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EXPLOSIVES

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EXPLOSIVES

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In 2005, U.S. explosives sales were 3.20 million metric tons (Mt), a 27% increase from those in 2004; sales of explosives were reported in all States except Delaware. Much of this increase is believed to be attributable to more accurate reporting by the manufacturers. Coal mining, with 65% of total consumption, continued to be the dominant use for explosives in the United States. Wyoming, West Virginia, and Kentucky, in descending order, led the Nation in coal production, accounting for 60% of the total. These States also were the leading explosives-consuming States, accounting for 45% of total U.S. explosives sales.

Legislation and Government Programs

As of October 1, 2005, the National Institute of Occupational Safety and Health (NIOSH) discontinued its explosives research program, which had been transferred to the agency from the U.S. Bureau of Mines in 1996. The NIOSH claimed that the small number of serious accidents involving the use of explosives in occupational settings was the reason it could no longer justify supporting explosives research. The loss of the NIOSH's explosives program leaves the United States without a Government laboratory responsible for commercial explosives health and safety research. This also affects the Mine Safety and Health Administration's (MSHA) permissible explosive approval program; the NIOSH was responsible for testing permissibles (Institute of Makers of Explosives, 2005§[1]).

In July, the Secure Handling of Ammonium Nitrate Act was introduced in the House of Representatives (H.R. 3197). It mirrored a bill introduced in the Senate (S. 1141). The Act would give the U.S. Department of Homeland Security (DHS) the authority to regulate entities and individuals that produce, sell, or distribute ammonium nitrate-base fertilizer. This bill also would allow the DHS, working with the U.S. Department of Agriculture, to develop regulations to create a registry of those who handle ammonium nitrate-base fertilizer. Only facilities and people registered with the DHS would be able to legally access ammonium nitrate-base fertilizer. Anyone purchasing ammonium nitrate would be required to have a registration number, and retailers would be required to keep records of ammonium nitrate sales for at least 3 years. At yearend, both bills still were in committee (Fertilizer Institute, The, 2005§).

The U.S. Department of Justice amended the regulations of the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF) to require licensed importers to mark all explosive materials they import for sale or distribution. Licensed manufacturers are required to place identification markings on explosive materials manufactured in the United States. Similar marking requirements, however, did not exist for imported explosive materials. Identification markings are needed on explosives to help ensure that these materials can be effectively traced for criminal enforcement purposes. Although the ATF does not have regulatory oversight over foreign manufacturers, it does have authority over licensed importers of explosive materials. This new rule will impose identification requirements on licensed importers of explosive materials that are similar to the marking requirements imposed on domestic manufacturers. The rule became effective on July 26 (U.S. Department of Justice, Bureau of Alcohol, Tobacco, Firearms, and Explosives, 2005).

Production

Sales of ammonium-nitrate-base explosives (blasting agents and oxidizers) were 3.17 Mt, which was a 28% increase from those of 2004, and accounted for 99% of U.S. industrial explosives sales. Most of the increase in explosives sales was believed to result from more accurate reporting by the manufacturers. Sales of permissibles increased by 28%, and sales of other high explosives decreased by 23% (table 1). Figure 1 shows how sales for consumption have changed since 1996. Sales for consumption data have been revised on the basis of revised data from the Federal Reserve Board and the U.S. Census Bureau.

Companies contributing data to this report, including those that are not members of the Institute of Makers of Explosives (IME), are as follows:

- Accurate Energetic Systems LLC
- Apache Nitrogen Products Inc.*[2]
- Austin Powder Co.
- Baker Atlas International
- Daveyfire Inc.
- Douglas Explosives Inc.
- Dyno Nobel Inc.
- Energetic Systems Inc.
- Ensign-Bickford Co., The
- ETI Canada
- D.C. Guelich Explosives Co.
- Jet Research Center
- Mining Services International Corp.
- Nelson Brothers LLC *
- Orica USA Inc.
- Owen Oil Tools Inc.
- St. Lawrence Explosives Corp.
- Schlumberger Perforating Center
- Senex Explosives Inc.
- Titan Specialties Ltd.
- Vet's Explosives Inc.
- Viking Explosives and Supply Co.
- W.A. Murphy Inc.

