Economic Analysis for Regulatory Modifications to the Definition of Solid Waste for Zinc-Containing Hazardous Waste-Derived Fertilizers, Notice of Proposed Rulemaking

Final Report

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CHAPTER 1

INTRODUCTION AND EXECUTIVE SUMMARY

Zinc is among several micronutrients required for normal plant growth and development. Because of its role in plant nutrition, zinc is incorporated in some fertilizers, especially those targeted at crops sensitive to lower soil zinc levels (e.g., corn, sorghum, flax, grapes). Typically, zinc micronutrient fertilizer is sold to fertilizer distributors who then mix the micronutrient into customized blends of other required nutrients, such as potassium or nitrogen; the relative amounts of each fertilizer are blended based upon the specific soil deficiencies of the end-users' farm land. Farmers purchase these custom blends to apply to their fields. Zinc micronutrient fertilizer is produced in two forms: Oxy-sul (a combination of zinc oxide and zinc sulfate) and ZSM (zinc sulfate monohydrate).

1.1 Introduction

A variety of secondary materials are used in the manufacturing of zinc-containing micronutrient fertilizers for agriculture. Some of these materials are hazardous wastes under Federal regulations promulgated under the Resource Conservation and Recovery Act (RCRA). Examples of hazardous secondary materials used to manufacture zinc-containing micronutrient fertilizer include emission control dust from electric arc furnaces (EAFs) in the iron and steel industry (K061, a listed hazardous waste) and tire ash (characteristically hazardous for both lead and cadmium and designated as D006 and D008). Brass fume dust is mostly used to produce zinc micronutrient for animal feed or sent for zinc reclamation. It is possible that zinc micronutrient manufacturers or zinc manufacturers will use brass fume dust to produce zinc micronutrient fertilizer or ZSM in the future. Brass fume dust from brass ingot makers, brass mills, and brass and bronze foundries is usually characteristically hazardous for both lead and cadmium and is designated as D006 and D008. Examples of nonhazardous secondary materials include zinc fines from galvanizing and zinc hydroxide from electrowinning of automobiles for rust prevention.

Currently, handlers of hazardous wastes used in manufacturing zinc-containing micronutrient fertilizers are subject to generator and transporter standards as well as applicable standards for facilities that treat, store, or dispose of hazardous wastes (see 40 CFR §§266.21-23). Storage prior to recycling of these wastes is subject to RCRA permit requirements. The use of zinc-containing hazardous waste-derived fertilizers other than K061-derived fertilizers is conditionally exempt from RCRA regulation provided that they meet the applicable treatment standard specified under Subpart D of Part 268 of RCRA regulation (see 40 CFR §266.20(b)). K061-derived fertilizers are currently exempt from RCRA regulation, although the K061 used to produce them is fully regulated until the product is made.

In 1998, the U.S. Environmental Protection Agency (EPA) promulgated two regulations affecting the status of hazardous waste-derived fertilizers. In May 1998, EPA promulgated the Phase IV final rule for TC metal wastes (63 FR 28556 [May 26, 1998]). This rule revised the treatment standards for hazardous wastes that exhibited the toxicity characteristic for metals (hereafter TC metals) to the Universal Treatment Standards (UTS) specified in 40 CFR §268.40. The rule did not change the regulatory exemption for K061-derived fertilizers. The revised UTS standards for TC metal wastes are more stringent than the previous treatment standards. In reconsideration of the appropriateness of the UTS standards to zinc-containing fertilizer, the Agency in August 1998 administratively stayed the effect of the treatment standards for zinc-containing fertilizers (63 FR 46631 [August 31, 1998]).

EPA is developing a notice of proposed rulemaking that

- removes the K061 fertilizer exemption from RCRA regulation,
- provides a conditional exclusion from the definition of solid waste for hazardous secondary feedstocks (e.g., brass dust, EAF dust from steel mills, and tire ash) used to produce zinc-containing fertilizers, and
- provides product specifications based on zinc sulfate monohydrate for excluding hazardous waste-derived zinc-containing fertilizers.

The conditions for excluding the hazardous secondary feedstocks would include handling requirements for storage and transport (e.g., no land storage), reporting requirements, and labeling requirements. This report provides analytic support to the Agency's notice of proposed rulemaking effort.

1.2 Summary of Findings

EPA projects that two firms currently producing zinc micronutrient fertilizers using hazardous feedstocks will have to change their operations at one facility each to comply with the conditional exclusion. One raw material supplier will have to change its disposal practices. These three firms are the only directly affected entities. Also, EPA projects that two other zinc micronutrient producers will modify their output markets and one zinc producer will change its raw material supplier. Some brass fume dust generators will change their disposal habits, according to EPA estimates.

One of the directly affected firms, Bay Zinc, is projected to substitute nonhazardous feedstocks in its Oxy-sul production process, at an annual cost of approximately $2.3 million. EPA estimates that the resulting Oxy-sul will have a higher zinc content than hazardous-waste derived Oxy-sul and will command a higher price per pound of zinc.[1] When the resulting increases in revenues are taken into account, Bay Zinc is estimated to incur net annual costs of $139,000. Another directly affected firm, Frit Industries, is projected to install a ZSM line replacing its current Oxy-sul production line. Frit is projected to incur estimated capital costs of $5.68 million and annualized costs of approximately $900,000 (more the first year to set up new recordkeeping and reporting procedures, less in subsequent years). Again, the firm is estimated to increase its revenues, because ZSM sells for a higher price than Oxy-sul. When all cost savings and increases in revenues are accounted for, Frit's revenues are estimated to increase by more than

[1] Note: zinc-micronutrient fertilizers are usually priced based on both their zinc content and price per unit of zinc.

$1 million. The third directly affected company, Exeter Energy, is expected to be affected by the conditional exclusion, because Bay Zinc is projected to no longer purchase its tire ash. The firm will thus incur the incremental costs of $209,000 of disposing of the tire ash in a hazardous waste landfill or of paying to have it reclaimed.

