Economic Impact Analysis for the Nitric Acid Manufacturing NSPS

Final Report

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SECTION 1
BACKGROUND

New Source Performance Standards (NSPS), mandated under Section 111 of the Clean Air Act (CAA), are directly enforceable federal regulations issued for categories of sources that cause, or contribute significantly to, air pollution that may reasonably be anticipated to endanger public health or welfare. Section 111 of the CAA requires that NSPS reflect the "degree of emissions limitation achievable through application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any non-air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." This level of control is commonly referred to as best demonstrated technology (BDT). By requiring BDT for new, modified, and reconstructed sources, the NSPS program seeks to attain and maintain ambient air quality as the industrial infrastructure is modernized. Since 1970, the NSPS have been successful in achieving long-term emissions reductions in numerous industries by ensuring that cost-effective controls are installed on such sources.

The Environmental Protection Agency (EPA) is required by Section 111(b)(1)(B) of the CAA to review and, if appropriate, revise existing NSPS at least every 8 years. The purpose of an NSPS review is to determine if the standards reflect BDT. The nitric acid NSPS (part 60, subpart G) has been reviewed in the past, but the last review was more than 8 years ago. As a result of this, EPA received a citizen suit from Sierra Club and Environmental Integrity Project prompting a review of the standards.

Section 111(b)(1)(B) of the CAA requires EPA to periodically review and revise the standards of performance, as necessary, to reflect improvements in methods for reducing emissions. EPA is currently reviewing the nitric acid manufacturing NSPS and has noted that improvements in technology allow emissions to be better controlled than the current NSPS requires. In light of this review, EPA is revising the current NSPS. These revisions include tightening the current nitrogen oxides (NO_x) limit set back in 1971 for plants that manufacture nitric acid. The revised NSPS will be promulgated on May 14, 2012 under a court-order.

Following legislative and administrative requirements, EPA conducts economic analyses of its regulatory actions. EPA's Air Economics Group is responsible for conducting such economic analyses in support of residual risk and national emission standards for hazardous air pollutants (NESHAP), NSPS, and national ambient air quality standards (NAAQS) for criteria pollutants.

This economic impact analysis (EIA) contains four other sections. Section 2 is a profile of the nitric acid manufacturing industry. It provides the reader with a basic understanding of the structure of the nitric acid production process, and characterizes nitric acid suppliers and demanders. Section 3 describes the estimated costs that the nitric acid industry would incur with the promulgation of the revised regulations for the industry. Section 4 analyzes the impacts of these costs on the industry, including potential impacts on small businesses owning nitric acid production facilities. Section 5 provides conclusions.

SECTION 2
INDUSTRY PROFILE

EPA has developed this industry profile to provide the reader with a general understanding of the technical and economic aspects of the nitric acid industry. We begin by examining the supply of nitric acid by discussing the nitric acid production process and the associated costs. We then examine the demand for nitric acid and the end products for which it serves as an intermediate. We then address the characteristics that define the nitric acid market and profile the companies owning nitric acid production facilities.

2.1 Supply of Nitric Acid

Nitric acid is an inorganic chemical with a variety of productive applications, including nitrogen-based fertilizers, explosives, and many specialty chemicals including polyurethane intermediates, dyes, and pharmaceuticals (Dow, 2008). Although there is a small direct market for nitric acid, many producers share the role of supplier and consumer by using nitric acid internally as an input to final market goods.

2.1.1 Nitric Acid Production Process

Nitric acid is produced through chemical reactions in two main phases: oxidation and absorption. Specifically, it is produced through a series of chemical reactions stemming from the oxidation of ammonia with air over an alloy catalyst (EFMA, 2000). In the oxidation phase, ammonia (NH_3) is oxidized at a high temperature over the catalyst, which is usually a platinum-alloy gauze-like structure, into nitric oxide (NO) (EFMA, 2000). As the gases cool, the nitric oxide is oxidized into nitrogen dioxide (N_2O) (EFMA, 2000). Nitrous oxide, water, and nitrogen are also formed in secondary reactions during this phase (EFMA, 2000). In the absorption phase, the nitrogen dioxide (N_2O) reacts with water to form nitric acid (HNO_3):

$$4NH_3 + 5O_2 \rightarrow 4\ NO + 6H_2O$$

$$2NO + O_2 \rightarrow 2NO_2$$

$$3NO_2 + H_2O \rightarrow 2HNO_3 + NO$$

In addition to the composition and efficiency of the platinum-alloy catalyst, the pressure and temperature in the oxidation environment can influence the yield of nitric oxide recovered from the catalytic reaction (EFMA, 2000). The first reaction of ammonia into nitric oxide is more efficient at a high temperature and low pressure, whereas the reaction of nitric oxide to nitrogen dioxide and the oxidation to nitric acid are more conducive to low temperatures and high pressure (EFMA, 2000). Production plants may be designed as dual-pressure or single-pressure plants. Dual-pressure plants separate the oxidation and absorption phases and use lower pressure for oxidation than absorption; single-pressure plants use the same degree of pressure throughout production (EFMA, 2000).

2.1.2 Product Types

Nitric acid is a water-soluble liquid that can range in color from clear to yellow and has a pungent acidic odor (Dow, 2008). Most of the chemical is used as weak, or industrial-grade, nitric acid and tends to range from a 50% to 70% concentration of nitric acid in water (Dow, 2008). Fuming or concentrated nitric acid ranges from 85% to 100% in concentration (Dow, 2008).

2.1.3 Materials and Costs of Production

Ammonia is the chief raw material required for nitric acid production, and many nitric acid producers also manufacture their own ammonia supplies to vertically integrate production. Although some producers fuel ammonia production with coal, the majority of world ammonia production is based on natural gas (PotashCorp, 2010). As an example, one affected fertilizer company, CF Industries, notes that natural gas purchases represented over 50% of total 2009 cost of sales in the nitrogen production segment (CF Industries, 2010). Securing an affordable fuel supply in a volatile natural gas market is pivotal for a company's competitiveness and sustainability in the industry (PotashCorp, 2010). One affected entity, Coffeyville Resources, is the only nitrogen plant in the United States to use lower cost petroleum coke instead of natural gas (CVR, 2009). Because of the unpredictable nature of natural gas prices, some other smaller facilities are also looking into alternative fuel options (REMC, 2010).

Since the shift toward deregulation in the natural gas market in the 1980s, natural gas prices have played an increasingly significant role in ammonia production. In the period immediately following deregulation (1985 to 1999), natural gas prices remained relatively stable (Huang, 2007a). There was little correlation between natural gas prices and ammonia prices until 2000, when natural gas prices began to fluctuate erratically. Between 2000 and 2006, the correlation between natural gas and ammonia prices was 0.8 (Huang, 2007a). Further analysis suggests that the long-run price elasticity of ammonia with respect to natural gas is 0.79 (Huang, 2007b).

Ammonia producers use a variety of purchasing options to manage the inherent volatility of natural gas prices. Since natural gas is traded as a commodity, companies can buy natural gas at real-time spot prices or under contract in the futures market (NGSA, 2004). In contrast to the immediate purchase of natural gas at its daily spot price, buying into a future contract involves an agreement between buyer and seller on a physical transaction at a later date (NGSA, 2004). Natural gas is traded in the United States at market hubs around the country, the largest of which is Henry Hub in Louisiana (NGSA, 2004). Roughly 30 hubs are strategically located at major natural gas pipeline intersections (NGSA, 2004).[1] The natural gas futures prices that are used for futures trading on the New York Mercantile Exchange (NYMEX) are the Henry Hub contract prices and illustrate the price of the physical delivery of natural gas from this hub (NGSA, 2004). The "location differential" is the variation between prices at Henry Hub and another market hub, which arises from different supply and demand dynamics between the different hubs (NGSA, 2004). Heavy users of natural gas, including ammonia producers, benefit from building facilities close to these market hubs.

Table 2-1 illustrates the cost comparisons for labor and materials across the North American Industry Classification System (NAICS) codes in which the affected entities are classified. Both nitric acid production and the production activities of facilities and firms that use nitric acid as an input are classified within NAICS 325, Chemical Manufacturing. Most nitric acid is used in making ammonium nitrate (AN), the majority of which is used in nitrogenous fertilizer production, NAICS 325311. Other consumers of nitric acid fall within NAICS 325211, 325510, and 325920. In all of these NAICS industries, the cost of materials, including nitric acid, represents approximately half of the value of shipments in a typical year. The cost of materials is typically several times higher than the payroll costs (or cost of labor) for these affected industries.

An additional capital cost to consider in nitric acid production is that of the catalyst used in ammonia oxidation, which is typically made primarily with platinum and supplemented with other metals (EFMA, 2000). Catalyst costs could thereby be influenced by variation in metals supply and pricing.

2.1.4 Nitric Acid and Materials Transportation

Since the majority of nitric acid is consumed in the facility or complex in which it is produced, transporting the product is not of paramount concern. However, some companies do sell nitric acid to industrial customers or potentially need to transfer between facilities, so the

[1] For a map of the major market hubs and pipeline distribution network, see http://www.eia.doe.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/MarketCenterHubsMap.html.

