### **EXPLOSIVES**

### By Deborah A. Kramer

U.S. production of industrial explosives and blasting agents increased almost 24%, based on producer sales of 2.319 million metric tons. All of the markets for explosives registered an increase, and explosives sales were recorded in all 50 States.

#### Production

Sales of ammonium nitrate-base explosives increased to 2.280 million tons and represented 98% of U.S. consumption of industrial explosives. High explosives sales rose by 7%, the first sales increase since 1987.

Companies covered by this report, including IME members, are as follows:

- \* Apache Nitrogen Products Inc.—Benson, AZ
- \* Arcadian Corp.—Memphis, TN Austin Powder Co.—Cleveland, OH
- \* Coastal Chem Inc.—Cheyenne, WY Amos L. Dolby Co.—Corsica, PA Dyno Nobel Inc.—Salt Lake City, UT El Dorado Chemical Co.—St. Louis, MO The Ensign-Bickford Co.—Simsbury, CT Explosives Technologies International Inc. (ETI)—Wilmington, DE
- ICI Explosives Canada—Ontario, Canada ICI Explosives USA Inc.—Dallas, TX LaRoche Industries Inc.—Atlanta, GA Mining Services International—Salt Lake City, UT
- \* Nitram Inc.—Tampa, FL Nitrochem Inc.—Montreal, Quebec, Canada SENEX Explosives Inc.—Cuddy, PA Sierra Chemical Co.—Reno, NV Slurry Explosive Corp.—Oklahoma City,
- OK
- Trojan Corp.—Salt Lake City, UT
- \* Unocal Corp.—Los Angeles, CA Viking Explosives and Supply Co.—Rosemount, MN
- \*Indicates non-IME members.

### Consumption

Coal mining was estimated to account for 66% of the total U.S. explosives demand in 1994. Quarrying and nonmetal mining accounted for 13% of demand; metal mining, 11%, construction, 7% and miscellaneous uses, 3%. Coal production in the United States increased by 9.0%, according to the U.S.

Department of Energy. The Appalachian, Interior, and Western States all had higher coal production, but the largest increase was in the Western States. According to the Federal Reserve Board production indices, metal mining activity decreased by 1.8% and quarrying and nonmetal mining activity rose by 5.9%. Based on the value of new construction, in constant 1987 dollars, reported by the Economics and Statistics Administration, Bureau of the Census, new construction in 1994 increased by 4.2% from the 1993 level.

Six States, Kentucky, West Virginia, Wyoming, Nevada, Arizona, and Virginia, in declining order, consumed 53% of the total U.S. explosives demand. Three of these States, Wyoming, West Virginia, and Kentucky, in descending order, were the largest coalproducing States, accounting for 54% of total U.S. coal production.

Two companies are involved in creating new uses explosives and explosives for manufacturing facilities. ICI Explosives Environmental was awarded a \$370,000 strategic planning contract to evaluate the use of the Volunteer Army Ammunition Plant in Tennessee, which was used to produce trinitrotoluene (TNT). This contract is the first phase in developing a commercial use for the 6,500-acre facility. Alliant Techsystems, in cooperation with Sandia National Laboratories, is working to find way to convert materials such as explosives and liquid rocket fuel into a synthetic fuel gas that can be used to generate electricity or be burned in turbines.<sup>1</sup>

The International Society of Explosives Engineers (SEE) held its annual conference on explosive and blasting technique from January 30 to February 4, 1994. Topics covered at the conference included blasting and productivity, vibration, blast design, blast analysis tools, environmental effects of blasting, and computer blast modeling. Published conference proceedings may be obtained from SEE.

Classification of Industrial Explosives and Blasting Agents.—Apparent consumption of commercial explosives used for industrial purposes in this report is defined as sales reported to the Institute of Makers of Explosives (IME) by members and furnished to the U.S. Bureau of Mines on a proprietary basis, together with sales directly reported to the Bureau by nonmember manufacturers. Commercial explosives imported for industrial uses are included. Certain explosives sales may be concealed under "unprocessed ammonium nitrate" to avoid disclosure of individual company proprietary data.