Madison Industries and Tetra Micronutrients, two other zinc micronutrient fertilizer producers, are expected to change their output markets as a result of the conditional exclusion. Madison Industries currently sells all of their product to animal feed suppliers, and Tetra Micronutrients sells one-half of their product to animal feed suppliers. EPA predicts that both fertilizer manufacturers will sell all of their product to fertilizer dealers in a post-rule environment. Fertilizer demands a higher price than animal feed; therefore, both producers should experience an increase in revenues.[2] Madison Industries is expected to experience a cost savings of $500,000, while Tetra Micronutrients is expected to experience a cost savings of $250,000. Big River Zinc, a zinc producer, is expected to switch its raw material supplier as a result of the conditional exclusion. Currently, Big River Zinc purchases zinc oxide from Zinc Nacional. EPA predicts that Big River Zinc will substitute brass fume dust for its raw material, resulting in feedstock purchase savings of $1,244,043. Big River Zinc will incur additional disposal costs, since a sludge is produced when a hazardous material is incorporated. These disposal costs amount to $180,247; thus, Big River Zinc's net cost savings are expected to amount to $1,063,797. EPA expects several of the brass fume dust generators to experience cost savings as a result of the conditional exclusion, since Big River Zinc will create an increased demand for brass fume dust. These brass fume dust generators will no longer pay disposal costs for their dust; instead, they will receive payment for their dust. EPA expects ten brass mills to experience cost savings of $34,227 each ($342,267 aggregate savings). Three brass foundries are expected to realize cost savings of $27,381 each ($82,144 aggregate savings), and ten brass ingot makers are expected to realize cost savings of $111,545 each ($1,115,454 aggregate savings).

All three of the directly affected firms are small businesses. In compliance with the Small Business Regulatory Enforcement Fairness Act (SBREFA), EPA examined the potential impacts of the conditional exclusion on these small businesses. For Bay Zinc and Frit, the costs of complying are estimated to be substantial; however, EPA's analysis indicates that they may experience increases in revenues that largely offset their costs. Taking all costs, cost savings, and estimated revenue increases into account, Bay Zinc is expected to incur net costs that are slightly greater than 1 percent of their baseline revenues. However, EPA estimates that Bay Zinc may be able to realize significant cost savings (in excess of the projected costs) by substituting brass fume dust in place of nonhazardous zinc as a feedstock for their ZSM production line. Frit Industries is expected to realize net cost savings that are slightly less than 1 percent of their baseline sales. Exeter Energy is projected to incur costs of managing their tire ash that are 1.15 percent of their baseline revenues.

Because only three small entities are projected to be directly affected, and because their overall financial impacts are estimated to be small relative to their baseline revenues (and

[2] Queneau, Paul. Personal communication with Paul Borst, U.S. Environmental Protection Agency, March 9, 1999.

positive for one of the three firms), and because one entity may be able to completely recover their costs, EPA certifies that the conditional exclusion will not have a significant impact on a substantial number of small entities.

The benefits of the proposed conditional exclusion are described qualitatively for both hazardous secondary materials (e.g., brass fume dust, tire ash, electric arc furnace dust) used to make zinc micronutrient fertilizer and the fertilizer itself. These benefits include reduced loadings of heavy metals and dioxins to the environment for both hazardous secondary materials used to make fertilizer and the fertilizer itself. These benefits also include reduction of potential exposures that could result from the mismanagement of hazardous secondary materials used to make fertilizer. Because the Agency has not completed a quantitative risk assessment for this proposed rule, EPA cannot make any quantitative conclusions about the risk reduction from today's proposal.

1.3 Organization of the Economic Analysis

This report is organized into seven chapters. Chapter 2 provides an industry profile of the zinc micronutrient fertilizer industry; it discusses the supply side and demand side dynamics, industry organization, and the market for zinc micronutrient fertilizers. Chapter 3 examines the methodology and data limitations of this analysis. The proposed rulemaking and current regulations are presented in Chapter 4. Chapter 5 discusses a cost analysis for the proposed rulemaking. The economic impacts of the proposed regulations are also examined in Chapter 5. Chapter 6 discusses the potential benefits of the proposed rulemaking, while Chapter 7 considers other regulatory requirements. Appendices A, B, and C provide greater detail about how the costs of the proposed standards were estimated and analyzed. Appendix D provides a sensitivity analysis of the economic impacts, analyzing the impacts when the production levels of zinc micronutrient fertilizer vary.

In addition to the zinc micronutrient fertilizers made from hazardous secondary feedstocks, considered in the body of this report, EPA is considering regulating the practice of recycling wastes from extraction and beneficiation to make fertilizer products. These wastes (referred to hereafter as mining wastes) are currently exempt from hazardous waste regulations according to RCRA section 3001(b)(3)(A)(ii), commonly referred to as the "Bevill exemption."

CHAPTER 2

PROFILE OF THE AFFECTED INDUSTRY

This chapter presents an industry profile of the zinc micronutrient fertilizer industry in the United States. Section 2.1 considers the supply of zinc micronutrient fertilizers, and Section 2.2 covers the demand for zinc micronutrient fertilizers. The organization of the zinc micronutrient fertilizer industry is addressed in Section 2.3. This chapter concludes with a discussion of the markets involved in this industry.

2.1 The Supply of Zinc Micronutrient Fertilizers

This section provides an overview of zinc micronutrient fertilizer production in the United States. The industry is small, relative to the fertilizer industry as a whole; the United States has fewer than 20 zinc micronutrient producers. This section examines the raw materials used, the production processes incorporated, and the costs of production and discusses production in terms of "zinc tons" rather than in tons of input or product.

2.1.1 Raw Materials

Zinc micronutrient fertilizers are made from a variety of raw materials, or feedstocks. Figure 2-1 presents an overview of zinc micronutrient production and consumption. In 1999, the amount of zinc tons of fertilizer produced annually derived from nonhazardous materials was roughly equivalent to the zinc tons produced annually derived from EAF dust, brass dust, or tire ash, which EPA classifies as hazardous waste.[1]

Table 2-1 presents the amount of each type of feedstock used in the production of zinc fertilizer, as well as its RCRA status and percentage of zinc content. The nonhazardous materials have a much higher concentration of zinc.

The nonhazardous raw materials include zinc fines from galvanizing, zinc hydroxide from electrowinning of automobiles for rust protection, and some crude zinc oxide from nonhazardous sources or crude zinc oxide refined from a hazardous waste source such as K061, EAF dust. These materials do not have the high levels of heavy metals that are characteristic of the hazardous raw materials and are therefore not regulated by the Federal government.