[1]References that include a section mark (§) are found in the Internet References Cited section.

[2]Companies denoted by an asterisk are not members of the IME.

Terra Industries Inc. announced that it had entered into a renewable 10-year supply contract with Orica USA Inc. to supply the company with industrial-grade ammonium nitrate and ammonium nitrate solution. Terra planned to invest $10 million to modify the smaller of two ammonium nitrate production towers at its Yazoo City, MS, production plant to enable it to produce industrial-grade product. This modification was expected to be completed by September 2006, at which point Terra Industries would begin supplying the industrial-grade ammonium nitrate to Orica USA; the ammonium nitrate solution would be supplied at the start of the agreement in July 2005 (Green Markets, 2005c).

Rising security costs and concerns prompted some companies to stop marketing agricultural-grade ammonium nitrate. In January, J.R. Simplot Co. announced that it would discontinue marketing fertilizer-grade ammonium nitrate to its United States and Canadian customers after the spring planting season. As a result of this decision, the company's Brandon, Manitoba, Canada, plant, which supplied these markets, would increase production of its other products—urea ammonium nitrate solutions and urea—and produce only a small quantity of ammonium nitrate for blending (Green Markets, 2005b). In July, Agrium Inc. announced that it would discontinue production and sales of fertilizer-grade ammonium nitrate. The company produced ammonium nitrate at its Beatrice, NE, facility (Green Markets, 2005a). Air Products and Chemicals Inc. was looking for a buyer for its Pace, FL, ammonium nitrate production facility. Yara North America Inc. announced that it would stop selling fertilizer-grade ammonium nitrate in California because of security concerns and rising costs associated with security regulations. By yearend, the only firms producing fertilizer-grade ammonium nitrate in the United States were El Dorado Chemical Co. and Terra Industries.

In September, The Ensign-Bickford Co. announced that its Spanish Fork, UT, explosives manufacturing plant would close no later than February 28, 2006. The company had decided to get out of the commercial explosives business in 2003 and had tried unsuccessfully to sell the Spanish Fork plant. The company expected to continue to manage shutdown and cleanup activities (International Society of Explosives Engineers, 2005§). Dyno Nobel ASA had purchased Ensign Bickford's explosives assets in 2003, with the exception of the Spanish Fork plant.

Consumption

Coal mining, with 65% of total explosives consumption, remained the principal application for explosives in the United States (table 2). In 2005, U.S. coal production increased by 1.9% to a record level of 1.03 Mt, according to preliminary data from the U.S. Department of Energy, Energy Information Administration (EIA). Coal production in all three regions (Appalachian, interior, and western) increased in 2005. The tonnage increase in the western region accounted for about 56% of the total U.S. tonnage increase (Freme, 2006§). Wyoming, West Virginia, and Kentucky, in descending order, led the Nation in coal production, accounting for 60% of the total. These States also were the leading explosives-consuming States.

Quarrying and nonmetal mining, the second ranked consuming industry, accounted for 14% of total explosives sales; construction, 11%; metal mining, 7%; and miscellaneous uses, 3%. Wyoming, West Virginia, Kentucky, Indiana, Virginia, and Alabama, in descending order, were the leading consuming States, with a combined total of 57% of U.S. sales (table 3).

The value of new construction in 2005 increased by 10.5% compared with that in 2004 (U.S. Census Bureau, 2006§). Based on monthly data, the seasonally adjusted industry growth rate from 2004 to 2005 for metal mining was 6.8%, and the growth rate for nonmetallic mineral mining and quarrying was 1.9% (Federal Reserve Board, 2006§).

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 MSHA approved grades by brand name as originally established by NIOSH testing.

