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

# MINERAL INDUSTRY SURVEYS

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Annual Review

## EXPLOSIVES IN 1993

U.S. production of industrial explosives and blasting agents declined slightly in 1993, based on producer sales of 1.876 million metric tons, according to the U.S. Bureau of Mines. Increases in metal mining and construction activity were partially offset by a decrease in coal production, traditionally the largest market for explosives. Explosives sales were recorded in all 50 States.

Sales of ammonium nitrate-base explosives decreased slightly to 1.840 million tons and represented 98% of U.S. consumption of industrial explosives. High explosives sales fell by 13%, continuing a downward trend begun in 1988.

Coal mining was estimated to account for 66% of the total U.S. explosives demand in 1993. Quarrying and nonmetal mining accounted for 13% of demand; metal mining, 11%, construction, 7% and miscellaneous uses, 3%. Coal production in the United States fell by 5.4%, according to the U.S. Department of Energy. Both the Appalachian and Interior sections of the country showed sharp declines, while coal production in Western States increased by 5.1%. According to the Federal Reserve Board production indices, metal mining activity increased by about 4% and quarrying and nonmetal mining activity remained about the same. 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 1993 increased by 4% from the 1992 level.

Five States, Kentucky, West Virginia, Arizona, Wyoming, and Pennsylvania, in descending order, accounted for 43% of total explosives demand in 1993. Of these States, Wyoming, Kentucky, West Virginia, and Pennsylvania, in descending order, also ranked in the top five coal-producing States, together producing 59% of total U.S. coal production.

ICI Explosives Environmental Co. reportedly signed a contract with the U.S. Army to convert the Indiana Army Ammunition Plant in Chestertown, IN, from a military base to a site for commercial manufacturing. The 1,400-building facility had operations for loading propellant charges and manufacturing charge bags, single-base smokeless propellant, and black powder. ICI Explosives also announced that it would complete a feasibility study to convert or demilitarize surplus Russian conventional ammunition for use a commercial explosives. The feasibility study was supported by a $300,000 grant form the U.S. Trade and Development Agency. Russia claimed to have almost 2 million tons of conventional munitions that were designated as excess and were ready for conversion. ICI was expected to work with a Russian firm, Nitro-Vzryv, which manufactures military and commercial explosives to complete the study by the beginning of 1994.[1]

The Mine Safety and Health Administration (MSHA) published a final rule on eight safety standards for explosives at metal and nonmetal mines. On January 18, 1991, MSHA published a final rule in the Federal Register that set safety measures to address explosive hazards that may be present when persons use or work near explosive materials at metal and nonmetal mines. Most of the regulations became effective on November 1, 1991; the remaining eight regulations were subject to an administrative stay. The final rule on the remaining regulations, effective on December 30, 1993, defined "barrier," "blast site," "magazine," and "storage facility;" addressed storage of blasting agents; location of explosive material storage facilities; vehicles transporting explosive material; primer protection; loading and blasting; double trunklines in nonelectric initiation systems; excessive temperatures; and burning explosive material.[2]

The International Society of Explosives Engineers

Prepared in the Branch of Industrial Minerals and the Branch of Data Collection and Coordination, August 12, 1994.

(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. The SEE also held the 20th annual Kentucky Blasting Conference from December 1-3, 1994. Presentation subjects at the conference included regulations, community relations, and legal concerns as well as technical subjects.

The Energy Information Administration expected coal production to increase by 10.4% in 1994 as coal producers and consumers replenish stocks drawn down as a result of the United Mine Workers of America against member companies of the Bituminous Coal Operators' Association early in 1993. If coal production increases, demand for explosives also is expected to increase, but at a slower rate. Coal production has increased mainly in the Western States, which in general have lower overburden to matrix ratios and, consequently, higher production efficiencies.

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
  El Dorado Chemical Co. – St. Louis, MO
* Dyno Nobel Inc. – Salt Lake City, UT[1]
  The Ensign-Bickford Co. – Simsbury, CT
  Explosives Technologies International Inc. (ETI) – Wilmington, DE
  GOEX International Inc. – Cleburne, TX
  ICI Explosives Canada – NY; Ontario, Canada
  ICI Explosives USA Inc. – Dallas, TX
* LaRoche Industries Inc. – Atlanta, GA
  Mining Services International – Salt Lake City, UT
* Mt. State Bit Service Inc. – Morgantown, WV
* Nitram Inc. – Tampa, FL
  Nitrochem Inc. – Montreal, Quebec, Canada
  SENEX Explosives Inc. – Cuddy, PA[2]
  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.
[1]Formerly IRECO Inc.
[2]Formerly H. L. and A. G. Balsinger Inc.

*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 are 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:**

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

Other high explosives – All high explosives except permissibles.