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[1] Queneau, Paul et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

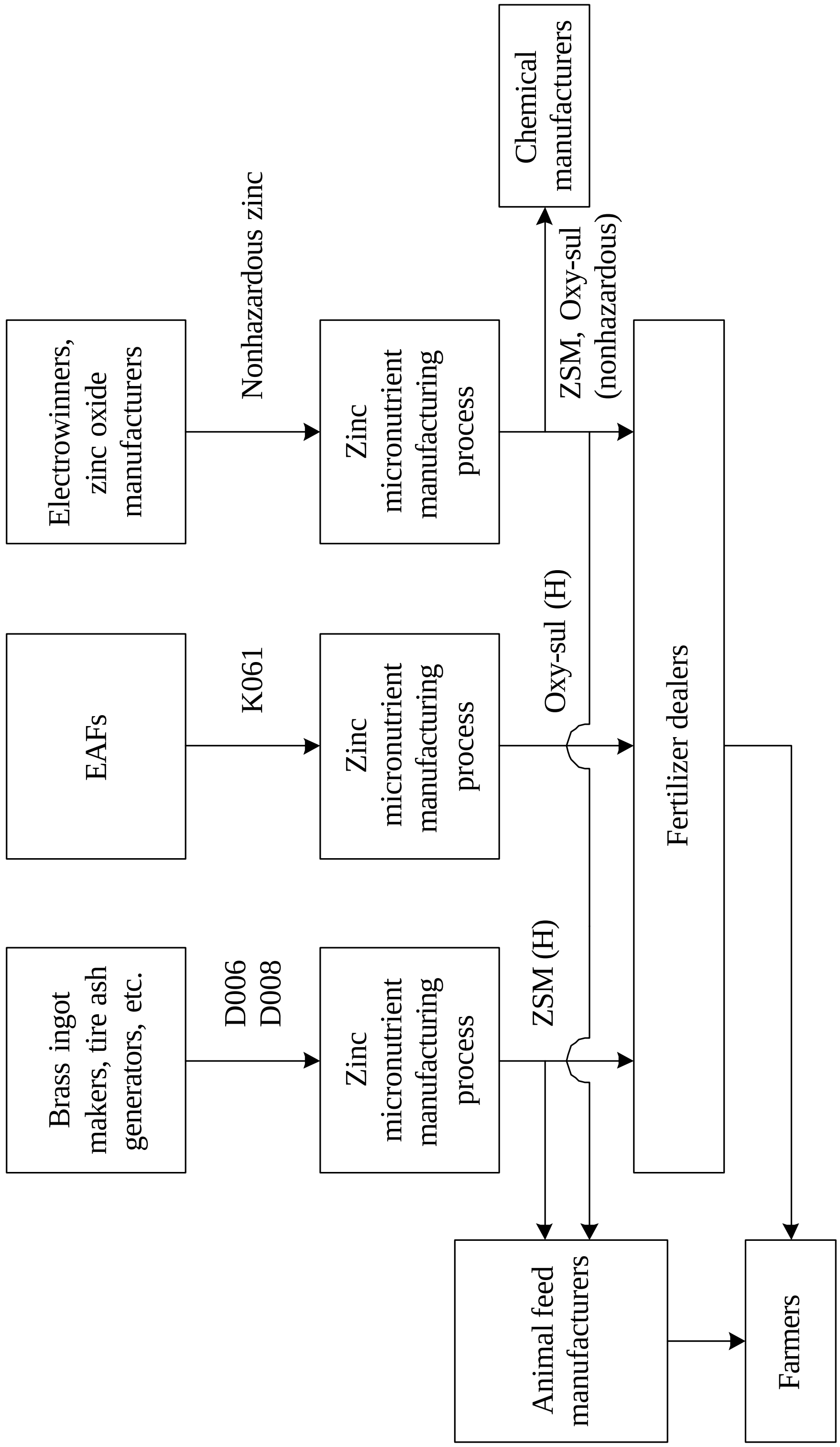

Figure 2-1. Zinc Micronutrient Production and Consumption

Table 2-1. Domestic Zinc-Bearing Secondary Materials Used in Micronutrient Fertilizer Production, 1997 or Most Current Year

Material	Annual generation (tons)	Annual amount used in fertilizer production (tons)[a]	Typically hazardous or nonhazardous under RCRA[b]	Zinc content (%)
Tire ash (D006, D008)	7,500	3,120	Hazardous (Pb, Cd)	27-35[c]
Electric arc furnace dust from steel mills (K061)[d]	925,000	10,000	Hazardous (Pb, Cr, Cd)	15-25
Brass fume dust (D006, D008)[e]	32,200	842	Hazardous (Pb, Cd)	40-60
Zinc fines from galvanizing	Unknown	10,836	Nonhazardous	72[f]
Zinc hydroxide from electrowinning for rust protection	Unknown	4,715	Nonhazardous	60-75[f]

[a] The estimated amount of tire ash used in fertilizer was approximated from a teleconference between Richard Camp, Bay Zinc, and Paul Borst, U.S. Environmental Protection Agency, April 16, 1999. The annual amount of K061 destined for fertilizer production is estimated based on Oxy-sul volume given for Frit in Queneau, Paul, et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste," Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines. The amount of brass fume dust incorporated into fertilizer production was estimated based on volumes given in a handout entitled, "Zinc Micronutrient Fertilizer/Estimated Market Share Analysis," given to EPA during a meeting between representatives of the zinc micronutrient fertilizer industry and EPA, April 14, 1998.

[b] Camp, Richard, Bay Zinc, handout to U.S. Environmental Protection Agency. 1998.

[c] Borst, Paul, U.S. Environmental Protection Agency, personal communication with Ken Wycherley, Exeter Energy Ltd. November 19, 1998.

[d] Queneau, Paul, P.B. Queneau & Associates, Inc., facsimile to Paul Borst, U.S. Environmental Protection Agency. "EAF Dust—U.S.A. 1998." February 10, 1999.

[e] Personal communication between Paul Borst, U.S. Environmental Protection Agency and Gary Mosher, American Foundrymen's Society, November 19, 1998. Personal communication between Paul Borst, U.S. Environmental Protection Agency and George Obeldobel, Big River Zinc, July 12, 1999. Total generation of brass fume dust is a total of ingotmaker, brass foundry, and brass mill dust generation. Total estimated brass fume production is based on a 450 ton per ingot maker times 12 ingot makers, 32 ton per foundry annual generation rate times 791 nonferrous foundries, 125 tons per brass mill times 12 brass mills.

[f] Borst, Paul, U.S. Environmental Protection Agency, personal communication with Richard Camp, Bay Zinc. November 18, 1998.

Source: Unless otherwise noted, volumes used in fertilizer production were derived from a handout entitled "Zinc Micronutrient Fertilizer/Estimated Market Share Analysis" given to EPA during a meeting between representatives of the zinc micronutrient fertilizer industry and EPA, April 14, 1998.

Note: Some imported sources of zinc-bearing secondary materials may also be used in micronutrient fertilizer production.