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

Blasting Agents and Oxidizers.—These include ammonium nitrate-fuel oil (ANFO) mixtures, regardless of density; slurries, water gels, or emulsions; ANFO blends containing slurries, water gels, or emulsions; and ammonium nitrate in prilled, grained, or liquor (water solution) form. Bulk and packaged forms of these materials are contained in this category. In 2005, about 94% of the total blasting agents and oxidizers sales was in bulk form.

World Review

On November 30, a consortium of investors led by Macquarie Bank Ltd. completed its acquisition of Dyno Nobel Holding ASA for $1.7 billion from Industri Kapital Ltd. and Ensign-Bickford Industries Inc. The consortium intended to separate Dyno Nobel Holding into two parts. The consortium will retain the Australian and North American businesses and the 50% interest in the DetNet initiation systems joint venture. These entities will now make up the new Dyno Nobel Ltd., retaining the Dyno Nobel name. In a separate agreement, Orica Ltd. agreed to acquire Dyno Nobel Holding's African, Asian, European, Latin American, and Middle Eastern businesses for $685 million, subject to regulatory approvals. Completion of the consortium's acquisition of Dyno Nobel Holding was not conditional on the Orica sale. Orica expected that a number of the Dyno Nobel businesses that were acquired by Orica would be transferred within 2 months of closing, with the balance completed within 6 months (Dyno Nobel Ltd., 2005a§).

On December 29, Dyno Nobel America purchased Nitrochem Corp.'s three nitric acid plants and two ammonium nitrate plants in Maitland, Ontario, Canada. Nitrochem's principal markets were in eastern Canada and the northeastern United States. Products manufactured at the plants include nitric acid, ammonium nitrate (prills and solution), and aqua ammonia,

which are used in explosives, nylon intermediates, drugs, pigments, and other industries (Dyno Nobel Ltd., 2006§).

Before the sale of Dyno Nobel Holdings, Russia's Ural Mining & Metallurgical Co. (UMMC) and Dyno Nobel agreed to establish a joint-venture company in the Urals region to supply explosive-related products, initiation systems, and related services to the UMMC group of mines. UMMC is the second ranked copper producer in Russia. The new company, called Dyno Nobel UMMC, would be the exclusive supplier to all UMMC-controlled mines and also would serve other third-party mines and quarries in the region. By the second quarter of 2006, the joint-venture company planned to establish two emulsion explosives plants serving the Urals region (Dyno Nobel Ltd., 2005b§).

Current Research and Technology

In a U.S. Department of the Army-wide awards program dedicated to recognizing the best technology solutions for soldiers, the Army chose the 10 winning programs for their impact on Army capabilities, inventiveness, and potential benefit outside the Army. One of the awards went to the Fido™ explosives detector. The detector, developed by the U.S. Army Research Laboratory and Nomadics Inc., is a lightweight (less than 3 pounds) integrated explosives detection system based on a sensitive amplifying fluorescent polymer. Fido™ can be handheld as a tethered sensor, mounted on a robotic platform, such as unmanned ground or aerial vehicles, or on underwater autonomous vehicles. With a new polymer developed by scientists at Massachusetts Institute of Technology, the sensitivity of Fido's™ explosives-vapor sensing has been shown to detect quantities of explosives at femtogram (10^{-15} gram) levels, which is comparable in field tests to bomb-sniffing dogs (U.S. Department of the Army, 2006§; Massachusetts Institute of Technology, Institute for Soldier Nanotechnologies, 2005§). Fido™ can be used to screen packages, vehicles, facilities, and people for traces of explosives, as well as for improvised explosive device and landmine sensing. The product's key markets are military force protection and homeland security. The U.S. military is currently using Fido™ in field tests for a variety of applications related to improvised explosive devices.