Table 2-1. Cost Comparisons for Labor and Materials across Several NAICS Codes

Geographic Area Name	NAICS-Based Code	Meaning of NAICS-Based Code	Year	Number of Employees	Annual Payroll ($1,000)	Production Workers Average per Year	Total Cost of Materials ($1,000)	Materials, Parts, Containers, Packaging, etc. Used ($1,000)	Cost of Purchased Fuels ($1,000)	Cost of Purchased Electricity ($1,000)	Total Value of Shipments ($1,000)
United States	325	Chemical manufacturing	2008	780,127	50,766,204	448,790	396,684,686	322,593,772	17,055,845	9,898,041	751,029,562
United States	325	Chemical manufacturing	2007	803,904	50,643,442	465,557	362,244,062	297,388,193	14,368,287	8,908,756	724,080,627
United States	325211	Plastics material and resin manufacturing	2008	67,410	4,261,853	44,809	60,505,056	55,097,538	2,141,353	1,840,588	83,802,525
United States	325211	Plastics material and resin manufacturing	2007	70,514	4,360,808	47,312	57,459,312	52,197,817	2,000,583	1,637,878	85,069,731
United States	325311	Nitrogenous fertilizer manufacturing	2008	3,818	275,321	2,481	4,456,195	3,539,303	575,847	191,581	8,272,625
United States	325311	Nitrogenous fertilizer manufacturing	2007	3,997	269,249	2,709	3,465,718	2,724,769	455,402	193,225	6,157,614
United States	325510	Paint and coating manufacturing	2008	40,407	2,108,485	22,924	11,556,743	10,527,160	68,649	108,754	22,418,425
United States	325510	Paint and coating manufacturing	2007	42,021	2,193,104	23,876	12,177,643	11,090,399	70,723	110,149	23,636,807
United States	325920	Explosives manufacturing	2008	6,042	312,208	4,183	958,319	828,569	19,829	13,168	1,934,663
United States	325920	Explosives manufacturing	2007	6,532	321,152	4,348	857,000	728,615	16,530	12,316	1,745,029

Source: U.S. Census Bureau. 2010. American Fact Finder. Sector 31: Annual Survey of Manufactures: General Statistics: Statistics for Industry Groups and Industries: 2008 and 2007. http://factfinder.census.gov. Accessed April 20, 2010.

costs and dangers of moving the hazardous chemical can play a role in the supply side of the market. Nitric acid can be shipped via tanker truck, rail, and, in fewer cases, barge.

More important than nitric acid transportation may be the transportation costs associated with the final products. Ammonium nitrate, the primary end product of nitric acid, can be particularly dangerous if not handled carefully. Suppliers are responsible for taking all necessary precautions to avoid mishaps and for complying with federal regulations for shipping hazardous materials.

2.2 Demand for Nitric Acid

Although some nitric acid is sold to outside customers, the majority of nitric acid is used by its producers in the vertically integrated production of a wide range of chemical products. Roughly 90% of nitric acid is manufactured for on-site consumption within the facility, so the retail nitric acid market represents only 10% of total nitric acid production (ICIS, 2008a). Because it is an intermediate good, the demand for nitric acid is largely contingent on the demand for the end products for which it serves as an input. The total U.S. nitric acid demand in 2007 was 8.9 million tons, and this was projected to grow to 10.1 million tons in 2011 (ICIS, 2008a).

2.2.1 Nitric Acid Applications

Ammonium nitrate production represents the largest demand market for nitric acid, accounting for roughly 76% of total U.S. demand in 2007 (ICIS 2008a). About 9% of nitric acid demand is for adipic acid, which is used for nylon 6,6 polymers and resins, polyester polyols for polyurethane resins, and other related fibers and resins (ICIS, 2007). Toluene di-isocyanate (TDI) and nitrobenzene each account for 6% of nitric acid demand, with the remaining 3% going toward metal nitrate and other miscellaneous applications.

Of ammonium nitrate produced from nitric acid, the majority (86%) is used in the nitrogen-based fertilizer industry, either as a direct fertilizer or in the production of alloy-fertilizer blends like urea ammonium nitrate (UAN) (ICIS, 2008a). The balance of the ammonium nitrate derived from nitric acid is used mainly for manufacturing explosives.

Because the majority of nitric acid is consumed by ammonium nitrate producers, the demand for ammonium nitrate products, especially fertilizer, is the main driver of nitric acid demand. The dominance of ammonium nitrate demand is also reflected in the production and sales for the companies affected by the rule, so the market discussion in this profile is focused on the fertilizer industry and, to a lesser extent, ammonium nitrate-based explosives.

2.2.2 Influential Factors

Fertilizer

As noted in the previous section, the nitric acid market is driven chiefly by the demands of the fertilizer industry. In the United States, the agricultural industry consumes 80% of the country's fertilizer demand (Richardson, 2010a). Within the agricultural demand side, corn production is the largest nitrogenous fertilizer consumer, followed by wheat, soybeans, and cotton (Richardson, 2010). Nurseries, golf courses, and landscaping projects are small-scale fertilizer consumers (Richardson, 2010a).

The U.S. farm economy and income within the sector is the main force behind fertilizer demand. Unpredictable weather conditions are probably the most important determinant in fertilizer needs. In poor weather seasons, fertilizer demand declines as farmers reduce or abandon crop fields and pastures (Richardson, 2010a). Demand is also seasonal and increases during planting season. Global food demand also plays a role in determining the crop needs and thus contributes to fertilizer needs. Food security is a concern for policy makers as the global population increases, and the demand for fertilizer may increase in the coming years (IFA, 2009).

Explosives

Because industrial explosives are mainly used in the mining and mineral industries, the demand for coal and basic metals drives the demand for these products (IBISWorld, 2009). Coal mining is the main use for industrial explosives in the United States, accounting for around two-thirds of explosives consumption. Stone quarrying and construction are also industries that consume the blasting agents and oxidizers provided by the industry (IBISWorld, 2009). One key factor in maintaining the level of demand for explosive products is the relative affordability of coal as a fuel source compared to its alternatives (IBISWorld, 2009).

Chemicals and Resins

Adipic acid and TDI are the other main chemical products in which nitric acid is used, both of which have a wide variety of applications and tend to follow gross domestic product (GDP) trends in terms of demand. Nylon 6,6 fibers and resins represent 84% of adipic acid demand (ICIS, 2007). Although historically, nylon 6,6 has been used mainly in industrial carpeting, the demand for nylon 6,6 resins has been driven by automobile and truck parts as the industry has trended toward replacing metal parts with plastic. It is often used for exterior body pieces, internal components under the hood, and various mechanical parts (ICIS, 2007). The demand for automobiles and the growing acceptance of nylon as a viable replacement for metal is likely to influence market conditions.

TDI is used mainly in the production of flexible urethane foams, which are used across several industries. Transportation, furniture, carpet underlay, bedding, packaging, and other miscellaneous applications of the flexible foams make up 88% of total TDI consumption in the United States (ICIS, 2008b). The remaining demand for TDI is used in the production of rigid urethane forms and polyurethane products like adhesives, sealants, coatings, and elastomers (ICIS, 2008b). Demand for these products is expected to grow in the future (ICIS, 2008b).

2.3 Market Characteristics

A review and description of market characteristics (i.e., geography, product differentiation, product transportation, entry barriers, and degree of concentration) can enhance our understanding of the mechanisms underlying the market for nitric acid and its end products. These characteristics provide indicators of a firm's ability to influence market prices by varying the quantity of product it sells. For example, in markets with large numbers of sellers and identical products, firms are unlikely to be able to influence market prices via their production decisions (i.e., they are "price takers"). However, in markets with few firms, significant barriers to entry (e.g., licenses, legal restrictions, or high fixed costs), or products that are similar but can be differentiated, a firm may have some degree of market power (i.e., to set or significantly influence market prices). In addition, if a product is difficult to transport over long distances (because of weight or its hazardous nature), then the market size may be more restricted than one might expect, *ceteris paribus*.

Nitric acid producers are mainly involved in the supplying nitrogenous fertilizer, industrial explosives, and specialty chemicals and resins. Each of these markets has a set of distinct characteristics and is discussed individually below.

2.3.1 Competition and Entry

Fertilizer

The environments in which the targeted companies participate are extremely competitive, driven mainly by the firms' ability to control production costs rather than differentiate their products. This is especially true in the fertilizer industry where companies have individual fertilizer solution formulas, but the basic chemical properties are consistent. Firms with larger production facilities have the advantage of using economies of scale to become low-cost suppliers relative to their competitors (Richardson, 2010a). Comprehensive vertical integration of the entire production process is another tool that larger firms, like Agrium, use to control costs (Richardson, 2010a).

Because fertilizer is generally treated as a commodity, prices are determined at a global level (Richardson, 2010a). Agrium, Koch, and CF Industries are among the dominant domestic forces in the fertilizer market, but in 2006, more than 60% of nitrogen-based fertilizer consumed in the United States was purchased internationally (Richardson, 2010a). Not only do U.S. companies face steep domestic competition, they also must compete with foreign companies that might face lower fuel prices and production costs. With many firms vying for a global consumer base and selling nearly identical products, the nitrogenous fertilizer industry provides individual companies with very little market power.

In addition to the fierce market competition, other significant barriers to entry into the fertilizer industry exist. Initial capital expenses to purchase fertilizer manufacturing equipment can be very high; building a nitrogenous fertilizer plant with a 1 million metric ton capacity can cost between $700 million and $1 billion and can take several years to construct (Richardson, 2010a). Maintaining ammonia and natural gas inputs is also costly and prevents easy entry into the market. Because the industry is dominated by a few global firms, nascent companies also must compete with established product identification and brand names (Richardson, 2010a).

Explosives

As in the fertilizer industry, explosives products are essentially similar in their basic structure and content. Competition in this industry is based more on price than product differentiation (IBISWorld, 2009). However, recent years have seen an increase in the role of customer service and specializing explosives for customers as a means of competition (IBISWorld, 2009). Firms are gradually shifting away from providing basic commodity explosives and more toward becoming comprehensive demolition and blast solution providers (IBISWorld, 2009). Entry into the market is difficult because the market in the United States is dominated by two major companies with name recognition and ongoing customer relationships. The technical requirements, capital costs, and pricey raw materials essential to success in the industry also prohibit new companies from gaining market share (IBISWorld, 2009).

