



U.S. Department of the Interior • Bureau of Mines



MINERAL INDUSTRY SURVEYS

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Explosives, Annual

APPARENT CONSUMPTION OF INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS IN THE UNITED STATES, 1991

U.S. apparent consumption of domestic and imported industrial explosives materials declined 14%, to 4.1 billion pounds, according to the U.S. Bureau of Mines annual survey of explosives manufacturers. The significant drop in explosives sales, or apparent domestic consumption, was attributable primarily to a continuing downturn in the economy, attendant losses in fuel and nonfuel minerals output, and restricted construction activity. Explosives sales were recorded in 48 States in 1991, including Hawaii.

Ammonium nitrate-based explosives sales declined 14%, to 4.0 billion pounds, but continued to account for about 97% of total U.S. industrial explosives consumption. The 1991 survey of explosives-grade ammonium nitrate was complicated by industry restructuring and substantial changes in product distribution patterns. Domestic production of industrial-grade ammonium nitrate declined 9% in 1991, according to the Bureau of the Census.

High explosives sales were down 21% in 1991, reflective of the downturn in coal mining, nonfuel minerals mining, and construction activity. Permissibles declined 36%, to 12.6 million pounds, while other high explosives dropped 19%, to 107.3 million pounds.

Coal mining typically accounts for about 65%-68% of U.S. explosives demand, quarrying and nonmetal mining, 15%; metal mining, 10%; construction, 7%; and miscellaneous use, 3%-4%. Coal output was down 3.4% in 1991, according to the Department of Energy, while Federal Reserve Board production indices reflected declines of 10% in nonmetal mining, and 2% in metal mining. Construction activity was off 10%, according to the Economics and Statistics Administration, Bureau of the Census.

Events, Trends, and Issues

The Bureau's 1991 survey indicates that a 14% drop was experienced in ammonium nitrate explosives sales at the producer level. This may not be indicative of the actual drop in total industry demand, however, because of potential swings in field inventories, and other statistical discrepancies. On the upside, leading indicators of mining and construction activity, and Bureau of the Census domestic production data suggest that actual explosives use in the United States in 1991, declined by a more moderate 10%. On the downside, the industry could have potentially ended the year with an inordinate inventory overhang, in the face of declining demand.

Industrial explosives demand was negatively impacted by a decline in industrial productivity and mild winter weather that contributed to significant declines in nonfuel minerals mining across the United States, and in coal output east of the Mississippi River. There was, however, a continuing growth trend in the open-pit mining of low-sulfur western coal. Although U.S. coal output was off 3.4% in 1991, western States production increased 2.4%, owing principally to a 5.4% increase in the Powder River Basin area of Wyoming. Western mines, in general, have lower overburden to matrix ratios and higher productive efficiencies.

Fifteen States accounted for about 80% of U.S. industrial explosives demand in 1991, of which, 13 States in this group produced 85% of our nation's coal. The nine State Appalachian region of the eastern United States accounted for about 50% of U.S. explosives consumption. Kentucky, West Virginia, and Pennsylvania, in the Appalachian coal belt, led the nation with 35% of apparent domestic demand. The remaining 50% of U.S. consumption was equally divided between the interior and western States. Wyoming, the nation's leading coal producer, led all western States, and accounted for 5% of total U.S. explosives demand.

Explosives sales by consuming industries in 1990-91 were estimated as shown in table 2. Correlation patterns between explosives sales and end use sectors were developed from U.S. Bureau of Mines time series data and leading indicators of industrial production and economics as reported by the Department of Energy, Federal Reserve Board, Bureau of the Census, and Department of Transportation.

Ammonium Nitrate Project and Technology Review

Coastal Chem, Inc. was constructing a 130,000-ton-per-year low density ammonium nitrate plant at Elko, Nevada, that was scheduled onstream in the fall of 1992. The plant was reportedly in the commissioning phase at this printing.