2.1.2 Production Processes

The production processes vary according to the type of fertilizer produced. Oxy-sul is produced by adding sulfuric acid (H_2SO_4) to the raw material. Producers may or may not add crude zinc oxide (ZnO) to the raw material, depending on the zinc concentration in the raw material. The sulfuric acid granulates the raw material dust to create a form more appropriate for fertilizer application. The addition of sulfuric acid also converts some of the zinc oxide into zinc sulfate. Oxy-sul is produced from both hazardous and nonhazardous feedstocks. This production process does not remove any of the heavy metals that may be present in the raw material. For example, Oxy-sul from EAF dust averages approximately 20 percent zinc, 6,000 ppm lead, and 200 ppm cadmium.[2]

The production of ZSM involves more elaborate capital equipment. This production process removes heavy metals (lead and cadmium) from hazardous raw materials through a two-step process involving filtration. While the production of Oxy-sul only partially converts the raw zinc oxide to zinc sulfate, the ZSM production process completes the chemical reaction, and nearly all of the zinc oxide in the raw material is converted to ZSM.

2.1.3 Costs of Production

Production of zinc fertilizer requires a combination of variable inputs such as raw materials, labor, transportation and energy, and fixed capital equipment. Costs are also associated with complying with RCRA regulations for those producers who use hazardous raw materials. This report focuses on the costs of raw materials and the change in costs of complying with the proposed regulations. (Chapter 5 examines the regulatory costs.)

A major component of the variable costs for zinc fertilizer producers is the cost of raw zinc materials. The price that the zinc fertilizer producers pay to the raw zinc suppliers is mainly a function of the zinc concentration in the raw material. Transportation costs are also a factor in the cost of zinc raw material. Frit Industries pays $10 per ton of EAF dust, or approximately $0.025 per pound of zinc.[3] Bay Zinc pays much more for their raw zinc, which they purchase from Exeter Energy, a tire burning facility. Bay Zinc pays Exeter $32 per ton of tire ash, or about $0.05 per pound of zinc.[4] Nonhazardous zinc feedstocks are more expensive and are estimated to cost between $0.30 and $0.42 per pound of zinc.[5]

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2 Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

3 Ibid. Page 1.

4 *Seattle Times*. November 23, 1997. "Toxic Sludge as Fertilizer." <http://www.purefood.com/Toxic/toxicSludge.html>. As obtained on March 10, 1999. Page 7.

5 Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1. The higher estimate is from Paul Queneau, personal communication with Paul Borst, U.S. Environmental Protection Agency, March 9, 1999.

The capital equipment for ZSM production is much more expensive than the capital equipment for Oxy-sul production. One fertilizer producer purchased the ZSM production equipment for approximately $4.5 million.[6]

2.2 The Demand for Zinc Micronutrient Fertilizers

This section characterizes the consumption of zinc micronutrient fertilizers. It describes the characteristics of zinc fertilizers, its uses and consumers, and the substitution possibilities in consumption.

2.2.1 Product Characteristics

There are two major types of zinc micronutrient fertilizer: Oxy-sul and ZSM. As described above, Oxy-sul consists of a combination of zinc oxide and zinc sulfate, while the zinc in ZSM is in the form of zinc sulfate monohydrate. Oxy-sul (liquid $ZnSO_4$ or L. $ZnSO_4$) is always sold in the granular form; ZSM may be sold in either a granular form or a liquid form, usually depending on consumer preference. Both types of zinc fertilizer can be produced from either hazardous or nonhazardous raw material. Because the production of ZSM incorporates a filtration process, the product characteristics of ZSM will be the same regardless of the raw material, and the concentration of heavy metals in ZSM is low. Oxy-sul, however, will differ in both zinc concentration and heavy metal concentration, depending on the raw material. Oxy-sul produced from nonhazardous feedstocks has higher zinc concentration and lower levels of lead and cadmium than Oxy-sul produced from hazardous feedstocks.

Although most fertilizer distributors perceive no difference between the two types of fertilizer, some believe that ZSM is more readily available for plant uptake, because zinc sulfate is more soluble than zinc oxide.[7] This point is quite controversial. Some proponents of Oxy-sul argue that many chemical reactions occur in the soil, and it is possible that the effects of microbes, temperature, and sunlight convert the less soluble zinc oxide to soluble zinc sulfate. Armani et al.[8] recently concluded that ZSM is more effective as fertilizer, because they discovered a high correlation between water solubility of zinc in fertilizer material and measured plant parameters. Table 2-2 presents their findings. The researchers examined six different types of Oxy-sul; the grades of Oxy-sul differ as a result of the different characteristics of the raw zinc used.

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6 Borst, Paul, U.S. Environmental Protection Agency, personal communication with Richard Camp, President, Bay Zinc. April 16, 1999. Page 1.

7 Green, Richard, Martin Resources, teleconference with Katherine Heller and Lindsay James, Research Triangle Institute. March 19, 1999. Page 1.

8 Armani, M., D.G. Westfall, and G.A. Peterson. 1997. “Zinc Plant Availability as Influenced by Zinc Fertilizer Sources and Zinc Water Solubility.” Colorado Agricultural Experiment Station Technical Bulletin TB 97-4 (pre-publication draft). Page 1.

Table 2-2. Fertilizer Forms and Zinc Solubility

Zinc source	Zinc fertilizer symbol	Total zinc (%)	Water soluble zinc (%)
$ZnSO_4 \times H_2O$	$ZnSO_4$	35.5	99.9
Zn Oxy-sul	Zn20	20.4	98.3
Zn Oxy-sul	Zn27	27.3	66.4
Zn Oxy-sul	Zn40	39.9	26.5
Zn Oxy-sul	ZnOxS	37.7	11.0
Zn Oxy-sul	ZnOS	17.5	0.7
Zn Oxy-sul (K061)	ZnK	15.0	1.0

Source: Armani, M., D.G. Westfall, and G.A. Peterson. 1997. "Zinc Plant Availability as Influenced by Zinc Fertilizer Sources and Zinc Water Solubility." Colorado Agricultural Experiment Station Technical Bulletin TB 97-4 (pre-publication draft). Page 3.

2.2.2 Uses and Consumers

Zinc micronutrient fertilizer producers typically sell their product to fertilizer dealers or distributors. These fertilizer dealers blend many different kinds of fertilizer (e.g., nitrogen, potassium) and sell these blends to farmers. There are two methods for blending fertilizers. The more expensive option is referred to as precision agriculture. This site-specific method requires soil testing in grids of farmland every 2 to 5 years. Based on the soil tests, the fertilizer dealer recommends precise blends, and a "variable rate application machine" is used to apply the fertilizer. This machine actually changes the blend as it is driven across the farmland. The other method of blending is more general. The dealer blends the fertilizer at the plant, based on the average nutrient needs for soil in that area.[9]

Farmers consider the zinc concentration when applying fertilizer, and the amount of zinc applied is usually referred to in zinc pounds. The average application rate for zinc fertilizers is 5 zinc pounds per acre. Table 2-3 displays the application rates for zinc fertilizer. Sometimes micronutrients are applied directly to the plant leaves in a technique called foliar fertilization.[10]

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9 Skillen, Jim, The Fertilizer Institute, teleconference with Katherine Heller and Lindsay James, Research Triangle Institute. March 10, 1999. Page 1.