**Blasting agents:**

Ammonium nitrate-fuel oil (ANFO) – All mixtures, regardless of density

Bulk slurries, water gels, and emulsions – All bulk slurries, water gels, emulsions and ANFO mixtures containing slurries, waters gels and emulsions.

**Unprocessed ammonium nitrate** – Includes prilled, grained, and water solution (liquor) ammonium nitrate sold for use in the manufacture of commercial explosives.

[1]The Journal of Explosives Engineering. V. 11, No. 1, May-June 1993, p. 28.
[2]Federal Register. Safety Standards For Explosives at Metal and Nonmetal Mines. Final Rule. (Dep. Labor). V. 58, No. 249, Dec. 30, 1993, pp. 69596-69617.

TABLE 1
SALIENT STATISTICS OF INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, 1992–93

(Metric tons)

| Class | 1992 | 1993 |
|---|---|---|
| Permissibles | 4,970 | 4,429 |
| Other high explosives | 37,294 | 32,259 |
| Water gels, slurries, and emulsions | 285,136 | 277,219 |
| Ammonium nitrate–fuel oil blasting agents | 254,168 | 262,335 |
| Unprocessed ammonium nitrate | 1,311,519 | 1,300,022 |
| Total | 1,893,087 | 1,876,264 |
| Total (thousand pounds)[1] | 4,173,538 | 4,136,449 |

[1]One metric ton is equal to 2,204.62 pounds.

TABLE 2
INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, BY CLASS AND USE, 1992–93[e 1]

(Thousand metric tons)

| Class | Coal mining | | Quarrying and nonmetal mining | | Metal mining | | Construction work | | All other purposes | | Total[2] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1992 | 1993 | 1992 | 1993 | 1992 | 1993 | 1992 | 1993 | 1992 | 1993 | 1992 | 1993 |
| Permissibles | 4.9 | 4.4 | ([3]) | ([3]) | -- | -- | ([3]) | ([3]) | -- | -- | 5.0 | 4.4 |
| Other high explosives | 5.0 | 4.3 | 16.8 | 14.1 | 1.8 | 1.6 | 12.2 | 10.4 | 1.5 | 1.9 | 37.3 | 32.3 |
| Water gels and slurries | 103.9 | 96.2 | 98.4 | 96.9 | 41.3 | 40.2 | 37.2 | 39.7 | 4.4 | 4.2 | 285.1 | 277.2 |
| Ammonium nitrate–fuel oil blasting agents | 150.6 | 153.6 | 50.8 | 52.4 | 18.6 | 19.2 | 30.8 | 34.9 | 3.3 | 2.2 | 254.1 | 262.3 |
| Unprocessed ammonium nitrate | 1,010.2 | 980.4 | 78.9 | 79.2 | 137.9 | 147.6 | 46.7 | 50.8 | 37.8 | 42.0 | 1,311.5 | 1,300.0 |
| Total | 1,274.6 | 1,238.9 | r244.9 | 242.6 | 199.6 | 208.6 | r126.9 | 135.8 | r47.0 | 50.3 | r1,893.0 | 1,876.2 |
| Total (million pounds)[4] | 2,810.0 | 2,731.3 | 540.1 | 534.8 | 440.0 | 459.9 | 280.0 | 299.4 | 103.4 | 110.9 | 4,173.5 | 4,136.4 |

[e]Estimated. [r]Revised.

[1]Distribution of industrial explosives and blasting agents by consuming industry in 1992 and 1993 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]Data may not add to totals shown because of independent rounding.

[3]Less than 1/2 unit.

[4]One metric ton is equal to 2,204.62 pounds.

## TABLE 3
## INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, BY STATES AND CLASS, 1993

(Metric tons)