Unocal's plans for a new 150,000-ton-per-year plant at West Sacramento, California were significantly delayed by economic and regulatory considerations, according to the Unocal Corporation 1991 Annual Report. The 110,000-ton-per-year plant at Brea, California, was also reported to have been closed permanently. Unocal purchased Chevron's Kennewick, Washington nitrogen production facility that included 240,000 annual tons of ammonium nitrate capacity.

Ireco, Inc. of Salt Lake City, Utah, introduced Super Prills™ ammonium nitrate. Ireco officials reported that applied research and development efforts had resulted in the production of a superior prill that overcomes problems typically associated with traditional low density prills. The prills were reported to be exceptionally uniform with a high degree of dimensional stability or resistance to breakdown, free-flowing, and compatible with all types of emulsions. Optimal blasting performance for all ammonium nitrate-fuel oil (ANFO) and ANFO/emulsion blends was reflective of the product's uniform oil absorption characteristics.

Explosives Research and Technology

The International Society of Explosives Engineers (S.E.E.) 18th Annual Conference on Explosives and Blasting Technique, and 8th Annual Research Symposium and Exhibits was held in Orlando, Florida, during January 19-23, 1992. This conference represents the largest gathering of blasters in the world. The conference was highlighted by a General Session, with presentations by blasters on practical aspects, including techniques, safety, productivity and cost effectiveness in the use of explosives, together with a Research Symposium that focused on the technical and analytical aspects of explosives products, services and methods. Workshops were held under the topics: Ongoing U.S. Legislation and Regulation; Blast Casting; and, Underground Blasting. The conference Proceedings were published in two volumes

The Society of Explosives Engineers evolved into the International Society of Explosives Engineers in 1991, reflecting the significant growth in international membership and foreign participation in Society activities. S.E.E. international membership outside of North America was composed of representatives from 62 countries around the globe, according to the Society's 1991 Membership Directory and Desk Reference. The Society President announced that S.E.E. membership increased about 20% to over 3,000 worldwide in 1991.

Outlook

U.S. industrial explosives sales by primary producers should recover somewhat in 1992, and will most probably be variably dependent upon the level of field inventory liquidation that occurred during 1991. A low level pipeline field inventory situation could produce sales significantly higher than actual demand in 1992, partially offsetting the precipitous losses of 1991. Fuel and nonfuel minerals production, together with industrial construction activity, should exhibit modest to level growth during 1992. Coal production at mid-year 1992, for example, was proceeding at an annualized rate of 980 million tons, essentially the same as last year. The average annual mean temperature in the United States was projected to be substantially below normal in the summer and fall of 1992.

The long-range outlook for U.S. industrial explosives supply and demand will be dependent upon the degree of U.S. economic growth, coupled with our ability to effectively compete in the international minerals, chemicals, and materials marketplace. Environmental factors, evolutionary patterns in minerals and materials trends, competitive economics between fossil fuels in the U.S. energy equation, weather, and geopolitical factors, should continue to play an

integral role in our nation's productive capacity, and industrial explosives potential.

According to the Energy Information Administration (EIA), U.S. Department of Energy, coal's share of total U.S. energy production is projected to rise from 31% in 1990 to a range between 35%-38% by the year 2010, dependent upon world oil prices and U.S. economic growth. EIA reported that coal has eclipsed petroleum as the nation's leading source of U.S. primary energy, since 1984.^{1/}

EIA projections indicate that U.S. coal production will increase at an average annual rate of 1%-2% during the 1990's, from 1.0 billion tons in 1990, to between 1.1 to 1.2 billion tons by the year 2000. Production was pegged at between 1.3 to 1.6 billion tons by the year 2010, representing an average annual growth of 2%-3% over the 20 year forecast period.

Exports are expected to be the fastest growing segment of the U.S. coal Industry over the next two decades, rising from 106 million tons, or 10% of the domestic supply in 1990, to about 240 million tons, or 15% by the year 2010. Eastern coal will reportedly account for most of the increase. EIA cited three major factors that were expected to drive exports: declining coal production capability in Europe; growing electricity demand in Asia; and the limited capability of other countries to increase exports beyond the year 2000.