Chemicals and Resins

Because of the wide range of chemical products derived from nitric acid, the network of markets in which they are sold is extensive. Compared to fertilizer and explosives, there is also a greater degree of product differentiation between products like coatings and adhesives, so the market as a whole is likely to be less competitive than that of nitrogenous fertilizers.

2.3.2 Concentration

Table 2-2 provides information about the concentration of sectors using nitric acid as an input. The most recent industry concentration data compiled by the Census Bureau (U.S. Census Bureau, 2006) are based on Economic Census data from 2002. Thus, the data reflect conditions in these sectors in 2002. As noted in the sector-specific sections below, many of these sectors have recently become increasingly concentrated.

Table 2-2 shows the total number of companies in each sector potentially affected by the rule and the total value of shipments for all companies in the sector. Next, it shows the percentage of sector value of shipments for the largest 4, 8, 20, and 50 companies. Finally, it provides the Herfindahl-Herschman Index (HHI) for the sectors. The HHI is a commonly accepted measure of market concentration. It is calculated by squaring the market share of each firm competing in the market and then summing the resulting numbers. The HHI takes into account the relative size and distribution of the firms in a market and approaches zero when a market consists of a large number of firms of relatively equal size. The HHI increases both as the number of firms in the market decreases and as the disparity in size between those firms increases. Markets in which the HHI is between 1,000 and 1,800 points are considered to be moderately concentrated, and those in which the HHI is in excess of 1,800 points are considered to be concentrated. Two of the sectors in Table 2-2, nitrogenous fertilizer manufacturing and explosives manufacturing, had HHI values between 900 and 1,000 (approaching moderate concentration values) in 2002.

Fertilizer

Although many entities operate in the fertilizer and ammonia products industries, the market is dominated by the larger firms that can secure low-cost raw materials and gain market share by pricing below their competitors. Four major firms have over 50% of the entire global fertilizer market share (Richardson, 2010a). Recently, there has been even more of a trend toward increased concentration. Agrium submitted a $5.43 billion takeover bid for CF Industries but let the offer expire in early 2010 after CF Industries refused to engage in discussions (Agrium, 2010; Katz, 2010). CF Industries in turn acquired competitor Terra Industries in March 2010 after a bitter yearlong battle (Katz, 2010). With this move, CF Industries became one of the world’s largest fertilizer producers and increased its customer diversity by acquiring Terra’s industrial customers (CF Industries, 2010).

Table 2-2. Concentration Ratios for Sectors Using Nitric Acid as an Input, 2002

NAICS Code	Industry Description	Total Companies	Total Value of Shipments ($1000), 2002	Percentage, 4 Largest Companies	Percentage, 8 Largest Companies	Percentage, 20 Largest Companies	Percentage, 50 Largest Companies	HHI
325	Chemical manufacturing	9,659	462,438,453	13.7	21.8	36.8	54.3	99.9
325211	Plastics material and resin manufacturing	445	46,846,851	32.4	45.8	67.9	87.8	442.5
325311	Nitrogenous fertilizer manufacturing	116	3,291,075	53.9	78.8	94.6	98.2	976.9
325510	Paint and coating manufacturing	1,149	19,917,828	37.3	54.5	69.9	78.6	505.0
325920	Explosives manufacturing	57	1,027,797	54.2	77.8	93.4	99.9	991.3

Source: http://www.census.gov/prod/ec02/ec0231sr1.pdf

Explosives

The explosives manufacturing industry is highly concentrated around the two largest manufacturers in the United States: Orica and Dyno Nobel (IBISWorld, 2009). These two companies maintained 30% and 40% of the market share, respectively, through 2009 (IBISWorld, 2009). In recent years, the industry has witnessed further concentration as companies have engaged in acquisitions to reinforce their market positions (IBISWorld, 2009). Between 1998 and 2005, the number of active companies in the industry declined by 16% (IBISWorld, 2009).

Chemicals and Resins

Multiple markets sell nitric acid–based products, each with its own dynamics. For example, the market for adipic acid in the United States seems to be concentrated around INVISTA (owned by Koch) and Solutia (ICIS, 2007). Because of the diversity in adipic acid and TDI end products, there is less concentration of market power relative to the other two industries.

2.3.3 Price-Responsiveness of Supply and Demand

EPA used elasticities of demand and supply to characterize the responsiveness of supply and demand to changes in price, in each affected market. These elasticities are shown in Table 2-3.

Table 2-3. Market Price-Elasticities of Supply and Demand

Sector	NAICS	Supply	Demand
Nitrogenous fertilizer	3253	0.7	−1.0
Other chemicals (nitric acid)	3259	0.6	−1.0
Plastics	3252	0.7	−1.0
Explosives	3259	0.6	−1.0

Sources: Ho, M. S, R. Morgenstern, and J. S. Shih. 2008. "Impact of Carbon Price Policies on US Industry." RFF Discussion Paper 08-37). Http://Www.Rff.Org/Publications/Pages/Publicationdetails.Aspx?. Publicationid=20680. Table 8.A.6.

Broda, C., N. Limao, and D. Weinstein. 2008a. "Export Supply Elasticities." http://faculty.chicagobooth.edu/christian.broda/website/research/unrestricted/TradeElasticities/TradeElasticities.html.

2.4 Market Trends

This section provides an overview of conditions in the sectors that consume nitric acid as an input. The projected trends for these sectors will affect future demand for nitric acid.

2.4.1 Derived Demand for Nitric Acid

Nitric acid is an intermediate good that is used in the production of fertilizers, explosives, plastics and resins, and paints and coatings, among other products. Because it is an intermediate good, nitric acid is valued because it is needed to produce those products; thus, the demand for nitric acid is driven by the demand for the products it is used to produce. These, in turn, are generally intermediate goods, whose demand depends on the demand for the final products they are used to produce. For example, demand for fertilizers depends on the demand for agricultural products, the supply of other inputs to agriculture, and the ability to substitute fertilizer for other inputs. Similarly, nitrate-based explosives are used in mining (especially coal mining) and construction. The demand for explosives thus depends on the demand for coal and other minerals and the demand for new buildings and infrastructure.

2.4.2 International Trade in the Sectors that Consume Nitric Acid

Table 2-4 presents historical data on exports for the four sectors that dominate demand for nitric acid. Export values were converted from current-year dollars to 2009 dollars using the GDP deflator. Each of the sectors grew during the period 2005 through 2007. Beginning in 2008, several of the sectors' exports contracted, and all of them fell from 2008 to 2009, reflecting the contraction of the world economy.

Table 2-4. Exports of Sectors that Consume Nitric Acid (FAS Value, 10^3 $2009)

Sector	2005	2006	2007	2008	2009	Percentage Change, 2008–2009
325211 Plastics and Resins	20,719,115	23,153,733	26,189,230	27,796,054	21,891,848	−21.2
325311 Fertilizer Mfg	1,900,234	2,080,653	2,126,120	2,087,632	1,820,042	−12.8
325510 Paint and Coating	460,977	520,502	543,554	535,996	487,616	−9.0
325920 Explosives Mfg	3,214,101	3,140,175	3,482,423	693,429	444,080	−36.0
Total	26,294,427	28,895,064	32,341,327	31,113,109	24,643,585	−20.8

Source: http://dataweb.usitc.gov/.

Table 2-5 presents historical data on these sectors' imports for consumption into the United States. In each sector, imports generally display an upward trend through 2007; imports of fertilizers, the major user of nitric acid, increased through 2008. In 2008, and even more in 2009, the imports of these commodities declined, reflecting the contraction of the U.S. economy.

Table 2-5. Imports for Consumption of Sectors that Consume Nitric Acid (Customs Value, 10^3 \$2009)

Sector	2005	2006	2007	2008	2009	Percentage Change, 2008–2009
325211 Plastics and Resins	10,964,777	11,452,755	10,735,086	11,040,286	7,281,554	−34.0
325311 Fertilizer Mfg	4,829,611	4,348,070	5,739,289	8,120,624	3,264,581	−59.8
325510 Paint and Coating	796,634	898,904	923,868	850,706	589,295	−30.7
325920 Explosives Mfg	303,669	366,150	378,236	355,657	306,703	−13.8
Total	16,894,691	17,065,878	17,776,479	20,367,273	11,442,132	−43.8

Source: http://dataweb.usitc.gov/.

2.4.3 Industry Trends and Projections for Sectors Using Nitric Acid as an Input

Appendix A presents industry data and projections for four of the sectors that demand nitric acid as an input: 32521, Plastics and Resins Manufacturing; 32531, Fertilizer Manufacturing; 32551, Paint Manufacturing; and 32592, Explosives Manufacturing, compiled by industry analysts IBISWorld (IBISWorld, 2009, 2010a and 2010b, and Richardson, 2010b).

NAICS 32521, Plastics and Resins Manufacturing, is closely tied to the automobile manufacturing and housing industries. During the period 2005 to 2010, these industries experienced volatility that was reflected in their demand for plastics (and thus, nitric acid). Nevertheless, IBISWorld (2010b) projects growth in revenue of approximately 3% per year for the period 2010 to 2015.

NAICS 32531, Fertilizer Manufacturing, depends largely on crop production decisions and fertilizer prices. In the short run, IBISWorld (2010a) notes that demand levels are influenced by grain prices, weather patterns, world economic conditions, and international trade variables. In the longer term, population growth, living standards, and food consumption patterns also influence demand. IBISWorld notes that inputs, specifically nitrogen and potash, are sourced internationally (60% of nitrogen and 88% of potash for fertilizer production are supplied by imports), so the strength of the U.S. dollar affects costs. In addition, approximately 30% of domestic demand for fertilizer is met by imports. Although domestic and international economic conditions resulted in a reduction in output and revenue in 2009, both are expected to increase from 2010 through 2015.