| State | Class | | | | | |
|---|---|---|---|---|---|---|
| | Fixed high explosives | | | Blasting agents | | |
| | Permissible | Other high explosives | Water gels, slurries, and emulsions | Ammonium nitrate-fuel oil blasting agents | Unprocessed ammonium nitrate | Total |
| Alabama | 90 | 516 | 2,008 | 4,147 | 63,890 | 70,449 |
| Alaska | 16 | 1,163 | 1,258 | 871 | 3,494 | 6,822 |
| Arizona | -- | 741 | 18,182 | 834 | 115,074 | 132,611 |
| Arkansas | 39 | 548 | 2,007 | 4,050 | 1,301 | 7,945 |
| California | -- | 810 | 3,746 | 902 | 33,605 | 39,063 |
| Colorado | -- | 532 | 3,270 | 295 | 17,156 | 21,253 |
| Connecticut | -- | 384 | 1,354 | 722 | 3,406 | 5,866 |
| Delaware | -- | -- | -- | -- | 2 | 2 |
| Florida | 20 | 281 | 1,580 | 508 | 25,416 | 27,803 |
| Georgia | -- | 701 | 3,407 | 5,858 | 8,856 | 18,822 |
| Hawaii | -- | -- | 6 | 22 | 80 | 88 |
| Idaho | -- | 357 | 384 | 501 | 7,607 | 8,849 |
| Illinois | 36 | 1,161 | 15,602 | 14,805 | 9,623 | 41,229 |
| Indiana | 11 | 709 | 13,573 | 34,072 | 30,633 | 78,998 |
| Iowa | -- | 2,007 | 2,790 | 754 | 4,775 | 10,326 |
| Kansas | -- | 642 | 853 | 3,627 | 5,467 | 10,589 |
| Kentucky | 2,680 | 2,953 | 35,742 | 65,098 | 211,777 | 316,250 |
| Louisiana | -- | 202 | 44 | 837 | 13 | 1,096 |
| Maine | -- | 122 | 111 | 185 | -- | 418 |
| Maryland[1] | 3 | 82 | 235 | 538 | 1,181 | 2,039 |
| Massachusetts | -- | 586 | 1,109 | 1,190 | 372 | 3,257 |
| Michigan | 68 | 91 | 7,618 | 3,649 | 22,206 | 33,632 |
| Minnesota | -- | 314 | 35,206 | 1,657 | 49,701 | 86,878 |
| Mississippi | -- | 108 | 1 | 81 | -- | 190 |
| Missouri | 15 | 3,008 | 6,982 | 11,423 | 14,071 | 35,497 |
| Montana | -- | 682 | 2,778 | 1,373 | 43,130 | 47,981 |
| Nebraska | -- | 78 | 110 | 58 | 3,581 | 3,827 |
| Nevada | 16 | 730 | 15,782 | 6,017 | 68,620 | 91,167 |
| New Hampshire | -- | 401 | 890 | 874 | -- | 2,165 |
| New Jersey | -- | 286 | 868 | 264 | 7 | 1,427 |
| New Mexico | -- | 571 | 4,130 | 300 | 84,747 | 89,748 |
| New York | -- | 580 | 1,354 | 1,944 | 7 | 3,885 |
| North Carolina | -- | 889 | 4,800 | 2,437 | 14,200 | 22,326 |
| North Dakota | -- | 14 | 222 | 2,558 | 225 | 3,019 |
| Ohio | 22 | 931 | 8,420 | 10,558 | 77,252 | 95,183 |
| Oklahoma | 1 | 337 | 2,715 | 4,908 | 2,478 | 10,439 |
| Oregon | -- | 476 | 120 | 1,729 | 3,171 | 5,496 |
| Pennsylvania | 315 | 2,191 | 14,288 | 25,335 | 61,071 | 103,200 |
| Rhode Island | -- | 55 | 10 | 73 | -- | 138 |
| South Carolina | -- | 61 | 1,492 | 883 | -- | 2,436 |
| South Dakota | 4 | 46 | 388 | 835 | 727 | 2,000 |
| Tennessee | 24 | 1,256 | 6,547 | 4,330 | 13,337 | 25,494 |
| Texas | 12 | 722 | 3,267 | 10,204 | 15,767 | 29,972 |
| Utah | 44 | 270 | 1,916 | 69 | 14,834 | 16,933 |
| Vermont | -- | 61 | 39 | 95 | -- | 195 |
| Virginia | 722 | 1,065 | 11,100 | 8,855 | 77,899 | 99,641 |
| Washington | -- | 931 | 645 | 3,871 | 10,809 | 16,456 |
| West Virginia | 261 | 828 | 28,210 | 14,089 | 97,884 | 141,272 |
| Wisconsin | 2 | 664 | 2,383 | 607 | 6,102 | 9,756 |
| Wyoming | 22 | 296 | 11,304 | 3,847 | 94,686 | 110,159 |
| Total[2] | 4,429 | 32,259 | 277,219 | 262,335 | 1,300,022 | 1,876,264 |
| Total (thousand pounds) | 9,764 | 71,119 | 611,162 | 578,349 | 2,866,055 | 4,136,449 |

[1]Includes District of Columbia.

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

[3]One metric ton is equal to 2,204.62 pounds.