One major ramification of the Clean Air Act Amendments of 1990 will involve a significant increase in limestone quarrying and downstream use for the removal of sulfur dioxide (SO₂) emanating from flue gas in electrical powerplants. This, in turn, may potentially result in a significant increase in explosives demand in the limestone industry.

^{1/} Energy Information Administration. Annual Energy Outlook, 1992. DOE/EIA-0383(92), January, 1992, pp. 49-55.

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

- Apache Nitrogen Products--Benson, Arizona
- * Arcadian Corp.--Memphis, Tennessee 1/
Atlas Powder Co.--Dallas, Texas 2/
Austin Powder Co.--Cleveland, Ohio
H. L. & A. G. Balsinger, Inc.--Cuddy, Pennsylvania
- * Coastal Chem Inc.--Cheyenne, Wyoming
Amos L. Dolby Company, Corsica, Pennsylvania
El Dorado Chemical Co.--St. Louis, Missouri
The Ensign-Bickford Co.--Simsbury, Connecticut
Explosives Technologies International, Inc. (ETI)--
Wilmington, Delaware
- * Farmland Industries, Inc.--Kansas City, Missouri
Goex International, Inc.--Cleburne, Texas
ICI Explosives Canada.--North York, Ontario, Canada 3/
IRECO Inc.--Salt Lake City, Utah 4/
- * LaRoche Ind., Inc.--Atlanta, Georgia
Mining Services International--Salt Lake City, Utah
Mt. State Bit Service, Inc.--Morgantown, West Virginia
Nitrochem Inc.,--Montreal, Quebec, Canada 5/
Sierra Chemical Co.--Reno, Nevada
- * Thermex Energy Corp.--Dallas, Texas 6/
Trojan Corp.--Salt Lake City, Utah
- * Unocal Corp.--Los Angeles, California
Viking Explosives and Supply Co.--Rosemount, Minnesota

*Indicates non-IME producers.

1/ Includes former Nitrex plant at Wilmington, NC; Columbia Nitrogen, at Augusta and Garden City, GA; and Hawkeye Chemical Co., Clinton, IA.

2/ Owned by ICI of the United Kingdom

3/ Formerly CIL; in 1990 name was changed to reflect corporate ownership.

4/ Includes former Southeastern Energy, Inc. operation at Louisville, TN, purchased in 1990.

5/ Parent company of former Nitrochem Energy Corp., Allentown, PA.

6/ Closed in 1990.

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 reported directly to the U.S. Bureau of Mines 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. ANFO and "water gels and slurries" trends may be masked because of the large volume of unprocessed ammonium nitrate that had no identified end-use product description.

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 U.S. Bureau of Mines in 1971.

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

I. High Explosives

A. Permissibles: Grades approved by brand name by the Mine Safety and Health Administration (MSHA), as established by U.S. Bureau of Mines testing.

B. Other High Explosives: All high explosives except permissibles.

II. Blasting Agents

A. Ammonium Nitrate - Fuel Oil (ANFO): All mixtures regardless of density.

B. Bulk Slurries, Water Gels, and Emulsions: All bulk slurries, water gels, emulsions and ANFO mixtures containing slurries, water gels and emulsions.

III. Unprocessed Ammonium Nitrate: Includes prilled, grained and water solution (liquor) ammonium nitrate sold for use in the manufacture of commercial explosives.

