior Regions declined. For the first time, the Western Region surpassed the Appalachian Region to become the largest coal-producing region in the Nation. Demand for western coal increased because of a large drop in hydroelectric power generation west of the Mississippi, its low cost, and its low sulfur content, which is important in meeting sulfur emission reduction requirements. Mild weather in regions east of the Mississippi and the return to operation of significant numbers of nuclear power generators led to reduced requirements for coal in this area.

Wyoming, West Virginia, and Kentucky, in descending order, led the Nation in coal production, accounting for 57% of the total and were the largest explosives-consuming States, accounting for 41% of total U.S. explosives sales.

Quarrying and nonmetal mining, the second-largest consuming industry, accounted for 14% of total explosives sales; metal mining, 9%; construction, 7%; and miscellaneous uses, 3% (table 2). Kentucky, Wyoming, West Virginia, Virginia, and Indiana, in descending order, were the largest consuming States, with a combined total of 51% of U.S. sales (table 3).

According to Bureau of the Census statistics, the value of new construction increased by 6.0%, on the basis of constant 1992 dollars (U.S. Department of Commerce, 1999, December 1998 construction at \$688.5 billion annual rate, accessed July 14, 1999, at URL <http://www.census.gov/pub/const/C30/c309812.txt>). Federal Reserve Board indexes indicated that the

industry growth rate for metal mining from 1997 to 1998 was -2.3% and that the growth rate for stone and earth minerals was 4.5% (Federal Reserve Board, 1998, Industrial production and capacity utilization, Federal Reserve Statistical Release G17, accessed July 14, 1999, at URL <http://www.bog.frb.fed.us/releases/G17/Revisions/19981124/>).

**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 National Institute of Occupational Safety and Health (former U.S. Bureau of Mines) 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 1998, about 95% of the total blasting agents and oxidizers was in bulk form.

## World Review

**Australia.**—Wesfarmers CSBP Ltd. and Dyno Nobel Asia Pacific Ltd. completed a feasibility study to develop a joint-venture 180,000-metric-ton-per-year explosives-grade ammonium nitrate facility in Moura, Queensland. The joint-venture firm, called Queensland Nitrates Pty. Ltd., will spend \$116 million for the plant, which was intended to meet the needs of the BHP Australia Coal Ltd. and Rio Tinto Ltd. mining companies. The new plant was scheduled to be commissioned in late 1999. In addition to the ammonium nitrate plant, facilities at the plant will consist of a 230-metric-ton-per-day (t/d) ammonia plant and a 405-t/d nitric acid plant. Krupp Uhde will provide the basic engineering for the nitric acid and ammonium nitrate units, which will use the Krupp Uhde and Kaltenbach-Thuring processes, and Linde Australia Pty. Ltd. will construct the ammonia unit. This plant will enable these mining companies to replace imported ammonium nitrate with domestically produced product (Fertilizer International, 1998).

**Brazil.**—Ultrafertil SA planned to invest \$12 million to convert its nitrochalk unit for production of low-density ammonium nitrate for sale to explosives manufacturers. The conversion, which was overseen by Krupp Uhde, was scheduled for completion by June 1999. Ultrafertil also planned to invest another \$1 million to upgrade its storage and bagging facilities

(Fertilizer Week, 1998).

**Peru.**—Explosivos SA (EXSA) planned to develop a 200,000-t/yr explosives-grade ammonium nitrate facility in the southern part of the country; the cost is estimated to be \$100 million. The start of construction was planned for early 1999, with plant completion scheduled for 2001. Much of the plant's production was expected to be used by the local mining sector, but small quantities of fertilizer-grade material may be available for local farmers. The ammonia feed for the plant had not been secured. EXSA was considering either an import terminal or construction of an ammonia plant with enough capacity to have ammonia available for export (Nitrogen & Methanol, 1998).

### **Current Research and Technology**

Researchers at Duke University developed two micro-electromechanical devices that could become part of a portable detection system for explosives. The first uses ultrasound to loosen the explosive particles from the ground; once loose, the particles can be vacuumed up. The second device detects the vacuumed-up particles. One of the potential uses for the devices is a portable detector for land mines. If mines are in a field, then the explosive will be absorbed into the ecosystem, and the surface above the mines will have concentrations of explosives in the part-per-million or part-per-billion range. A portable bomb-detection system for airports is another potential use for the devices (Robinson, 1998).

### **Outlook**

The DOE projects a 0.2% decline in U.S. coal production in 1999, although total coal demand is expected to increase by 1.7%. Mild fall and winter weather over much of the country in 1998 led to reduced coal use at electric utilities, which

ultimately led to a buildup of stocks. The projected increase in demand will be met by a drawdown in stocks. In 2000, however, coal production is expected to increase by 1.8% as demand grows and stock levels are reduced. Coal production is expected to show the greatest growth in the Western Region (1.1% in 1999 and 4.8% in 2000), slow growth in the Appalachian Region (0.2% in 1999 and 0.1% in 2000), and a decline in the Interior Region (an average decrease of 4.8% from 1999-2000) (U.S. Department of Energy, July 8, 1999, Short-term energy outlook, accessed July 26, 1999 at URL <http://www.eia.doe.gov/emeu/steo/pub/highlights.html>). If these projections are correct, then explosives consumption is expected to decline slightly in 1999, and to increase in 2000. Because most of the increase in production is forecast for the Western Region, explosives consumption is not expected to increase at the same pace; the lower overburden-to-matrix ratio in the Western Region will lead to a slower growth in explosives consumption. Changes in weather patterns, however, could have a substantial impact on U.S. coal demand and, thus, the consumption of explosives for the forecast period.