10 Fertilizer Institute. 1999. "Fertilizer: From Plant to Plant." The Fertilizer Institute. <http://www.tfi.org/brochure.htm>. As obtained on March 5, 1999. Page 13.

Table 2-3. Zinc Application Rates (lbs/acre)

Average	5
High	10
Maximum	20

Source: U.S. Environmental Protection Agency (EPA). June 1998. *Background Report on Fertilizer Use, Contaminants and Regulations*. Washington, DC: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. EPA 747-R-98-003. Page 72.

A look at the regional consumption patterns of zinc micronutrient fertilizer reveals that the West North Central region (including KS, IA, MN, MO, NB, ND, SD) consumes more zinc fertilizer than the rest of the country (see Table 2-4). Zinc is a required nutrient for corn production, so this consumption pattern is logical.

ZSM has other uses beyond providing nutrients for crops, although 75 percent of ZSM produced is used for fertilizer. Animal feed comprises about 7 percent of the ZSM market, and another 7 percent of ZSM produced is used for water treatment. Approximately 11 percent of ZSM is used for miscellaneous purposes, including chemical manufacturing and froth flotation. Zinc stearate is zinc sulfate's largest chemical use.[11]

2.3 Industry Organization

Zinc micronutrient fertilizer producers are part of the zinc sulfate industry; in addition to its use in fertilizers, zinc sulfate is also used in animal feed and as a feed stock for various chemical production processes. In 1998, approximately 18 plants produced technical grade zinc sulfate.[12] Of these, approximately 16 produced micronutrient fertilizers, including both Oxy-sul and ZSM. While Oxy-sul is suitable only as a fertilizer input, ZSM can also be used as an ingredient in animal feed. Currently, two of the zinc micronutrient fertilizer producers use

[11] ChemExpo. "Chemical Profile: Zinc Sulfate." <http://www.chemexpo.com/news/PROFILE970811.cfm>. As obtained on March 17, 1999. Page 2.

[12] Queneau, Paul et al. June 22–24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

Table 2-4. Total Zinc Micronutrient Fertilizer Consumed in the United States and Regions in 1996 (tons)

Description	New England	Middle Atlanti c	South Atlantic	East north central	West north central	East south central	West south central	Mountain	Pacifi c	Alaska, Hawaii, Puerto Rico	U.S. and Puerto Rico	Percentage of total
Zinc chelate	2	95	83	3	2,955	61	646	4,989	790	0	9,623	24.67
Zinc oxide	0	367	120	673	4,849	359	63	243	1,482	0	8,158	20.91
Zinc oxy-sulfate	0	72	22	331	39	114	0	0	35	0	612	1.57
Zinc sulfate	20	298	34	206	12,645	186	141	1,526	3,499	15	18,569	47.61
Zinc sulfate solution	0	0	0	0	1,883	0	144	17	0	0	2,044	5.24
TOTAL	22	832	259	1,213	22,371	720	994	6,775	5,806	15	39,006	

Source: U.S. Environmental Protection Agency (EPA). June 1998. *Background Report on Fertilizer Use, Contaminants and Regulations*. Washington, DC: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics. EPA 747-R-98-003. Page 12.

hazardous feedstocks, including EAF dust and tire ash. (Other zinc sulfate producers incorporate brass fume dust into the production of animal feed, but since this is not a use constituting disposal, the feedstock is not categorized as hazardous.) Other manufacturers of zinc sulfates use zinc from nonhazardous sources, including zinc fines, zinc hydroxide, or zinc oxide. Demand for zinc sulfate comes from fertilizer dealers, who incorporate the zinc micronutrients into their fertilizer products; from animal feed manufacturers, who incorporate it into animal feeds; and from chemical manufacturers.

Twelve companies own the plants producing zinc micronutrients in this country; at least six SIC codes describe their primary businesses.[13] All of the industries designated by those SIC codes (although not all of the firms) produce many other goods in addition to zinc micronutrients. Therefore, traditional measures of market concentration at the industry level may not be useful in this analysis. Instead, this report examines the markets for zinc micronutrients.

2.3.1 Market Structure

Several markets are potentially affected, either directly or indirectly, by the proposed rulemaking. The market for zinc micronutrient fertilizers is expected to be directly affected by the proposed rulemaking, because the proposed rulemaking is expected to change the costs of zinc micronutrient fertilizer manufacturers, who in response will change their supply decisions. This response by manufacturers may change the overall supply of zinc micronutrient fertilizers and will likely change the market behavior of various zinc micronutrient fertilizer manufacturers, depending on how their operations are affected by the proposed rulemaking. Other markets, including the markets for hazardous and nonhazardous zinc-containing materials for use as inputs into the zinc micronutrient production process, and the markets for the products made with zinc micronutrient fertilizers, are expected to be indirectly affected. As the proposed rulemaking impacts the relative costs of producing zinc micronutrient fertilizers from different zinc-containing materials, EPA expects the demand for these inputs to increase or decrease (depending on whether the cost of producing zinc micronutrient fertilizers using the material has decreased or increased). Similarly, the markets for outputs made from zinc micronutrient fertilizers may experience increases or decreases in supply (and market price) depending on the overall impact on the price of zinc micronutrient fertilizers.

Fertilizer dealers stated that the market for zinc micronutrient fertilizers is regional, or possibly national. That is, zinc micronutrient fertilizer producers may serve customers located in many different parts of the country. While the zinc sulfate products vary significantly from producer to producer, fertilizer dealers focus on the zinc content of the product and state that the price they pay is based largely on the product's zinc content. Nevertheless, Oxy-sul, L. $ZnSO_4$, and granular $ZnSO_4$ (ZSM) have different production costs and somewhat different uses. These differences are reflected in their prices, per pound of zinc. Oxy-sul has the lowest median price, liquid $ZnSO_4$ has the next lowest median price, and ZSM has the highest median price, where the prices are defined in terms of price per pound of zinc (see Section 2.4, Table 2-6). Similarly, within each category, the zinc micronutrients made from hazardous feedstocks tend to sell for a lower price per pound of zinc than zinc micronutrients made from nonhazardous feedstocks. Thus,

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[13] Ibid. Page 9.

the zinc sulfate commodities are probably not perfect substitutes for one another, from the dealers' perspective. The fertilizer dealers also noted that zinc micronutrient fertilizer manufacturers might offer lower f.o.b. prices to customers who are located farther from their plant, to account for higher transportation costs.[14] Because there are fewer than 20 domestic suppliers of zinc micronutrients, and because their products are not perfect substitutes for each other in all uses, the market for them is probably not perfectly competitive. This means that zinc micronutrient manufacturers may have some ability to influence the price they receive for their goods, rather than being price-takers. Faced with increased costs, therefore, they may be able to pass some share of the increased cost along to their customers in the form of higher prices.