TABLE 1.--Salient statistics of industrial explosives and blasting agents sold for consumption in the United States, 1990-1991
(Thousand pounds)

Class	1990	1991
Permissibles-----	19,481	12,560
Other high explosives-----	132,793	107,339
Water gels, slurries, and emulsions-----	648,428	607,491
Ammonium nitrate-fuel oil blasting agents-----	684,577	581,506
Unprocessed ammonium nitrate-----	3,268,453	2,767,773
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Total-----	4,753,732	4,076,669

TABLE 2.--Industrial explosives and blasting agents sold for consumption in the United States, by class and use, 1990-1991 e/1/

(Million pounds)

Class	Coal mining		Quarrying and nonmetal mining		Metal mining		Construction work		All other purposes		Total2/	
	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991	1990	1991
Permissibles-----	r/19.1	12.4	r/.2	.1	--	--	r/.2	.1	--	--	19.5	12.6
Other high explosives-----	18.0	14.0	r/59.0	48.0	8.0	6.0	r/43.0	35.0	r/4.8	4.3	132.8	107.3
Water gels and slurries-----	236.0	221.0	r/224.0	210.0	r/94.0	88.0	r/84.0	79.0	r/10.4	9.5	648.4	607.5
Ammonium nitrate-fuel oil blasting agents-----	r/406.0	345.0	r/136.0	116.0	r/51.0	43.0	r/82.0	70.0	r/9.6	7.5	684.6	581.5
Unprocessed ammonium nitrate-----	r/2,521.0	2,168.0	r/221.0	166.0	r/346.0	283.0	r/111.0	76.0	r/69.5	74.8	3,268.5	2,767.8
Total-----	r/3,200.1	2,760.4	r/640.2	540.1	r/499.0	420.0	r/320.2	260.1	r/94.3	96.1	4,753.7	4,076.7

e/Estimated. r/Revised.

1/Distribution of industrial explosives and blasting agents by consuming industry in 1990 and 1991 estimated from indices of industrial production and economics as reported by the Department of Energy, Federal Reserve Board, Department of Transportation, and Bureau of the Census.

2/Data may not add to totals shown because of independent rounding.

TABLE 3.--Industrial explosives and blasting agents sold for consumption
in the United States, by State and class, 1991
(Thousand pounds)

State	Class					Total
	Fixed high explosives		Water gels, slurries, and emulsions	Blasting Agents		
	Permissibles	Other high explosives		Ammonium nitrate-fuel oil blasting agents	Unprocessed ammonium nitrate	
Alabama-----	134	1,526	6,106	14,439	88,987	111,192
Alaska-----	354	4,392	1,912	2,176	5,904	14,738
Arizona-----	--	1,933	8,310	5,972	101,011	117,226
Arkansas-----	--	1,232	4,183	12,574	2,597	20,586
California-----	--	2,156	7,593	6,171	60,546	76,466
Colorado-----	10	1,794	4,540	1,245	14,837	22,426
Conneticut-----	--	1,762	1,599	2,523	5,029	10,913
District of Columbia1/-----	--	--	--	--	--	--
Florida-----	--	2,020	15,431	410	7,198	25,059
Georgia-----	--	1,442	4,858	7,543	25,734	39,577
Hawaii-----	--	1,805	204	389	1,422	3,820
Idaho-----	--	1,177	1,389	1,928	30,865	35,359
Illinois-----	22	3,948	56,806	65,232	62,443	188,451
Indiana-----	23	2,310	53,097	119,672	86,973	262,075
Iowa-----	--	3,767	4,542	1,475	17,985	27,769
Kansas-----	--	383	575	4,920	1,538	7,416
Kentucky-----	6,972	8,053	111,048	70,312	576,171	772,556
Louisiana-----	--	277	141	2	--	420
Maine-----	--	259	365	435	--	1,059
Maryland-----	15	224	1,319	1,182	3,619	6,359
Massachusetts-----	--	1,081	2,311	1,876	97	5,365
Michigan-----	219	1,498	14,606	12,231	38,049	66,603
Minnesota-----	3	567	19,990	6,931	77,909	105,400
Mississippi-----	--	578	1	156	1,589	2,324
Missouri-----	26	8,791	10,076	30,079	65,437	114,409
Montana-----	--	2,470	30,521	17,974	101,172	152,137
Nebraska-----	--	476	--	--	2,272	2,748
Nevada-----	--	1,632	24,285	7,159	131,297	164,373
New Hampshire-----	--	1,704	1,670	2,296	--	5,670
New Jersey-----	--	1,710	1,648	1,271	1,909	6,538
New Mexico-----	--	1,472	12,282	1,078	112,216	127,048
New York-----	--	3,101	5,359	5,406	10,409	24,275
North Carolina-----	1	2,938	4,340	5,360	18,683	31,322
Ohio-----	100	3,787	18,410	22,655	147,989	192,941
Oklahoma-----	4	1,102	2,924	25,004	4,342	33,376
Oregon-----	--	1,327	285	5,124	4,496	11,232
Pennsylvania-----	683	6,059	23,508	43,541	187,437	261,228
Rhode Island-----	--	129	115	386	--	630
South Carolina-----	--	93	1,904	2,496	4,951	9,444
South Dakota-----	--	56	1,311	543	1,559	3,469
Tennessee-----	152	4,519	10,517	9,407	24,913	49,508
Texas-----	2	4,877	5,566	6,371	40,482	57,298
Utah-----	150	3,358	1,350	110	31,503	36,471
Vermont-----	--	169	809	517	--	1,495
Virginia-----	1,949	2,927	10,347	14,552	125,128	154,903
Washington-----	1	4,267	1,990	15,979	28,754	50,991
West Virginia-----	1,718	3,627	57,345	19,230	307,956	389,876
Wisconsin-----	--	1,444	7,412	2,562	65,156	76,574
Wyoming-----	22	1,120	52,591	2,612	139,208	195,553
Total2/-----	12,560	107,339	607,491	581,506	2,767,773	4,076,669