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 are minor and were last reported by the Bureau in 1971.

The production classifications used in this report are the same as those adopted by IME.

*High explosives.*—<u>Permissibles</u>—Grades approved by brand name by the Mine Safety and Health Administration (MSHA), as established by U.S. Bureau of Mines testing.

<u>Other high explosives</u>—All high explosives except permissibles.

**Blasting agents.**—<u>Ammonium nitrate-fuel oil</u> (<u>ANFO</u>)—All mixtures, regardless of density. <u>Bulk and packaged slurries, water gels, and</u> <u>emulsions</u>—All bulk and packaged slurries, water gels, emulsions and ANFO mixtures containing slurries, waters gels, and emulsions. <u>Unprocessed ammonium nitrate</u>—Includes prilled, grained, and water solution (liquor) ammonium nitrate sold for use in the manufacture of commercial explosives.

### **World Review**

ICI Australia announced plans to increase its explosives production at Gladstone, Australia, to 220,000 tons per year. The company planned to spend \$30 million to build a new nitric acid plant, thus expanding ammonium nitrate production capacity. The expansion is scheduled to be completed in late 1995.<sup>2</sup>

#### Outlook

U.S. coal production is expected to increase in 1995, but the increase would not be quite as significant as the increase between 1993 and 1994. The large 1993-94 increase primarily was a consequence of lower coal production in 1993, which resulted from the United Mine Workers of America strike against member companies of the Bituminous Coal Operators' Association early in 1993.

A major factor supporting the rise in U.S. coal production is the rise in demand for coal by

electric utilities, which accounted for 88% of total domestic coal consumption in 1994. Although coal consumption in electric utilities was up slightly, the quantity of electricity produced by coal-fired electric powerplants actually declined slightly. This inverse relationship partially reflects the increasing use by electric utilities of low-sulfur Western coal, which is lower in heat content than the coal it is replacing. If coal production increases, demand for explosives also is expected to increase, but at a slower rate. Western States in general have lower coal overburden to matrix ratios and, consequently, higher production efficiencies, thus requiring fewer explosives.

<sup>&</sup>lt;sup>1</sup>Chemical Marketing Reporter. Explosives Makers Se& Work in the Wake of the Cold War. V. 246, No. 6, Aug. 8, 1994, p. 4.

<sup>&</sup>lt;sup>2</sup>European Chemical News. ICI To Lift Queensland Capacity. V. 62, No. 1637, Oct. 3, 1994, p. 29.

## TABLE 1SALIENT STATISTICS OF INDUSTRIAL EXPLOSIVES AND BLASTINGAGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, 1993-94 1/

### (Metric tons)

Class	1993	1994
Permissibles	4,430	3,730
Other high explosives	32,300	35,500
Water gels, slurries, and emulsions	277,000	328,000
Ammonium nitrate-fuel oil blasting agents	262,000	463,000
Unprocessed ammonium nitrate	1,300,000	1,490,000
Total	1,880,000	2,320,000

1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

## TABLE 2 INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, BY CLASS AND USE, 1993-94 e/ $1/\,2/$

		Quarrying and	Construction	All other		
Class	Coal mining	nonmetal mining	Metal mining	work	purposes	Total
1993:						
Permissibles	4	(3/)		(3/)		4
Other high explosives	4	14	2	10	2	32
Water gels and slurries	96	97	40	40	4	277
Ammonium nitrate-fuel oil blasting agents	154	52	19	35	2	262
Unprocessed ammonium nitrate	980	79	148	51	42	1,300
Total	1,240	243	209	136	50	1,880
1994:						
Permissibles	4	(3/)		(3/)		4
Other high explosives	4	14	2	14	2	36
Water gels and slurries	114	115	51	42	6	328
Ammonium nitrate-fuel oil blasting agents	276	91	33	59	5	463
Unprocessed ammonium nitrate	1,140	82	158	53	57	1,490
Total	1,540	302	244	168	70	2,320

#### (Thousand metric tons)

e/ Estimated.