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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	1997	1998
Permissibles	2,510	2,340
Other high explosives	29,400	30,400
Blasting agents and oxidizers	2,630,000 r/	2,860,000
Total	2,670,000 r/	2,890,000

r/ Revised.

1/ Data are rounded to 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
<b>1997:</b>						
Permissibles	3	(3/)	--	(3/)	--	3
Other high explosives	4	12	1	10	2	29
Blasting agents and oxidizers r/	1,750	357	274	182	73	2,630
Total r/	1,750	369	276	193	75	2,670
<b>1998:</b>						
Permissibles	2	(3/)	--	(3/)	--	2
Other high explosives	4	14	1	10	2	30
Blasting agents and oxidizers	1,930	394	271	193	75	2,860
Total	1,940	407	272	203	76	2,890

r/ Revised.

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 Bureau of the Census.

2/ Data are rounded to 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							
	1997				1998			
	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	44	720	114,000 r/	115,000 r/	72	763	116,000	117,000
Alaska	--	1,000	16,200	17,200	--	533	11,700	12,200
Arizona	--	514	126,000	127,000 r/	16	434	128,000	128,000
Arkansas	--	258	11,400 r/	11,600 r/	--	191	11,900	12,100
California	--	723	34,200 r/	34,900 r/	1	829	33,400	34,200
Colorado	--	354	5,340 r/	5,690 r/	44	621	32,400	33,100
Connecticut	--	777	8,790 r/	9,570 r/	--	946	10,000	11,000
Delaware	--	3	108	111	--	4	152	156
Florida	--	186	10,000 r/	10,200 r/	--	123	7,460	7,590
Georgia	--	622	35,200 r/	35,800 r/	--	605	35,400	36,000
Hawaii	--	(2/)	1,300	1,300	--	1	1,250	1,250
Idaho	--	572	16,500	17,100	--	588	9,190	9,780
Illinois	(2/)	523	47,500 r/	48,100 r/	--	367	43,400	43,700
Indiana	1	680	167,000 r/	168,000 r/	1	691	193,000	194,000
Iowa	--	615	17,800 r/	18,400 r/	--	704	18,400	19,100
Kansas	--	482	61,800 r/	62,300 r/	--	463	15,900	16,300
Kentucky	1,310	2,360	409,000 r/	412,000	1,040	2,360	482,000	485,000
Louisiana	--	227	2,270	2,500	--	248	1,890	2,140
Maine	--	74	355	430	--	22	335	357
Maryland 3/	--	139	5,150	5,290	--	406	8,130	8,540
Massachusetts	--	582	2,490	3,080	--	695	3,180	3,880
Michigan	--	51	31,200 r/	31,300 r/	(2/)	132	31,000	31,100
Minnesota	--	178	65,300 r/	65,500 r/	--	178	83,100	83,200
Mississippi	--	76	650 r/	727 r/	--	327	1,500	1,830
Missouri	--	1,550	31,400 r/	33,000 r/	--	1,130	33,500	34,600
Montana	--	670	23,600 r/	24,300 r/	--	123	22,900	23,000
Nebraska	--	63	1,830 r/	1,890 r/	--	74	1,950	2,030
Nevada	88	1,600	129,000 r/	130,000 r/	--	1,640	189,000	190,000
New Hampshire	--	900	10,200	11,100	--	1,320	2,970	4,300
New Jersey	(2/)	195	5,950	6,140	--	222	6,750	6,980
New Mexico	--	557	81,100 r/	81,600 r/	--	288	91,400	91,600
New York	1	565	13,500	14,000	149	439	16,000	16,600
North Carolina	--	775	40,300 r/	41,100 r/	--	900	43,000	43,900
North Dakota	1	28	1,850 r/	1,880 r/	--	24	192	216
Ohio	12	568	91,200 r/	91,800 r/	5	533	81,100	81,700
Oklahoma	3	254	23,300 r/	23,500 r/	3	333	23,500	23,900
Oregon	--	283	5,710 r/	5,990 r/	--	246	8,900	9,150
Pennsylvania	140	1,740	122,000 r/	124,000 r/	179	2,910	114,000	117,000
Rhode Island	--	4	6,050 r/	6,050 r/	--	2	862	864
South Carolina	--	137	4,890	5,030	--	125	10,700	10,800
South Dakota	--	58	6,520	6,580	--	43	5,340	5,380
Tennessee	21	1,180	41,100 r/	42,300 r/	6	1,210	44,200	45,400
Texas	1	849	34,500 r/	35,300 r/	(2/)	924	37,600	38,500
Utah	419	563	42,300 r/	43,300 r/	433	570	44,700	45,700
Vermont	5	152	303 r/	460 r/	10	175	308	492
Virginia	305	1,160	240,000 r/	241,000 r/	261	1,120	245,000	246,000
Washington	--	861	17,700	18,600	--	562	14,800	15,300
West Virginia	163	1,300	329,000 r/	330,000 r/	121	1,200	259,000	260,000
Wisconsin	--	459	15,000 r/	15,400 r/	--	450	13,300	13,700
Wyoming	--	1,220	127,000 r/	128,000 r/	--	1,620	274,000	275,000
Total	2,510	29,400	2,630,000 r/	2,670,000 r/	2,340	30,400	2,860,000	2,890,000

r/ Revised.

1/ Data are rounded to 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