There is some international trade in zinc by-products and secondary zinc sources, as well as zinc sulfate. EAF dust is exported to Mexico, where it is converted into crude zinc oxide and then imported into the U.S. for use as a feedstock.[15] The U.S. imports zinc sulfate from several countries; the highest volume import countries are China, Mexico, and Germany.[16] These imports appear to be cyclical in volume, as discussed in Appendix E.[17] Also, the U.S. exports zinc sulfate to several countries, mostly to Canada, Mexico, and Costa Rica.[18]

2.3.2 Manufacturing Plants

Zinc micronutrients (Oxy-sul and ZSM) are manufactured by 18 plants located in 13 states.[19] Of these 18 plants, four currently use hazardous waste as a feedstock. Two of these four use the hazardous waste to produce zinc micronutrient that is used as a fertilizer. The other two plants use brass fume dust (a characteristic hazardous waste when landfilled or used in fertilizer production) as a feedstock, but these plants state that they produce zinc micronutrients that are used exclusively for animal feed.[20] The remaining 14 plants produce zinc micronutrients from nonhazardous feedstocks, such as zinc oxide, zinc hydroxide, or zinc fines. This rulemaking will directly affect the two producers making zinc micronutrient fertilizer using hazardous waste as a feedstock. The others will be indirectly affected because they compete with the directly affected

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14 Green, Richard, Martin Resources, teleconference with Katherine Heller and Lindsay James, Research Triangle Institute. March 19, 1999. Page 1.

15 Skillen, Jim, The Fertilizer Institute, teleconference with Katherine Heller and Lindsay James, Research Triangle Institute. March 10, 1999. Page 1.

16 U.S. International Trade Commission Database. "U.S. Imports for Consumption" and "U.S. Domestic Exports." HTS Code = 283326. 1989-1999.

17 Ibid.

18 Ibid.

19 Queneau, Paul et al. June 22–24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Speical Programs and Continuing Education, Colorado School of Mines.

20 When hazardous feedstocks are used to make animal feed, they are presumptively not used in a manner constituting disposal and are therefore not solid wastes because they are used as ingredients in an industrial process to make a product per 40 CFR §261.2(e)(1)(i).

facility in the markets for zinc micronutrients. Also the suppliers of the hazardous feedstocks will be affected by the rulemaking. The following sections describe in greater detail the directly and indirectly affected facilities.

2.3.2.1 Potentially Affected Zinc Micronutrient Manufacturers

Frit and Bay Zinc are currently the only zinc micronutrient fertilizer producers incorporating hazardous waste as a feedstock; therefore, they are the only zinc micronutrient fertilizer manufacturers that will be directly affected by the proposed rulemaking.

Frit owns and operates a fertilizer manufacturing facility at Norfolk, NE, located on-site at a Nucor Steel facility. Frit processes Nucor's EAF dust (K061, a listed hazardous waste) into Oxy-sul, a zinc micronutrient fertilizer used in agriculture, principally corn. Because Frit operates its facility on-site, it incurs no hazardous waste transportation cost and does not require a RCRA storage permit.[21] Frit also owns two plants that produce Oxy-sul from zinc oxide (a nonhazardous feedstock). These plants are located in Walnut Ridge, AR, and Chesapeake, VA.[22] Frit is a small business.

Bay Zinc is a small business, having an estimated $9.8 million in sales and 38 employees.[23] Historically, this company has made Oxy-sul from both K061 and tire ash. At present, it has stopped using K061, but Bay Zinc still incorporates tire ash into the production of Oxy-sul. Because of the low volume of the feedstock, the high transportation costs, and the proposed rulemaking, the continued use of tire ash in making Oxy-sul is uncertain.[24]

Bay Zinc recently invested in capital equipment to produce ZSM from zinc fines. This required an investment of approximately $4.5 million. Bay Zinc currently operates two co-located plants: one producing Oxy-sul and the new plant producing ZSM.[25] The company is currently evaluating other feedstocks for their ZSM line, such as brass fume dust and crude zinc oxide (which may or may not be derived from K061).[26] They have a RCRA permit, which cost them

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[21] Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

[22] Queneau, Paul et al. June 22–24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Speical Programs and Continuing Education, Colorado School of Mines.

[23] Employment data obtained from Jessica Camp, Bay Zinc. Personal communication with Katherine Heller and Lindsay James, Research Triangle Institute. June 23, 2000. Sales estimated based on industry sales-to-employment ratio of $280,000 per employee.

[24] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999.

[25] Camp, Richard, Bay Zinc, teleconference with Katherine Heller and Lindsay James, Research Triangle Institute. August 16, 1999. Page 1.

[26] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999.

several hundred thousand dollars to obtain.[27]

In addition to these two producers, EPA has identified three other zinc micronutrient manufacturers that may be indirectly affected by the rulemaking. These are Tetra's Fairbury, NE, plant, Madison Industries, and Big River Zinc. Tetra and Madison Industries currently use brass baghouse dust as an input to their ZSM production but sell all their brass-dust-derived ZSM for animal feed. In addition, under the conditional exclusion, Big River Zinc, which has used brass dust in the past, is projected to substitute brass dust for the nonhazardous feedstock they are currently using.

2.3.2.2 Secondary Material Suppliers

This section provides information on the suppliers of the hazardous waste feedstocks used by zinc micronutrient manufacturers. There are generally three types of hazardous feedstocks: EAF dust from steel mills; tire ash; and brass fume dust from brass ingot makers, brass mills, and brass and bronze foundries. Currently, only EAF dust and tire ash are used solely in the production of zinc micronutrient fertilizer. Brass fume dust, another hazardous waste that would be conditionally exempt under the proposed rulemaking, is mostly incorporated in the production of ZSM for animal feed. EPA predicts that at least two companies (Madison Industries and Tetra Micronutrients) will use brass fume dust to produce ZSM for fertilizer in the future and one company will use brass fume dust to produce zinc (Big River Zinc), since the proposed conditional exclusion could increase demand for this material as a feedstock. The two companies that currently market their product as feed will most likely switch to selling their product as fertilizer. Additionally, Bay Zinc is considering incorporating brass fume dust in their production of ZSM for fertilizer.[28]

All of the EAF dust feedstock is supplied by one steel company, and all of the tire ash is supplied by one tire-burning facility. In contrast, there are approximately 6 to 12 brass ingot makers, 10 brass mills, and 3 or 4 foundries supplying brass fume dust for zinc animal feed production, or zinc reclamation.[29] EAF dust and tire ash facilities are discussed specifically, but the secondary brass ingot makers and brass foundries are discussed in aggregate, since EPA does not have individual facility data available.