TABLE 4
SUPPLY TRENDS U.S. INDUSTRIAL EXPLOSIVES

(Thousand metric tons)

| Calendar year | Ammonium nitrate | ANFO | Water gels and slurries | Other high explosives | Permissible | Total supply[1] |
|---|---|---|---|---|---|---|
| 1980 | 1,017 | 633 | 183 | 80 | 25 | 1,939 |
| 1981 | 1,104 | 552 | 218 | 72 | 24 | 1,969 |
| 1982 | 1,079 | 471 | 149 | 54 | 21 | 1,774 |
| 1983 | 1,179 | 262 | 187 | 46 | 17 | 1,692 |
| 1984 | 1,415 | 288 | 213 | 46 | 18 | 1,976 |
| 1985 | 1,201 | 290 | 175 | 63 | 16 | 1,745 |
| 1986 | 1,219 | 294 | 191 | 60 | 16 | 1,779 |
| 1987 | 1,456 | 286 | 219 | 65 | 15 | 2,040 |
| 1988 | 1,375 | 394 | 298 | 68 | 13 | 2,148 |
| 1989 | 1,466 | 347 | 291 | 64 | 10 | 2,180 |
| 1990 | 1,482 | 310 | 294 | 61 | 9 | 2,156 |
| 1991 | 1,256 | 264 | 276 | 49 | 5 | 1,850 |
| 1992 | 1,312 | 254 | 285 | 37 | 5 | 1,893 |
| 1993 | 1,300 | 262 | 277 | 32 | 4 | 1,876 |

[1]Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of Mines.

TABLE 5
DEMAND TRENDS U.S. INDUSTRIAL EXPLOSIVES

(Thousand metric tons)

| Calendar year | Coal mining | Quarrying & nonmetal mining | Metal mining | Construction work | Other purposes | Total demand[1] |
|---|---|---|---|---|---|---|
| 1980 | 1,147 | 287 | 259 | 191 | 57 | 1,939 |
| 1981 | 1,134 | 252 | 334 | 151 | 97 | 1,969 |
| 1982 | 1,119 | 215 | 242 | 122 | 76 | 1,774 |
| 1983 | 1,030 | 229 | 221 | 134 | 78 | 1,692 |
| 1984 | 1,307 | 231 | 205 | 138 | 95 | 1,976 |
| 1985 | 1,091 | 244 | 179 | 112 | 119 | 1,745 |
| 1986 | 1,164 | 266 | 145 | 117 | 87 | 1,779 |
| 1987 | 1,461 | 235 | 154 | 140 | 50 | 2,040 |
| 1988[2] | 1,424 | 272 | 200 | 154 | 98 | 2,148 |
| 1989[2] | 1,442 | 290 | 227 | 145 | 75 | 2,180 |
| 1990[2] | 1,451 | 290 | 227 | 145 | 43 | 2,156 |
| 1991[2] | 1,252 | 246 | 191 | 118 | 44 | 1,850 |
| 1992[2] | 1,275 | 245 | 200 | 127 | r44 | 1,893 |
| 1993[2] | 1,239 | 243 | 209 | 136 | 50 | 1,876 |

rRevised.
[1]Data may not add to totals shown because of independent rounding.
[2]Distribution of total demand, estimated.

Source: U.S. Bureau of Mines.

FIGURE 1
SUPPLY TREND FOR U.S. INDUSTRIAL EXPLOSIVES

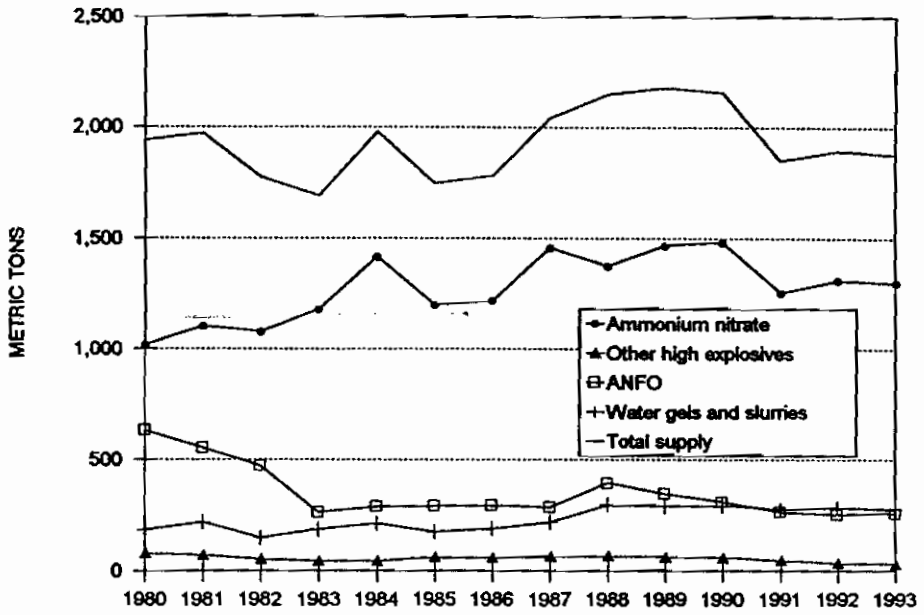


FIGURE 2
DEMAND TREND FOR U.S. INDUSTRIAL EXPLOSIVES