1/ Distribution of industrial explosives and blasting agents by consuming industry in 1993 and 1994 estimated from indices of industrial production

and economies as reported by the Department of Energy, Federal Reserve Board, Department of Transportation, and Bureau of the Census.

2/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

3/ Less than 1/2 unit.

# TABLE 3INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION<br/>IN THE UNITED STATES, BY STATES AND CLASS, 1994 1/

(Metric tons)

	Class					
	Fixed high explosives Blasting agents					
State			Water gels,	Ammonium	Unprocessed	
		Other high	slurries, and	nitrate-fuel	ammonium	
	Permissible	explosives	emulsions	oil blasting agents	nitrate	Total
Alabama	164	521	2,200	4,230	52,500	59,600
Alaska		931	1,690	687	6,530	9,830
Arizona		828	20,100	1,410	137,000	159,000
Arkansas		433	3,910	4,170	4,470	13,000
California		632	4,090	1,460	39,000	45,100
Colorado		583	3,520	849	25,800	30,800
Connecticut	2	354	1,320	879	4,280	6,840
Delaware					352	352
Florida	20	353	5,430	18	6,320	12,100
Georgia		468	6,390	8,160	5,140	20,200
Hawaii		5		28	259	292
Idaho		489	78	1,120	13,000	14,700
Illinois	62	1,100	22,100	40,800	14,900	79,000
Indiana	6	796	13,300	45,400	29,900	89,400
Iowa		1.760	2.740	920	10,800	16.200
Kansas		1.430	2,990	4.700	14,300	23,400
Kentucky	1.940	3.120	36.200	163.000	189.000	393.000
Louisiana	139	323	614	1.670	891	3.630
Maine		131	176	212		518
Maryland 2/		296	330	784	2.120	3,530
Massachusetts		573	1 470	1.230	4,500	7,770
Michigan	57	135	2 650	2 700	18,600	24 200
Minnesota		203	20,500	1 920	33,200	55,900
Mississinni		163	20,000	64		232
Missouri	15	2 860	9 690	13 800	17 500	43 900
Montana		1 890	5 860	2 430	53,900	64 100
Nebraska		100	17	123	2 480	2 720
Nevada		1 100	21 500	7 820	129,000	159,000
New Hampshire		/30	1 970	7,820	129,000	3 160
New Jersey		103	1,570	1 420	2 770	5,100
New Mexico		634	3 020	850	62,300	5,900
New York		530	3,020	1 060	3 800	9.540
North Carolina		078	5,250	1,900	11,700	22 500
North Dalvata		978	5,980	4,900	2.060	23,300
Norui Dakota		1.020	8050 8050		2,960	5,840 75,400
Ohlohomo	21	1,030	8,930 2,540	11,000	34,400	17,700
	2	248	3,340	4,820	9,100	17,700
Dregon		2 250	260	2,010	5,810	8,050
Pennsylvania	293	2,350	16,500	26,900	60,100	106,000
Rhode Island		22	20	4/		89
South Carolina		108	3,360	1,410		4,870
South Dakota		22	/5/	3,970	2,130	6,880
Tennessee	37	1,250	7,470	6,280	15,300	30,400
Texas	8	618	5,520	13,400	14,900	34,400
Utah	39	360	1,210	50	21,900	23,600
Vermont		78	28	44		150
Virginia	707	1,200	20,800	19,100	117,000	159,000
Washington		889	1,370	9,270	19,500	31,000
West Virginia	201	1,280	24,500	36,400	134,000	197,000
Wisconsin		645	4,390	4,500	2,320	11,900
Wyoming	12	436	23,400	3,890	132,000	160,000
Total	3,730	35,500	328,000	463,000	1,490,000	2,320,000

1/ Data rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.

2/ Includes District of Columbia.