Demand for the coatings and paints covered under NAICS 32551, Paint Manufacturing, is contingent on the demand for downstream products in the housing and automobile industries. Domestic demand dropped in 2008 and 2009 because of the downturn in the housing market and declines in automobile sales but is expected to increase in 2010 and continue to grow through 2015 (Richardson, 2010b).

NAICS 32592, Explosives Manufacturing, is projected to experience moderate growth. Demand for blasting agents (99% of explosives) is driven by demand levels for energy and minerals. Coal mining accounted for 66% of product consumption in 2007. Overall, IBISWorld (2009) projects continued moderate growth (about 3% per year) over the 2010 to 2015 period.

2.4.4 Projected Production of Nitric Acid

To estimate the number of new sources that might be affected by the rule, EPA projected production of nitric acid through 2016. Nitric acid production was estimated for 2006 (TSD for Greenhouse Gas Reporting Rule), using the production growth of 6.5% from 2006 to 2007 (ICIS). For the period 2007 through 2016, EPA used a predicted production growth rate of 3% for 2007 through 2016 (ICIS). These estimates are shown in Table 2-6. In the period from 2010 to 2016, the growth was approximately 1.6 million tons of nitric acid.

Table 2-6. Projected Nitric Acid Production

Year	Nitric Acid Produced		Increase (tons)
	Metric tons	Tons	
2006	6,446,767	7,107,560	461,991
2007	6,865,806	7,569,552	227,087
2008	7,071,781	7,796,638	233,899
2009	7,283,934	8,030,537	240,916
2010	7,502,452	8,271,453	248,144
2011	7,727,526	8,519,597	255,588
2012	7,959,351	8,775,185	263,256
2013	8,198,132	9,038,441	271,153
2014	8,444,076	9,309,594	279,288
2015	8,697,398	9,588,882	287,666
2016	8,958,320	9,876,548	—
2010–2016			1,605,095

2.5 Overview of Businesses Potentially Affected by the Rule

The regulation may affect up to 40 nitric acid facilities owned by 18 different parent companies. Table 2-7 lists the parent companies with facilities potentially covered under the rule and summarizes the nitric acid products that may be affected by the rule. In addition to producing nitric acid, the affected facilities and firms produce a variety of products using nitric acid.

To give the reader a better understanding of the specific characteristics that define each of the potentially affected entities, the following section gives a brief overview of each parent company.

2.5.1 Parent Companies

Agrium (3 facilities)

Agrium produces and markets a range of potash-, phosphate-, and nitrogen-based fertilizer products. In addition to the seven major nitrogen facilities worldwide, Agrium also operates five facilities in North America that upgrade ammonia to fertilizer products, including urea, nitric acid, and ammonium nitrate. Agrium's output serves a customer base that is roughly 75% agricultural and 25% industrial.

Air Products and Chemicals (1 facility)

Air Products and Chemicals produces an extensive range of chemical products, including gases, equipment, and performance materials for a variety of industries. At its Pasadena, Texas, facility, Air Products and Chemicals uses nitric acid to produce dinitrotoluene (DNT), which is converted to toluene diamine and sold to industrial customers as an intermediate for polyurethane products.

Apache Nitrogen (1 facility)

Apache Nitrogen is a small firm producing nitric acid and ammonium nitrate–based products for agricultural, mining, and industrial customers.

CF Industries (4 facilities)

After the acquisition of Terra Industries in 2010, CF Industries became one of the largest fertilizer companies in the world. CF produces nitrogen fertilizers, phosphate products, and custom fertilizer solutions. The company manufactures 900,000 tons of nitric acid annually, mainly for internal ammonium nitrate production.

Table 2-7. Parent Companies with Facilities Potentially Covered Under the Rule

Parent Company	Number of Affected Facilities	Small Business	Sells Nitric Acid as an End Product	Nitrogenous Fertilizer (Uses Nitric Acid as Intermediate)	Ammonia (Industrial Grade, for Market, for Internal Use)	Explosives (Uses Nitric Acid as Intermediate)	Polyurethane Intermediates, Polymers, Nylon Fibers, Coatings, Resins, and Other
Agrium	3	No		x			
Air Products and Chemicals, Inc.	1	No					x
Apache Nitrogen	1	Yes	x	x		x	x
CF Industries	4	No	x	x	x		
Incitec Pivot Ltd.	1	No	x	x	x	x	
CVR Energy	1	No		x	x		
DuPont	1	No					x
LSB Industries	2	No	x				
J.R. Simplot	1	No	x	x			
Koch Industries	3	No		x	x		x
Potash Corp.	2	No		x			
Rentech, Inc.	1	Yes	x	x	x		
Solutia Inc.	1	No					x
TradeMark Nitrogen	1	Yes		x			
Total	23						

CVR Energy (1 facility: Coffeyville Resources)

CVR Energy produces nitrogen-based fertilizers at its Coffeyville Resources facility. Instead of natural gas, the facility uses petroleum coke from its adjacent petroleum refining plant to produce ammonia products.

DuPont (1 facility)

DuPont is another well-known chemical conglomerate with operations worldwide. At its U.S. facilities affected by the rule, DuPont manufactures a variety of polymer, aniline, and specialty chemical products. It also produces agricultural seed at its Victoria location.

Incitec Pivot, Ltd. (1 facility)

Incitec Pivot Ltd. acquired Dyno Nobel in June 2008. Dyno Nobel offers a range of explosives products and blasting solutions and is the largest explosives company in the United States. Incitec Pivot is an Australian-based fertilizer company.

J.R. Simplot (1 facility)

J.R. Simplot is one of the largest privately held companies in the United States. In addition to sell varying grades of nitric acid, the company also manufactures fertilizers, turf, and a variety of other products.

Koch Industries (3 facilities)

As one of the largest private companies in the world, Koch Industries offers a range of services, including commodity trading, ranching, refining, polymers, and fertilizers. In 2004, Koch acquired INVISTA, which is a leading producer in nylon fibers and adipic acid. Through Koch Fertilizers, LLC, the company operates a number of nitrogenous fertilizer facilities throughout the central United States.

LSB Industries (2 facilities: El Dorado Nitrogen/El Dorado Chemical)

LSB Industries is an Oklahoma City–based company providing customers with agricultural products, industrial chemicals, and explosives. Through its El Dorado Nitrogen subsidiary, LSB is the largest domestic merchant supplier of nitric acid.

PotashCorp (2 facilities)

PotashCorp is a major player in all areas of agricultural fertilizer production. At its nitrogenous fertilizer plants, the company produces ammonia, nitric acid, urea, and other agricultural solutions.

Rentech, Inc. (1 facility: Rentech Energy Midwest Corporation)

Rentech produces nitrogen products, including anhydrous ammonia, ammonium nitrate, urea solutions, and nitric acid. It currently uses natural gas as a feedstock but is considering the transition to coal gasification. Rentech sells the majority of its products to customers within 150 miles of the facility.

Solutia (1 facility)

Solutia's primary business is specialty chemicals and it conducts business across the globe. Solutia produces window coatings and films at its Martinsville plant.

Trademark Nitrogen (1 facility)

Trademark Nitrogen is a small Florida company that manufactures nitrogen-based fertilizer products.

2.5.2 Parent Company Sales and Employment

To supplement the qualitative company profiles in the previous section, Table 2-8 displays annual revenue and employment data for each of the parent companies. This data is the most recent we are able to obtain for each parent company. The data reflect annual revenue and employment for either 2009 or 2010. Firms producing plastics and resins (NAICS 325211) are classified as small by the Small Business Administration (SBA, 2008) if they have fewer than 750 employees. Firms producing nitrogenous fertilizers (NAICS 325311) are considered small if they have fewer than 1,000 employees. Firms producing paints and coatings (NAICS 325510) are considered small if they have fewer than 500 employees. Based on these criteria and the data presented in Table 2-8, three firms producing nitric acid are classified as small businesses.

Table 2-8. Annual Revenue and Employment Data for Each of the Parent Companies

				Parent Company	
Facility Name	State	Parent Company	Headquarters	Sales (millions $)	Employees
Agrium US	WA	Agrium	Canada	9,129.00	10,000
Agrium US	OH	Agrium	Canada	9,129.00	10,000
Agrium US	CA	Agrium	Canada	9,129.00	10,000
Air Products	TX	Air Products and Chemicals, Inc.	United States	8,256.20	18,900
Apache Nitrogen Products	AZ	Apache Nitrogen	United States	31.70	82
CF Industries	LA	CF Industries	United States	2,608.40	1,500
CF Industries	OK	CF Industries	United States	2,608.40	1,500
CF Industries	MS	CF Industries	United States	2,608.40	1,500
CF Industries	IA	CF Industries	United States	2,608.40	1,500
Coffeyville Resources	KS	CVR Energy	United States	3,136.30	667
Dyno Nobel	WY	Incitec Pivot Ltd	Australia	3,418.90	4,500
El Dorado Nitrogen	TX	LSB Industries	United States	531.84	1,179
El Dorado Nitrogen	AR	LSB Industries	United States	531.84	1,179
First Chemical	MS	DuPont	United States	26,109.00	60,000
Geneva Nitrogen	UT	Geneva Nitrogen	United States	5,400,000	32
INVISTA	TX	Koch Industries	United States	100,000.00	80,000
INVISTA	TX	Koch Industries	United States	100,000.00	80,000
JR Simplot	CA	J.R. Simplot	United States	4,500.00	10,000
Koch Nitrogen	IA	Koch Industries	United States	100,000.00	80,000
PCS Nitrogen	GA	Potash Corp	Canada	3,976.70	5,136
PCS Nitrogen	LA	Potash Corp	Canada	3,976.70	5,136
Rentech Energy Midwest Corporation	IL	Rentech, Inc	United States	183.00	250
Solutia	FL	Solutia Inc	United States	1,667.00	3,400
TradeMark Nitrogen	FL	TradeMark Nitrogen	United States	NA	NA

NA = no information available.