Nucor Steel is a large company with multiple plants, using EAFs to produce a wide range of steel products. Nucor is in SIC 3312, primary iron and steel manufacturing, for which the small businesses are those with 1,000 or fewer employees. Nucor is a large company because it had

[27] Ibid.

[28] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999.

[29] Oberlin, Mike, I. Schumann Inc., personal communications with Paul Borst, U.S. Environmental Protection Agency. July 14, 1999, July 27, 2000, Arnett, John E. Copper and Brass Fabricators Council, Inc. June 2, 2000.

6,900 employees in 1997 and $4.2 billion in sales.[30] Nucor directly pipes its EAF dust to a storage silo at the co-located Frit plant.

Exeter Energy operates the largest tire-to-energy plant in the world, with a 3,000°F oven consuming 10 million tires a year and leaving about 5 percent of their weight behind as tire ash. The ash is collected from particulate matter in a baghouse and supplied to Bay Zinc.[31] Exeter Energy meets the small business criteria for SIC 4911, in terms of MWh generated. Exeter's sales total $18.1 million per year.[32] Exeter Energy is half-owned by a parent company, CMS Energy Corporation, which is not a small business. To ensure that impacts on Exeter Energy are not understated, EPA's analysis is conducted as if the costs of the rulemaking were borne entirely by Exeter Energy.

Under the conditional exclusion, brass baghouse dust generators are projected to be able to sell more of their baghouse dust to fertilizer manufacturers. At baseline, they are estimated to provide 1,352 tons of zinc to ZSM manufacturers, who produce ZSM for animal feed from this brass dust. The rest of their brass baghouse dust is assumed to be sent for reclamation to Zinc Nacional in Monterey, Mexico. Post-rule, ZSM manufacturers will be able to use brass baghouse dust for fertilizer production and are projected to increase the quantity of brass dust they purchase.

2.3.3 Firm Characteristics

The 16 plants manufacturing zinc micronutrient fertilizer are owned by 11 parent companies.[33] The potentially affected fertilizer manufacturers' and raw material suppliers' parent companies are shown in Table 2-5, together with some information about their SIC code (primary industry), their sales, and their employment.

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30 Nucor. "Annual Report, 1997." <http://nucor.com/1997/a_1997fin-high2.htm>. As obtained on March 8, 1999. Page 1.

31 *Seattle Times*. November 23, 1997. "Toxic Sludge as Fertilizer." <http://www.purefood.com/Toxic/toxicSludge.html>. As obtained on March 10, 1999. Page 2.

32 Wurdock, Jim, Exeter Energy. Personal communication with Lindsay James, Research Triangle Institute, June 26, 2000. Page 1.

33 Queneau, Paul et al. June 22-24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

Table 2-5. Parent Company Information for Potentially Affected Companies

Parent company	Facility location	Parent SIC code	Parent sales ($\$10^6$ 1998)	Parent employment (1998)	Small business size standard
Bay Zinc Company, Inc.	Moxee, WA	2879	$9.8	38	500
Frit Inc.	Norfolk, NE	2873	$67.6	120	1,000
Tetra Technologies	Fairbury, NE	4953	$238.5	1,425	$6.0
Madison Industries	Old Bridge, NJ	3441	$50.0	225	1,000
Big River Zinc	Sauget, IL	3356	$110.0	370	750
Exeter Energy	Sterling, CT	4911	$18.1	uk	4 million megawatt hours
Nucor Steel	Norfolk, NE	3312	$4,200.0	6,900	1,000

Sources: Bay Zinc employment: Camp, Jessica, Bay Zinc. Personal communication with Katherine Heller, Research Triangle Institute. June 23, 2000. Page 1. Bay Zinc sales estimated based on industry average sales-to-employee ratio of $280,000 per employee.

Lycos Companies Online. "Frit Industries." <http://www.companies.lycos.com>. As obtained on August 14, 2000.

Wurdock, Jim. Exeter Energy. Personal communication with Lindsay James, Research Triangle Institute, June 26, 2000. Page 1.

Nucor. "Annual Report, 1997." <http://nucor.com/1997/a_1997fin-high2.htm>. As obtained on March 8, 1999. Page 1.

Lycos CompaniesOnline. Tetra Technologies. <http://www.companies.lycos.com>. As obtained on June 20, 2000.

2.4 Markets

The proposed rulemaking will change the costs of producing zinc micronutrient fertilizers relative to compliance with current standards. This change in costs, in turn, will affect firm behavior in the markets in which the companies buy inputs and sell their outputs. The markets directly affected are those for zinc micronutrients produced from hazardous waste feedstocks. Markets for zinc micronutrients produced from nonhazardous zinc feedstocks, and the market for the hazardous and nonhazardous feedstocks themselves, as well as other inputs used to produce the zinc micronutrients, will be indirectly affected by market forces and behavioral changes. This section summarizes the market volumes and prices at baseline in affected markets. Table 2-6 shows volumes of zinc micronutrient fertilizer product derived from hazardous waste and derived from nonhazardous feedstocks.

Table 2-6. Volumes and Prices of Zinc Micronutrient Fertilizer, 1997

Zinc fertilizer type	Volume of product (tons)	Volume of zinc (tons)	Median price per pound zinc
Oxy-sul	35,336[a]	9,772[a]	$0.66
From hazardous feedstock	16,836[a]	3,367[a]	$0.59
From nonhazardous feedstock	18,500	6,405	$0.69
ZSM	21,500	7,330	$0.87
From hazardous feedstock	15,500	5,200	$0.87
From nonhazardous feedstock	6,000	2,130	$0.85
Liquid $ZnSO_4$	24,650	2,913	$0.75
From hazardous feedstock	11,000	1,320	$0.75
From nonhazardous feedstock	13,650	1,593	$0.75

[a]Volumes for Frit and Bay Zinc were estimated, based on industry information.

Source: Handout entitled "Zinc Micronutrient Fertilizer/Estimated Market Share Analysis" given to EPA during a meeting between representatives of the zinc micronutrient fertilizer industry and U.S.E.P.A., April 14, 1998.

Table 2-6 shows the volume of Oxy-sul and ZSM manufactured and also reports the volumes made from hazardous and nonhazardous zinc feedstocks. The volume of the final product Oxy-sul exceeds the volume of ZSM produced by 14,000 tons. The majority of the Oxy-sul volume is made from nonhazardous feedstocks, as is the majority of the liquid $ZnSO_4$. However, the majority of ZSM is produced from hazardous feedstocks.