Although the primary goal of the University of Wisconsin-Madison's inertial electrostatic containment fusion experiment is to produce more energy than it expends, modifications to the device may help to detect C-4 (a plasticized version of the high explosive cyclotrimethylenetrinitramine, also known as RDX). By altering the device's cathode size, geometry, and material composition, the researchers increased neutron-production rates from the fusion reaction. With 95% accuracy in repeated simulations, the scientists were able to detect the nitrogen in C-4 using prompt gamma neutron activation analysis techniques. The thermal neutrons interact with the nuclei—primarily nitrogen and hydrogen—of the C-4 and emit a characteristic gamma ray. From the nitrogen, the gamma ray is 10.83 megavolts (MV); from the hydrogen, it is 2.22 MV. The researchers planned to develop an improved system that will include additional detectors and an alternate configuration to increase the number of 10.83 MV gamma rays it can detect (University of Wisconsin-Madison, 2005§).

Researchers at the University of South Florida's Center for Ocean Technology developed a sensor that can detect the explosive 2,4,6-trinitrotoluene (TNT) in a marine environment. The newly developed sensor is a self-contained system that uses an electrochemical electrode to sense for trace TNT. Researchers took into account the fact that TNT in seawater undergoes biodegradation in a number of different ways and accounted for those processes in developing the sensor. The sensor has been designed to detect several kinds of commercial and military explosives while riding on a remotely controlled surface vehicle that wirelessly transmits data to a handheld computer. The system has been tested in the field under a number of conditions, including turbulent waters (University of South Florida, 2005§).

Spire Corp. won a $750,000 Phase II small business innovation research contract from the DHS Advanced Research Projects Agency to develop a portable terahertz-based detection imager. The device will contain a quantum cascade laser source that emits terahertz radiation and a detector that will be able to detect the reflected signal, which reveals weapons and explosives concealed under clothing or in nonmetal containers. Phase I of the project identified the atmospheric windows for terahertz transmission and selected the best candidate for the imaging system (Compound Semiconductor.net, 2005§).

Outlook

According to the EIA, in 2006, U.S. coal production is expected to grow by 1.0% from that in 2005 and increase by another 1.2% in 2007. Power sector consumption of coal, which is the leading consuming industry of coal, would continue to increase in response to high natural gas and oil prices. Most of the increased production was projected to come from the western region, which has less overburden than coal in the Appalachian or interior regions (U.S. Department of Energy, Energy Information Administration, 2006§). Based on the coal production projections, explosives consumption is expected to increase in 2006 and 2007, although at a slower rate than coal production because there would be less overburden to remove.

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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	2004	2005
Permissibles	970	1,240
Other high explosives	41,700	32,100
Blasting agents and oxidizers	2,480,000	3,170,000
Total	2,520,000	3,200,000

[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
2004:						
Permissibles	1	(3)	(3)	(3)	--	1
Other high explosives	5	17	1	16	3	42
Blasting agents and oxidizers	1,650 r	344 r	178 r	244 r	62 r	2,480
Total	1,660 r	361 r	179 r	260 r	65 r	2,520
2005:						
Permissibles	1	(3)	(3)	(3)	--	1
Other high explosives	4	13	1	13	1	32
Blasting agents and oxidizers	2,080	435	236	339	77	3,170
Total	2,090	448	237	352	78	3,200

rRevised. -- 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 ½ unit.

TABLE 3

INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, BY STATE AND CLASS[1]

(Metric tons)