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SECTION 3
ENGINEERING COST AND EMISSIONS ANALYSIS

This section presents EPA's estimated cost impacts for new, modified, and reconstructed sources to comply with a final standard of 0.5 lb NO_X/ton nitric acid.

To gather data for the cost estimation, EPA issued an Information Collection Request (ICR) under Section 114 authority to obtain NO_X emissions data using EPA Methods 7, 7A, 7B, 7C, 7D, 7E (modified version), or 320. The ICR also collected cost data for NO_X abatement technologies, including nonselective catalytic reduction (NSCR), selective catalytic reduction (SCR), and hydrogen peroxide (H_2O_2) injection. Cost data were received from 9 facilities with a total of 12 nitric acid production trains. This information was summarized in *Summary of Cost Data Received from Section 114 ICR* (NO_X Summary) dated November 22, 2010. The capital recovery factor was based on 7% interest and a 15-year useful life.

In addition, EPA has also revised the cost analysis done for proposal in response to public comments. There are now testing costs included that were not included in the proposal, and there is now one modified plant impacted along with five new plants, instead of six new plants as projected in the proposal. The modified facility will incur control equipment costs.

The NO_X Summary memo contained production data ranging from 40 tons per day (tpd) to 1,600 tpd of nitric acid. The data support the use of two model plants to represent the nitric acid production industry. The first model plant is 300 tpd, and the second model plant is 1,000 tpd. In the NO_X Summary memo, the cost data were normalized based on the production rate at the facility (cost per ton of nitric acid produced). Table 3-1 shows the results of the cost data analysis for NO_X control.

Table 3-1. Normalized NO_X Control Costs by Model Plant

Control	300 tpd ($/ton)	1,000 tpd ($/ton)
NSCR	$20.02	$7.80
SCR	$3.93	$1.10
H_2O_2	$2.06	$1.36

Table 3-2 shows the control device cost for an SCR installed at Agrium North Bend as part of a modification to the nitric acid plant. The plant produces 288 tons acid per day. SCR costs associated with a modification of a 1,000 tpd plant were not supplied.

Table 3-2. Normalized SCR Costs by Model Plant for Modified or Reconstructed Sources

Control	288 tpd ($/ton)	1,000 tpd ($/ton)
SCR	$3.52	-----

Nitric acid production was estimated beginning with 2006 production data (TSD for Greenhouse Gas Reporting Rule), **using** the production growth of 6.5% from 2006 to 2007 (ICIS), the predicted production growth rate of 3% for 2007 through 2017 (ICIS), and the exclusion of plants that were not operating in 2010. These estimates are shown in Table 3-3. In the period from 2012 through 2017, the growth is expected to be approximately 1.48 million tons of nitric acid. Assuming 365 days per year, this equals approximately 4,000 tpd of nitric acid production. Using the model plants, the estimate equals 3 production trains that produce 300 tpd, and 3 production trains that produce 1,000 tpd over the five year period after promulgation.

For purposes of the cost assessment, the growth will consist of five newly constructed production trains and one modification of an existing production train. These six production trains will become subject to the Subpart Ga limit of 0.50 lb NO_X/ton acid between 2012 and 2017.

Table 3-3. Nitric Acid Production Growth

Year	Nitric acid produced (metric tons)	Nitric acid produced (tons)	Increase (tons)
2010	6,729,836	7,419,644	-----------
2011	6,931,731	7,642,233	222,589
2012	7,139,683	7,871,500	229,267
2013	7,353,873	8,107,645	236,145
2014	7,574,489	8,350,874	243,229
2015	7,801,724	8,601,401	250,526
2016	8,035,776	8,859,443	258,042
2017	8,276,849	9,125,226	265,783

For the five new production trains predicted from 2012 to 2017, the annualized costs of controlling NO_X emissions for the 3 types of control equipment outlined in the NO_X Summary were calculated using the costs in Table 3-1. The control costs are shown in Table 3-4. These are the costs for each of the control devices in the 5th year after promulgation of these standards.

Table 3-4. Annualized Control Costs for New Production Trains in 2017

Model Plant (tpd)	Number of Plants	Nitric Acid (tons)	NSCR	SCR	H_2O_2
300	2	220,000	$4,400,000	$860,000	$450,000
1,000	3	1,10,000	$8,500,000	$1,200,000	$1,500,000

For the 1 production train that will undergo modification or reconstruction from 2011 to 2016, the annualized costs of controlling NO_X emissions for SCR were calculated using the costs in Table 3-2. The control costs are shown in Table 3-5. These are the costs for each of the control devices in the 5th year after promulgation of these standards.

Table 3-5. Annualized Control Costs for Reconstructed or Modified Trains in 2016

Model Plant (tpd)	Number of Plants	Nitric Acid (tons)	SCR
300	1	105,000	$370,000

The production trains could use any of the three control types to control NO_X emissions, , but we assumed that SCR would be universally applied as this is BSER. While hydrogen peroxide injection has the lowest potential costs, this control may not be feasible for all new production trains. Also, some H_2O_2 and NSCR installations may not be able to achieve emissions less than or equal to 0.50 lb NO_X/ton acid.

Using the control efficiency for SCR, the potential NO_X emission reductions were calculated in Table 3-6. The baseline emissions were calculated as 3.0 lb NO_X/ton acid (the level of the existing NSPS). The controlled emissions were calculated as 0.50 lb NO_X/ton acid.

Table 3-6. NO_X Emission Reductions for All New, Modified, or Reconstructed Production Trains with SCR Control in 2017

Plant Type	Model Plant (tpd)	Days per year	Number of Plants	Nitric Acid (tons)	Baseline NO_X @3.0 lb/ton (tons NO_X)	Controlled NO_X @0.50 lb/ton (tons NO_X)	NO_X Emission reductions (tons)
New	300	365	2	220,000	355	55	300
New	1,000	365	3	1,100,000	1,779	274	1,506
Modified	288	365	1	105,000	315	17	299
TOTALS				1,423,500	2,449	345	2,104

The last step in calculating impacts for sources to meet the revised standard of 0.50 lb NO_X/ton acid is to calculate the costs and reductions per year over the 5 year period after promulgation. In addition to control equipment, each modified or reconstructed production train will be required to install the following: a stack gas flow monitor and a dual range NO_X concentration monitor. The capital costs are $39,000 and $23,000, respectively. The annualized costs are $15,000 and $9,000, respectively. These costs include installation.

In addition to control equipment, each new or modified production train will be required to perform an annual stack test according to Appendix F. These testing costs were inadvertently excluded from the proposed rule. These tests are estimated at $12,000 per test.

These costs are based on comments received from The Fertilizer Institute (TFI). The requirement of a NO_X CEMS was included in the existing NSPS so its cost is not included in this analysis.

SCR is already being used to control NO_X emissions to the current NSPS level of 3.0 lb NO_X/ton acid. As shown in *Statistical Evaluation of CEMS Data to Determine the NO_X Emission Standard (Updated Memo for Final Standard)*, dated May 14, 2012, there are at least 3 production trains using SCR that already meet the revised NSPS level of 0.50 lb NO_X/ton acid. The control device costs are based on current usage where sources are only required to meet 3.0 lb NO_X/ton. Sources are not likely to spend additional money to meet a limit of 0.50 lb NO_X/ton acid when they were only required to meet a limit of 3.0 lb NO_X/ton. Therefore, we believe that the lower limit is achievable without additional cost impacts.

Accordingly, there is no incremental control cost to control NO_X emissions from the current NSPS limit of 3.0 lb NO_X/ton acid to the proposed revised NSPS limit of 0.50 lb NO_X/ton acid. The costs of monitors and operation and maintenance costs in the 5th year after promulgation are shown in Table 3-7 and Table 3-8.

Table 3-7. Incremental Costs in 5th Year after Promulgation for All New Production Trains

Model Plant (tpd)	Number of Plants	SCR Cost ($2010-2nd quarter)	Stack flow monitor cost ($2010-2nd quarter)	Dual range NO_X monitor cost	Annual stack testing cost	Total Annualized Costs ($2010-2nd quarter)
300	2	$0	$30,000	$18,000	$24,000	$72,000
1,000	3	$0	$45,000	$27,000	$36,000	$108,000

Table 3-8. Incremental Costs in 5th Year after Promulgation for All Modified or Reconstructed Production Trains

Model Plant (tpd)	Number of Plants	SCR Cost ($2010-2nd quarter)	Stack flow monitor cost ($2010-2nd quarter)	Dual range NO_X monitor cost	Annual stack testing cost	Total Annualized Costs ($2010-2nd quarter)
288	1	$370,000	$15,000	$8,900	$12,000	$406,000

Using the total monitoring costs, the cost effectiveness was also calculated. These numbers are shown in Table 3-9.

Table 3-9. Total Incremental Cost Effectiveness in 5th Year after Promulgation for All New, Reconstructed, and Modified Production Trains

Model Plant (tpd)	Type	Number of Plants	Total Annualized Costs ($2010-2nd quarter)	NO_X Emission reductions (tpy)	Cost effectiveness ($/ton NO_X)
300	New	2	$72,000	300	$240
1,000	New	3	$108,000	1,500	$70
300	Mod	1	$406,000	300	$1,360
All	----	6	$585,000	2,100	$280

For the new 300 tpd model plants, total annualized costs in the 5th year after promulgation are $72,000. The amount of NO_X reductions expected in the 5th year after promulgation is approximately 300 tpy. This results in a cost effectiveness of approximately $240.