1/Included with Maryland.

2/Data may not add to total shown because of independent rounding.

TABLE 4.--Supply trends U.S. industrial explosives
(Thousand short tons)

Calendar Year	Ammonium Nitrate	ANFO	Water Gels and Slurries	Other High Explosives	Permissibles	Total Supply ^{1/}
1980	1,121	698	202	88	28	2,137
1981	1,217	609	240	79	26	2,171
1982	1,189	520	164	59	23	1,955
1983	1,300	289	206	51	19	1,865
1984	1,555	318	235	51	20	2,178
1985	1,324	320	193	69	18	1,924
1986	1,344	324	210	66	18	1,961
1987	1,605	315	241	72	17	2,249
1988	1,516	434	329	75	14	2,368
1989	1,616	383	321	70	11	2,403
1990	1,634	342	324	r/67	10	2,377
1991	1,383	291	304	54	6	2,038

r/Revised.

^{1/}Data may not add to totals shown because of independent rounding.

Source: Branch of Industrial Minerals, U.S. Bureau of Mines.

TABLE 5.--Demand trends U.S. industrial explosives
(Thousand short tons)

Calendar Year	Coal Mining	Quarrying & Nonmetal Mining	Metal Mining	Construction Work	Other Purposes	Total Demand ^{1/}
1980	1,264	316	285	210	63	2,137
1981	1,250	278	368	166	107	2,171
1982	1,233	237	267	134	84	1,955
1983	1,135	252	244	148	86	1,865
1984	1,441	255	226	152	105	2,178
1985	1,203	269	197	124	131	1,924
1986	1,283	293	160	129	96	1,961
1987	1,610	259	170	154	55	2,249
1988 ^{2/}	r/1,570	r/300	220	r/170	r/108	2,368
1989 ^{2/}	r/1,590	r/320	r/250	r/160	r/83	2,403
1990 ^{2/}	r/1,600	r/320	r/250	r/160	r/47	2,377
1991 ^{2/}	1,380	270	210	130	48	2,038

r/Revised.

^{1/}Data may not add to totals shown because of independent rounding.

^{2/}Distribution of total demand, estimated.

Source: Branch of Industrial Minerals, U.S. Bureau of Mines.