State	2004				2005			
	Fixed high explosives				Fixed high explosives			
	Permissibles	Other high explosives	Blasting agents and oxidizers	Total	Permissibles	Other high explosives	Blasting agents and oxidizers	Total
Alabama	21	582	65,400	66,000	3	474	128,000	128,000
Alaska	--	541	17,500	18,000	--	759	16,800	17,500
Arizona	39	412	58,700	59,200	50	211	77,000	77,300
Arkansas	--	256	22,900	23,200	--	131	33,200	33,300
California	--	724	26,900	27,700	--	883	29,400	30,300
Colorado	88	1,530	22,800	24,400	15	1,250	21,300	22,600
Connecticut	--	420	5,490	5,910	--	449	5,650	6,100
Delaware	--	105	432	64	--	--	--	--
Florida	--	263	32,900	33,100	--	156	41,200	41,400
Georgia	22	1,200	46,500	47,700	--	1,380	44,400	45,800
Hawaii	--	15	1,330	1,350	--	5	1,260	1,260
Idaho	--	175	7,980	8,160	--	119	9,730	9,850
Illinois	--	837	49,400	50,200	1	405	53,700	54,100
Indiana	(2)	1,440	197,000	199,000	1	1,050	264,000	265,000
Iowa	--	1,250	16,100	17,300	2	802	19,800	20,600
Kansas	--	447	13,300	13,700	--	246	8,380	8,620
Kentucky	549	2,220	327,000	330,000	639	1,370	368,000	370,000
Louisiana	--	467	3,870	4,340	--	235	4,090	4,320
Maine	--	104	2,910	3,020	--	193	2,550	2,740
Maryland[3]	3	325	13,800	14,100	2	322	11,400	11,800
Massachusetts	4	532	7,820	8,360	1	444	7,130	7,570
Michigan	--	111	26,800	26,900	--	64	31,500	31,600
Minnesota	--	112	35,100	35,200	--	90	41,100	41,200
Mississippi	--	458	64	522	--	451	37	488
Missouri	--	3,340	60,500	63,800	61	2,530	84,900	87,500
Montana	--	2,280	53,900	56,200	--	1,880	67,500	69,400
Nebraska	--	240	929	1,170	--	44	1,230	1,270
Nevada	--	2,800	39,800	42,600	--	1,400	43,000	44,400
New Hampshire	--	635	11,400	12,000	--	620	12,100	12,800
New Jersey	1	396	5,890	6,280	--	196	5,730	5,930
New Mexico	--	279	25,100	25,400	1	313	39,300	39,600
New York	12	682	15,800	16,500	13	685	6,160	6,850
North Carolina	--	921	32,900	33,800	--	862	35,600	36,500
North Dakota	--	2	3,700	3,710	--	12	3,370	3,380
Ohio	1	818	58,100	58,900	(2)	582	45,500	46,100
Oklahoma	(2)	356	28,300	28,700	(2)	298	30,200	30,500
Oregon	--	1,430	7,280	8,710	--	2,250	8,300	10,600
Pennsylvania	77	2,950	101,000	104,000	43	1,540	120,000	122,000
Rhode Island	(2)	50	1,190	1,240	--	60	644	704
South Carolina	--	221	5,830	6,050	--	369	6,960	7,320
South Dakota	--	3	4,290	4,300	--	4	5,480	5,490
Tennessee	1	1,740	33,600	35,300	1	1,150	38,300	39,400
Texas	19	1,080	83,300	84,400	42	1,030	105,000	106,000
Utah	44	337	43,000	43,400	69	203	50,700	50,900
Vermont	(2)	153	1,150	1,300	--	89	1,140	1,230
Virginia	15	3,630	126,000	130,000	217	2,140	154,000	156,000
Washington	--	772	20,300	21,100	1	904	16,100	17,000
West Virginia	73	667	347,000	348,000	70	673	473,000	474,000
Wisconsin	--	807	14,000	14,800	--	388	14,500	14,900
Wyoming	--	559	350,000	351,000	--	348	582,000	582,000
Total	970	41,700	2,480,000	2,520,000	1,240	32,100	3,170,000	3,200,000

See footnotes at end of table.

TABLE 3—Continued

INDUSTRIAL EXPLOSIVES AND BLASTING AGENTS SOLD FOR CONSUMPTION IN THE UNITED STATES, BY STATE AND CLASS[1]

-- Zero.

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

[2]Less than ½ unit.

[3]Includes the District of Columbia.

Source: Institute of Makers of Explosives.

FIGURE 1

SALES FOR CONSUMPTION OF U.S. INDUSTRIAL EXPLOSIVES