For the new 1,000 tpd model plants, total annualized costs in the 5th year after promulgation are $108,000. The amount of NO_X reductions expected in the 5th year after promulgation is approximately 1,500 tpy. This results in a cost effectiveness of approximately $70.

For the modified 288 tpd model plant, total annualized costs in the 5th year after promulgation are $406,000. The amount of NO_X reductions expected in the 5th year after promulgation is approximately 140 tpy. This results in a cost effectiveness of approximately $1,360.

Overall, total annualized costs in the 5th year after promulgation are $585,000. The amount of NO_X reductions expected in the 5th year after promulgation is approximately 2,100 tpy. This results in a cost effectiveness of approximately $280.

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SECTION 4
ECONOMIC IMPACTS ON NEW SOURCES IN THE NITRIC ACID INDUSTRY

The rule will increase the cost of investing in new nitric acid production capacity, which in turn will increase the cost of producing nitric acid. As noted above, only a small share of nitric acid is sold (approximately 10%); the rest is consumed on site to produce other chemical products, including fertilizer, plastics and resins, and explosives. Thus, the nitric acid NSPS may result in market impacts in the market for nitric acid or in the markets for the other products that nitric acid is used to produce.

4.1 Modeling Approach to Estimating the Impacts on the Market for Nitric Acid

EPA's analysis of impacts on the market for nitric acid employs a model that recognizes that the decision facing a firm considering investing in new nitric acid production capacity is an investment decision. Investment decisions differ from operating decisions in that they involve whether the firm should put in place new plant and equipment. The investment decision is thus a long-run decision, since the time frame is sufficiently long that all inputs, including capital, can be varied. A firm will invest in new capital only if the current and future expected market price is sufficient to cover both the cost of operating the new capital and the annualized cost of purchasing and installing it.

To analyze the possible impacts of the NSPS on the market for nitric acid, EPA assumes that existing nitric acid production lines are operating more or less at capacity, and the market for nitric acid begins the period of analysis (2012 through 2017) in long-run equilibrium. Figure 4-1 shows the market for nitric acid in 2012; demand is shown by D1, and is downward sloping. Equilibrium quantity is shown by Q1 and equilibrium market price is shown by P1.

However, as demand for nitric acid grows over time, the market price increases. Existing producers would like to produce more nitric acid to meet this demand but are unable to do so, given their plant capacity. Thus, new product lines must be installed to meet the increased demand. Producers will be willing to invest in new nitric acid production capacity as long as the price of nitric acid is sufficient to cover the per-ton cost of operating the product lines plus the per-ton annualized cost of purchasing and installing the equipment. Figure 4-2 shows a long-run supply curve for nitric acid. Existing suppliers produce Qe; new suppliers face a per-ton cost (average total cost) that includes both the average variable cost of producing the nitric acid (a) and the average fixed cost of purchasing and installing the new capital equipment (f), for an average total cost of t, and produce Qn.

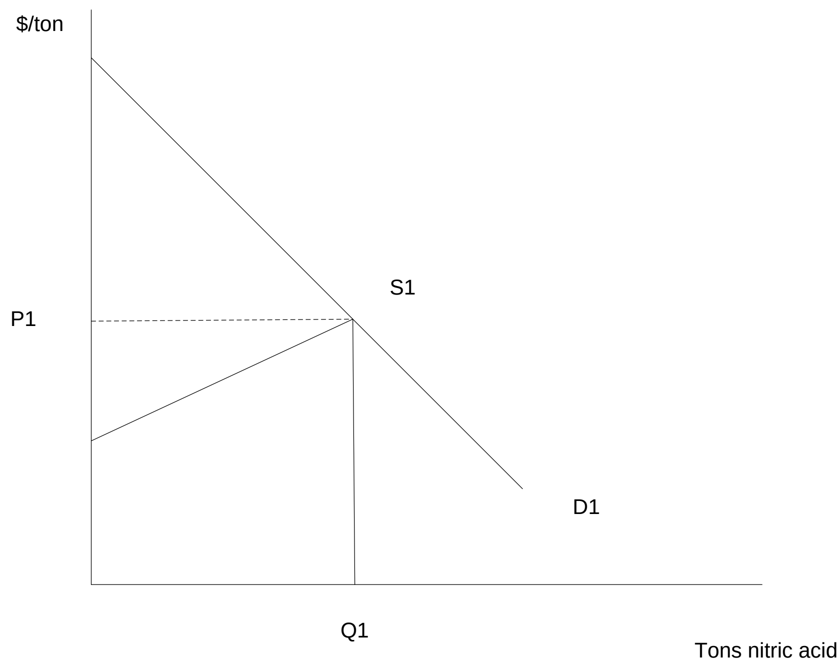

Figure 4-1. 2012 Market for Nitric Acid

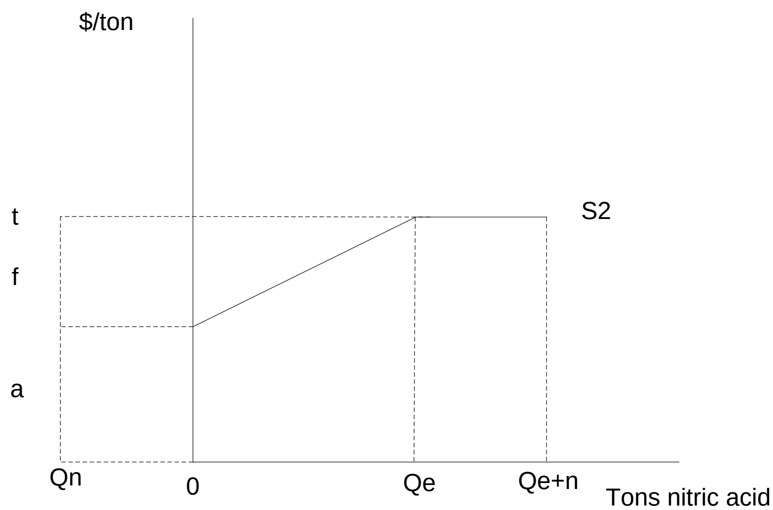

Figure 4-2. Market Supply of Nitric Acid, including New Source

Figure 4-3 shows the baseline market conditions in 2017. In 2017, demand for nitric acid has increased to D2. In the new market equilibrium, Q1 would be produced by existing suppliers, and Q2−Q1 would be produced by newly installed nitric acid product lines.

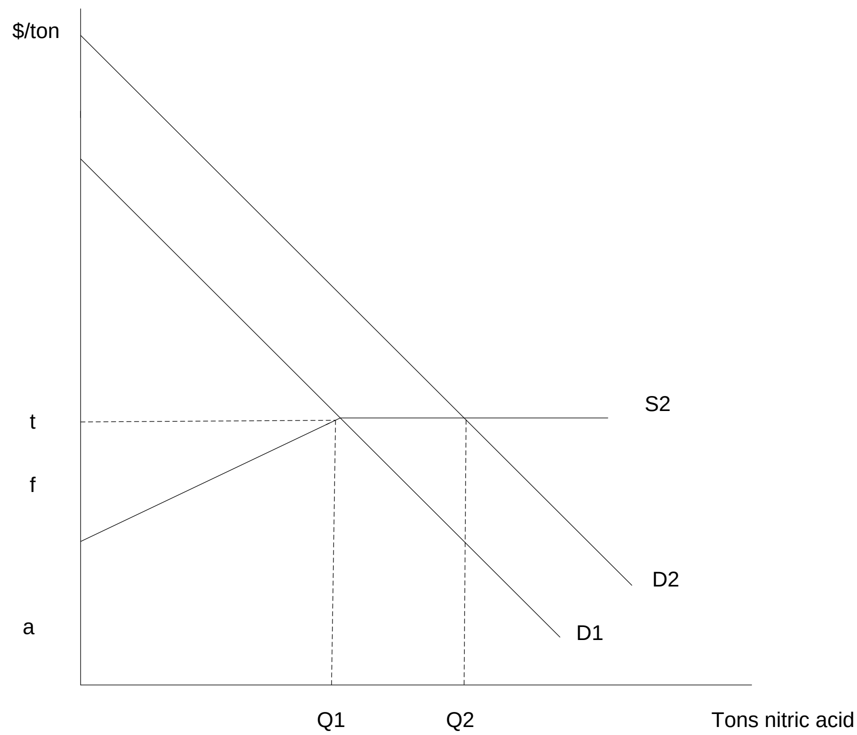

Figure 4-3. Increased Demand for Nitric Acid at Baseline (2017)

The revised nitric acid NSPS standard will increase the cost of producing nitric acid, resulting in an upward shift in the supply curve for new facilities in the amount of the per-ton costs of compliance. S3 in Figure 4-4 shows the with-regulation supply. Note that in this figure, D1 has been omitted for simplicity. As a result of the new higher costs, the equilibrium quantity of nitric acid is projected to decline slightly from Q2 to Q3.