Fig 1.-Supply trends U.S. industrial explosives

(Thousand short tons)

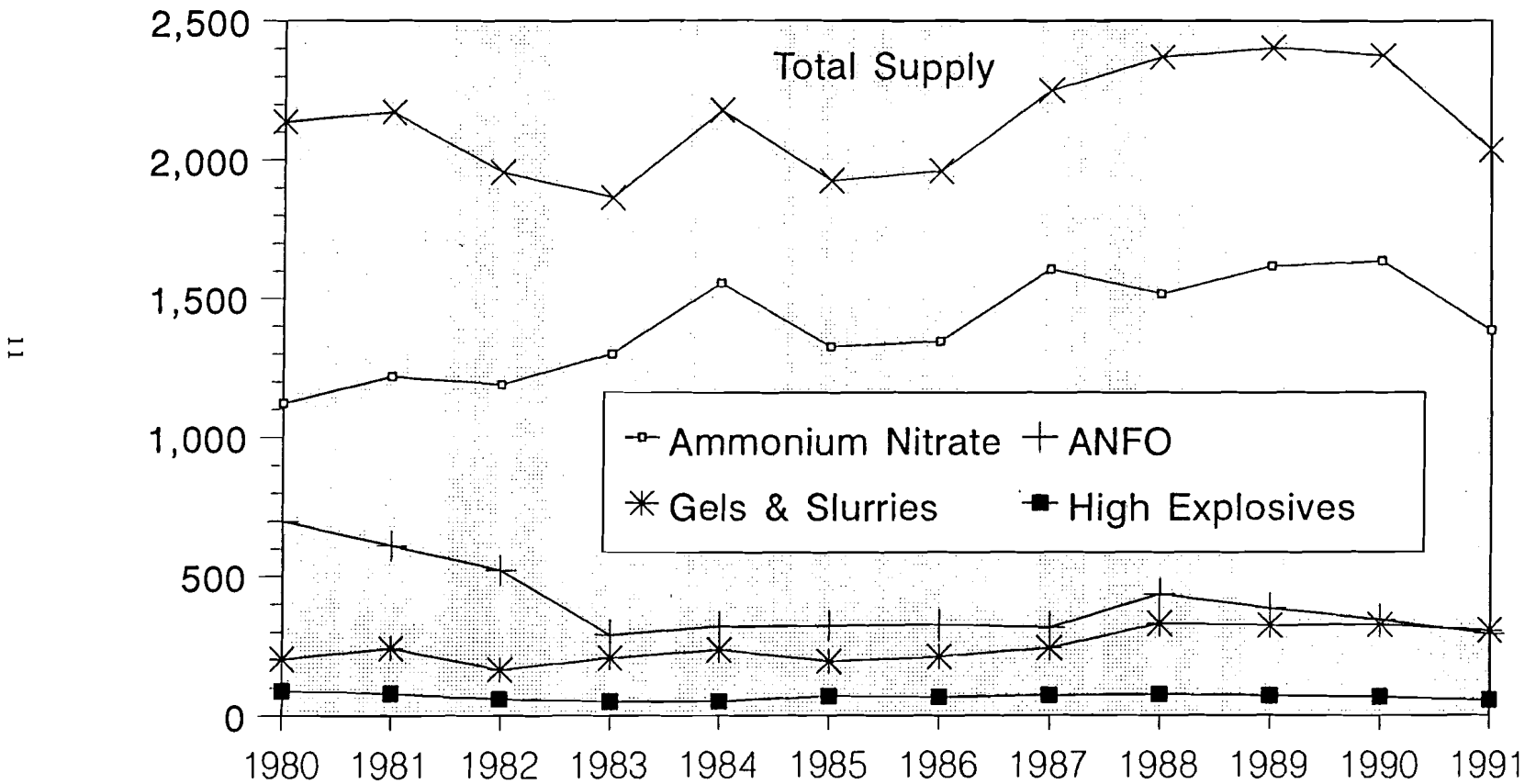


Fig 2.-Demand trends U.S. industrial explosives

(Thousand short tons)

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