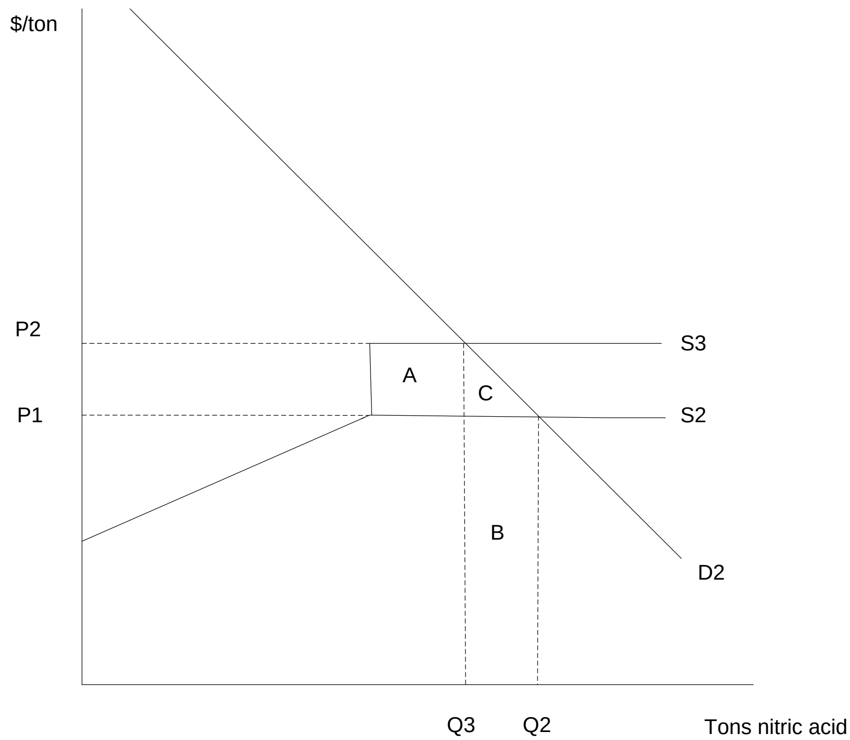

Figure 4-4. Market for Nitric Acid, With NSPS

4.2 Possible Impacts on Market for Nitric Acid

To implement the modeling approach described above, EPA gathered information on the estimated market quantity and market price for nitric acid. Over the period 2012 through 2017, EPA projects that nitric acid production will increase by 1.48 million tons. Historically, approximately 10% of nitric acid production has been marketed, with the remaining 90% used in house to produce other commodities. For simplicity, EPA modeled the impacts in the market for nitric acid under the assumption that one of the 300 tpd (105,000 tpy) product lines is a new commercial facility. This is a simplification, because not all marketed nitric acid is produced in exclusively commercial facilities. We thus assigned the per-facility cost ($72,000) to this new facility and computed the per-ton increase in their cost of approximately $0.72 per ton. The social cost of the rule was computed as the costs borne by producers of nitric acid and the costs borne by consumers of nitric acid. These are shown by areas labeled A, B, and C in Figure 4-4. The costs borne by producers include the compliance costs paid on the (remaining) quantity produced by new sources (Area A), and the production cost savings due to the reduction in output (- area B—a cost savings). The costs facing consumers include the loss in consumption (areas B plus C) due to the reduction in equilibrium market quantity. Summing these areas, the social cost of the rule = A – B + B + C, or A + C.

Table 4-1 shows the market impacts and estimated social costs for this scenario. The baseline quantity of nitric acid sold is approximately 932,000 tons, including 105,000 tons produced by a new product line. With the rule, the market price increases by approximately $0.72 per ton or about 0.36%, and the market quantity declines. After the market has adjusted to these increased costs, the equilibrium output falls by approximately 1,100 tons or 1.1%; thus, the new facility produces not 105,000 tons but 103,900 tons.

Table 4-1. Market Impacts of the Rule: Market for Nitric Acid

	Baseline	With-Regulation	Percentage Change
Quantity (tons)	932,145	931,068	−0.13%
Existing producers	827,145	827,145	0.00%
New /modified producers	105,000	103,922	−0.58%
Price ($/ton)	$220.00	$220.72	0.36%
Social cost			
Change in producers' surplus	$584,794		
Change in consumers' surplus	−$654,573		
Total social cost	−$69,779		

The engineering cost of the rule (assuming one new commercial production train is affected) is $72,000; taking into account market adjustments, the social cost of the rule is estimated to be $69,800, about 0.3% less than the engineering cost.

4.3 Estimated Impacts on Markets for Products Using Nitric Acid as an Input

Next, EPA estimated the economic impacts on three markets that use nitric acid as a production input: nitrogenous fertilizer, explosives, and plastics and resins. If producers in these sectors invest in new nitric acid product lines or purchase nitric acid from commercial suppliers that invest in new nitric acid product lines, the costs of complying with the NSPS would increase the cost of producing the final products that use nitric acid as an input. In each of these markets, EPA estimated the economic impacts using industry-level data for value of shipments at baseline. EPA used this dollar value to represent baseline market quantity and assigned a normalized price of $1. The impacts are thus measured against the baseline of domestic value of shipments in each market with no change in international trade in the final goods. This is a simplification, but because the costs and thus the estimated impacts are very small, it is not unrealistic.

To assess the maximum potential impact in each market, EPA assigned all the compliance costs from Section 3 of this RIA to each of the markets (reflecting the possibility that all the new sources may be supplying nitric acid to that industry). Using the demand and supply elasticities for these markets shown previously in Table 2-3, EPA then estimated the percentage change in market output in each market and computed the associated change in market quantity.

Table 4-2 shows the market impacts and estimated social costs in the markets for each of these nitric acid–using products in 2017. Even assuming that all the affected sources are within a given sector and thus all the costs are incurred by that sector, market quantity is estimated to change by a small fraction of a percentage. Thus, if the costs of complying with the NSPS are incurred by affected nitric acid product lines in the sectors that use nitric acid as an input, there will be extremely small impacts on the markets for their products, even if all the costs are assumed to be incurred by a single sector.

Table 4-2. Estimated Impacts in 2017 of the Nitric Acid NSPS on Sectors Using Nitric Acid as an Input[a]

	Nitrogenous Fertilizer Production (325311)	Explosives (325920)	Plastics and Resins (325211)
Market impact analysis			
Baseline value of shipments ($\$10^3$)	\$8,437,377	\$1,973,192	\$85,471,475
Annual cost of compliance	\$585,000	\$585,000	\$585,000
Percentage change in value of shipments	−0.002921%	0.0110%	0.000266%
Social cost			
Change in consumers' surplus ($\$10^3$)	−\$249.683	−\$218.595	−\$247.291
Change in producers' surplus ($\$10^3$)	−\$335.320	−\$366.411	−\$337.714
Change in total surplus ($\$10^3$)	−\$585.003	−\$585.006	−\$585.005

[a] Impacts on each sector are estimated assuming that all the new or modified sources are within that sector and thus all compliance costs are incurred by that sector.

4.5 Impacts on Small Entities of the NSPS Review of Nitric Acid for NO_X

Under the RFA as amended by SBREFA, EPA must evaluate potential impacts to small entities resulting from its actions. Small entities may be defined as (1) a small business, as defined by SBA's regulations at 13 CFR Part 121.201 (SBA, 2008); (2) a small governmental jurisdiction that is a government of a city, county, town, school district, or special district with a population of less than 50,000; or (3) a small organization that is any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

EPA assessed the possible impacts of the NSPS on small entities. To analyze the economic impacts on small entities with new or modified sources, EPA first gathered data on facilities producing nitric acid and then identified those facilities that could be affected by the regulation. In total, EPA identified 40 nitric acid facilities owned by 18 different parent companies. Of the 18 owner firms, four qualify as small entities based on guidance from the SBA and EPA's 2006 Final SBREFA Guidance (EPA, 2006) and sales/revenue data collected. Three of the entities, Apache Nitrogen, TradeMark Nitrogen, and Rentech Energy Midwest Corporation, are manufacturers of nitrogen-based fertilizers (NAICS 32531), and the fourth entity, Geneva Nitrogen, engages in manufacturing explosives (NAICS 32592). According to the SBA's small business size standards, a small entity in each of these industries is a parent company with 1,000 employees or less.

To measure the size of the potential impacts on small entities of complying with the NSPS, EPA developed cost-to-sales ratios (CSRs) for a 300 tpd and 1,000 tpd new source model plant. EPA assumes that the model plants' operating costs and revenues are similar to the four existing small entities described above. Using the estimated total annualized compliance cost for a new source model plant and the most recent available revenue data for the existing small entities (Table 4-3), EPA generated mean and median CSRs.

Table 4-3. Employment and Revenue of Existing Small Entities

Parent Company	Employment	Revenue ($2010)
Apache Nitrogen	82	$63,580,000
Geneva Nitrogen	32	$5,400,000
TradeMark Nitrogen	32	$35,000,000
Rentech	252	$130,600,000

Based on the model small firm CSRs, expected impacts to small entities are characterized in Table 4-4. The CSRs for model small firms withnew plants aresimilar , because total annualized compliance costs are close to each, and do not exceed 0.2%. The CSR for model small firms with the modified and reconsidered plant is higher since the total annualized compliance costs are higher, and this CSR does not exceed 0.65%. Based on these low expected impacts to small entities, EPA does not expect the NSPS to have a significant impact on a substantial number of small entities (SISNOSE) owning new, modified, or reconstructed sources that produce nitric acid.

Table 4-4. Cost-to-Sales Ratios for Model Small Firms Owning New, Modified, or Reconstructed 288 tpd, 300 tpd and 1,000 tpd Plants

			Cost-to-Sales Ratio		
Summary Statistic	**Employment**	**Revenue ($2010)**	**288 tpd Plant**	**300 tpd Plant**	**1,000 tpd Plant**
Mean small entity data	100	$58,645,000	0.65%	0.12%	0.17%
Median small entity data	57	$49,290,000	0.55%	0.10%	0.15%

4.6 References for Section 4

U.S. Environmental Protection Agency (EPA). 2006. "Final Guidance for EPA Rulewriters: Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act." http://www.epa.gov/sbrefa/documents/rfaguidance11-00-06.pdf

U.S. Small Business Administration. November 5, 2010. "Table of Small Business Size Standards Matched to North American Industry Classification System Codes." http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf

SECTION 5
CONCLUSIONS

This document has analyzed the economic impacts of the New Source Performance Standards for Nitric Acid Producers. The rule imposes more stringent limits on NO_X emissions from new, modified, or reconstructed sources in the nitric acid industry.

EPA estimates that there will be six new nitric acid production trains during the years following promulgation (2012 through 2017), three with production capacity of 300 tpd and three with production capacity of 1,000 tpd. To comply with the NSPS, EPA estimates that new sources would not incur incremental control costs (a modified source may incur control costs, those costs have been accounted for), but new sources would be required to undertake enhanced monitoring, recordkeeping, and reporting at a cost of $15,019 per new product line. (National total annualized cost of compliance for the six new sources is estimated to be $586,000 in 2010-2nd quarter dollars.)

EPA examined the potential impacts of the NSPS on a new or modified source in the commercial nitric acid sector and on new or modified sources owned by facilities that produce nitrogenous fertilizers, explosives, or plastics and use nitric acid as an input in their production processes. Overall, EPA estimates that market impacts in all of the affected markets will be extremely small.

EPA also examined the potential for significant impacts on small businesses that invest in new or modified nitric acid product lines. EPA used the characteristics (firm employment and firm sales revenues) for the four small entities that currently produce nitric acid to create model small firms in the affected industry. Using the mean and median sales revenues for the existing small firms as typical company sales for small entities that produce nitric acid, EPA estimates that the CSRs would be less than 0.2%. Thus, EPA does not expect the NSPS to impose a significant impact on a substantial number of small entities (or SISNOSE).

APPENDIX A:
INDUSTRY DATA AND PROJECTIONS FOR NAICS 32521

Table A-1. Industry Data and Projections for NAICS 32521, Plastic, Resin, and Rubber Manufacturing ($2010)

Year	Revenue ($m)	Industry Value Added ($m)	Establish-ments	Enterprises	Employment	Exports ($M)	Imports ($m)	Wages($m)	Domestic Demand ($m)	Production ($m)
2001	62,790	20,902	783	494	68,363	17,367	8,294	4,889	53,717	39,200
2002	62,599	22,778	965	630	76,817	17,542	8,210	5,264	53,267	41,600
2003	66,034	23,941	954	664	72,032	18,659	9,147	4,973	56,522	41,000
2004	74,768	29,040	944	653	65,408	22,108	10,409	4,703	63,068	43,500
2005	92,193	34,367	976	686	67,539	25,090	13,089	4,954	80,192	41,300
2006	91,756	34,756	944	669	62,612	27,887	13,427	4,624	77,296	41,500
2007	90,750	34,000	949	660	62,000	31,417	12,643	4,582	71,976	41,200
2008	87,500	33,000	915	645	60,300	33,139	13,374	4,486	67,736	38,750
2009	80,530	31,000	875	630	55,000	25,450	10,180	4,174	65,260	35,500
2010	83,052	31,750	865	625	56,000	27,000	10,750	4,100	66,802	N/A
2011	85,070	32,300	867	627	56,750	29,500	12,000	4,150	67,570	N/A
2012	88,565	33,200	868	629	56,250	31,000	12,950	4,125	70,515	N/A
2013	92,510	34,500	865	628	55,000	32,550	13,750	4,085	73,710	N/A
2014	94,250	34,750	863	627	54,500	34,000	14,500	4,075	74,750	N/A
2015	96,520	35,450	860	625	54,000	35,300	15,250	4,050	76,470	N/A

Source: Dai, R. June 2010. IBISWorld Industry Report 32521. Plastic, Resin, & Rubber Manufacturing in the US. http://www.ibisworld.com.

Table A-2. Industry Data and Projections for NAICS 32531, Fertilizer Manufacturing ($2010)

Year	Revenue ($m)	Industry Value Added ($m)	Establish-ments	Enterprises	Employment	Exports ($M)	Imports ($m)	Wage ($m)	Domestic Demand ($m)	Production ($m)
2001	12,281	2,491	704	492	21,405	2,850	3,412	1,180	12,843	19,000
2002	12,287	4,077	727	511	20,718	2,809	2,778	1,127	12,256	18,000
2003	13,207	4,338	679	478	19,688	3,100	4,097	1,076	14,204	N/A
2004	14,704	5,345	674	474	17,843	3,360	4,907	1,009	16,251	N/A
2005	14,084	5,137	659	474	17,076	3,665	6,656	979	17,074	N/A
2006	14,430	5,517	664	482	16,054	3,517	6,063	926	16,976	N/A
2007	16,805	5,894	665	503	17,777	4,012	7,814	1,031	20,607	N/A
2008	21,075	7,000	670	489	17,350	8,268	12,919	1,000	25,726	N/A
2009	18,000	6,300	660	486	16,500	4,500	6,500	950	20,000	N/A
2010	19,200	6,625	656	485	16,550	4,800	8,150	955	22,550	N/A
2011	19,700	6,755	653	483	16,250	5,085	8,800	940	23,415	N/A
2012	20,150	7,000	652	483	15,850	5,300	9,250	920	24,100	N/A
2013	20,700	7,200	651	481	15,300	5,600	9,900	895	25,000	N/A
2014	21,200	7,400	650	480	14,750	5,900	10,500	870	25,800	N/A
2015	21,750	7,600	650	480	14,500	6,225	11,100	855	26,625	N/A

Source: Richardson, A. March 2010a. IBISWorld Industry Report 32531. Fertilizer Manufacturing in the U.S. http://www.ibisworld.com.

Table A-3. Industry Data and Projections for NAICS 32551, Paint Manufacturing ($2010)

Year	Revenue ($m)	Industry Value Added ($m)	Establish-ments	Enterprises	Employment	Exports ($m)	Imports ($m)	Wages($m)	Domestic Demand ($m)	Production (gallons)
2001	24,447.8	12,043.8	1,463	1,192	51,084	1,851.4	902	2,677.2	23,498.4	N/A
2002	24,219	11,592.3	1,363	1,107	46,347	1,813.3	719.8	2,495	23,125.5	N/A
2003	23,954.2	12,217.1	1,371	1,114	44,852	1,835.1	742.5	2,244.7	22,861.6	N/A
2004	25,595.8	13,516.7	1,374	1,115	41,547	1,857.9	773.1	2,352.5	24,511	N/A
2005	25,847.2	13,360.3	1,365	1,105	40,073	1,939	812.9	2,296.4	24,721.1	N/A
2006	25,338.1	13,039.7	1,344	1,095	39,006	2,155.9	917.3	2,207.6	24,099.5	N/A
2007	24,861.5	12,130.6	1,369	1,131	41,893	2,203	942.7	2,308.5	23,601.2	N/A
2008	23,750	11,500	1,325	1,090	40,000	2,170.7	868.1	2,225	22,447.4	N/A
2009	22,000	10,800	1,290	1,060	37,500	1,892	599.9	2,125	20,707.9	N/A
2010	22,550	11,000	1,280	1,055	36,250	2,000	675	2,050	21,225	N/A
2011	23,200	11,350	1,283	1,060	36,350	2,175	825	2,055	21,850	N/A
2012	23,900	11,750	1,278	1,057	36,200	2,325	910	2,050	22,485	N/A
2013	24,650	12,100	1,270	1,053	36,000	2,450	990	2,040	23,190	N/A
2014	25,400	12,450	1,265	1,050	35,850	2,550	1,035	2,035	23,885	N/A
2015	26,150	12,775	1,260	1,045	35,700	2,650	1,080	2,030	24,580	N/A

Source: Richardson, A. 2010b. IBISWorld Industry Report 32551: Paint Manufacturing in the U.S. http://www.ibisworld.com.www.lib.ncsu.edu:2048/industryus/default.aspx?indid=492.

Table A-4. Industry Data and Projections for NAICS 32592, Explosives Manufacturing ($2010)

Year	Revenue ($m)	Industry Value Added ($m)	Establish-ments	Enterprises	Employment	Exports ($M)	Imports ($m)	Wages($m)	Domestic Demand ($m)	Production ($m)
2001	1,322	737	100	63	6,473	256	195	312	1,261	2,376
2002	1,230	718	92	61	5,721	300	200	277	1,129	2,510
2003	1,193	712	89	57	5,534	413	233	263	1,013	2,287
2004	1,212	659	84	53	5,234	480	288	266	1,019	2,523
2005	1,330	571	82	54	5,617	463	305	285	1,171	3,200
2006	1,506	710	82	53	6,018	536	368	302	1,338	3,160
2007	1,807	939	83	56	6,000	581	381	324	1,607	3,120
2008	1,950	1,035	81	55	5,970	573	358	320	1,734	3,115
2009	1,850	950	79	53	5,950	500	275	300	1,625	3,100
2010	1,875	970	78	N/A	5,930	N/A	N/A	N/A	N/A	N/A
2011	1,950	1,015	78	N/A	5,900	N/A	N/A	N/A	N/A	N/A
2012	2,050	1,075	79	N/A	5,925	N/A	N/A	N/A	N/A	N/A
2013	2,100	1,100	79	N/A	5,920	N/A	N/A	N/A	N/A	N/A
2014	2,150	1,130	78	N/A	5,920	N/A	N/A	N/A	N/A	N/A
2015	2,200	1,155	78	N/A	5,915	N/A	N/A	N/A	N/A	N/A

Source: Richardson, A. September 2009. IBISWorld Industry Report 32592. Explosives Manufacturing in the US. http://www.ibisworld.com

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