2.4.1 Market Volumes

Zinc micronutrient fertilizers are produced from both hazardous and nonhazardous feedstocks. Hazardous feedstocks currently include EAF dust (K061) and tire ash. At present, only Frit's Nebraska facility uses K061 to manufacture zinc micronutrient fertilizers.[34] In 1999, Frit accepted 10,000 tons of K061 and manufactured approximately 12,000 tons of Oxy-sul.[35] Bay Zinc's production of Oxy-sul from tire ash reached nearly 5,000 tons in 1998.[36] This production required approximately 3,120 tons of tire ash, which Bay Zinc purchased from Exeter Energy.[37] Many other facilities produce Oxy-sul as well, and these facilities incorporate nonhazardous feedstocks into their production. The total volume of Oxy-sul produced in 1998 was nearly 15 percent less than the volume produced in 1997.[38] Despite increasing ZSM production, Oxy-sul production volumes have been decreasing, on average, since 1993.[39] This decline has been especially marked from 1997 to 1999.[40] Even in the absence of government regulation, the trend of decreasing Oxy-sul is apparent. One explanation for why the demand for ZSM exceeds the demand for Oxy-sul is the perceived lack of heavy metals in ZSM.[41]

The other major category of zinc micronutrient fertilizer is ZSM. Unlike Oxy-sul, ZSM volumes are increasing for the most part. In 1998, total ZSM volume was approximately 13

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[34] Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999.

[35] Queneau, Paul et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

[36] This volume was estimated based on the raw material input range given by Richard Camp in personal communication between Richard Camp, Bay Zinc, and Paul Borst, U.S. Environmental Protection Agency. April 16, 1999. The volume of fertilizer produced was estimated using chemical ratios. Please see Appendix A for a description.

[37] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999.

[38] Queneau, Paul B., et al. June 22–24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Speical Programs and Continuing Education, Colorado School of Mines.

[39] Queneau, Paul B., et al. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines. June 28-30, 1994; June 25-27, 1996; June 24-26, 1997; June 22-24, 1999; June 27-29, 2000.

Queneau, Paul B. U.S. Recycling of Industrial Metals, Office of Solid Waste, Hazardous Waste Minimization and Management Division. December 1-2, 1998.

[40] Ibid.

[41] Painter, David, Martin Resources, personal communication with Lindsay James, Research Triangle Institute, July 2000.

percent larger than the volume produced in 1997.[42] Although the trend from 1993 to 1999 indicates increasing levels of ZSM, ZSM levels declined slightly in 1999.[43] This decline in ZSM production is most likely a result of several factors, including decreasing demand for zinc micronutrient fertilizer. The demand for zinc micronutrient fertilizer appears to be cyclical, based on the amount of zinc in the soil. This fluctuating demand for zinc micronutrient fertilizer, mirrored by the volume of zinc sulfate imports, seems to cycle every 4 or 5 years. Import volumes of zinc sulfate are also cyclical, although the highs and lows of the import cycle are offset from the domestic cycle by 1 year.[44] EPA reasons that the imports absorb excess demand during the first year of an upswing, before domestic producers have increased their production. Another contributing factor to the recent decline of ZSM is the closing of Tetra Micronutrient's Salida, CO, plant. Please refer to Appendix E for a discussion of the potential economic impacts when the demand for zinc micronutrient fertilizer has fallen or risen.

There is some international trade in zinc feedstocks and zinc micronutrient fertilizers, in addition to zinc sulfate. For example, K061 is exported to Mexico, where it is converted to crude ZnO and imported back into the United States as a nonhazardous feedstock.[45] Also, in 1995 ZSM exports were 3,800 tons, and ZSM imports were 4,900 tons.[46] The United States imported a total of 10,517 metric tons of zinc sulfate in 1999 and exported 4,750 metric tons the same year.[47] The United States imports most extensively from China, Mexico, and Germany. The three leading countries to whom the United States exports zinc sulfate are Canada, Mexico, and Costa Rica.[48] Table 2-7 lists the import and export volumes for these countries from 1992 to

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42 Queneau, Paul et al. June 22–24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Speical Programs and Continuing Education, Colorado School of Mines.

43 Queneau, Paul B., et al. Recycling Heavy Metals in Solid Waste. Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines. June 28-30, 1994; June 25-27, 1996; June 24-26, 1997; June 22-24, 1999; June 27-29, 2000.

Queneau, Paul B. U.S. Recycling of Industrial Metals, Office of Solid Waste, Hazardous Waste Minimization and Management Division. December 1-2, 1998.

44 U.S. International Trade Commission Database. "U.S. Imports for Consumption" and "U.S. Domestic Exports." HTS Code = 283326. 1989-1999.

45 Green, Richard, Martin Resources, teleconference with Katherine Heller and Lindsay James, Research Triangle Institute. March 19, 1999. Page 1.

46 ChemExpo. "Chemical Profile: Zinc Sulfate." <http://www.chemexpo.com/news/PROFILE970811.cfm>. As obtained on March 17, 1999. Page 1.

47 U.S. International Trade Commission Database. "U.S. Imports for Consumption" and "U.S. Domestic Exports." HTS Code = 283326. 1989-1999.

48 Ibid.

Table 2-7. Highest Volume U.S. Trading Partners, International Trade in Zinc Sulfate, 1992-1999, in Metric Tons

	1992	1993	1994	1995	1996	1997	1998	1999
Imports								
China	22	1,237	2,576	264	74	306	1,971	2,037
Mexico	3,379	3,589	3,986	4,361	3,547	6,247	7,684	7,800
Germany	154	172	233	237	232	213	188	237
All countries	3,828	5,617	7,197	5,399	4,054	7,094	10,366	10,517
Exports								
Canada	1,734	2,128	2,054	2,461	3,282	2,414	2,563	2,703
Mexico	112	40	122	928	617	596	724	732
Costa Rica	250	1,096	412	251	436	420	518	689
All countries	2,826	4,334	4,803	4,206	5,231	5,795	4,378	4,750

Source: U.S. International Trade Commission Database. "U.S. Imports for Consumption" and "U.S. Domestic Exports." HTS Code = 283326. 1989-1999.

1999. The countries are listed in order of their import or export volumes (highest volume listed first). U.S. imports appear to be cyclical, while exports are relatively stable, as seen in Figure 2-2. The cyclical nature of zinc sulfate imports may in part be a response to the cyclical nature of domestic demand for zinc micronutrient fertilizer. As discussed in Appendix E, the domestic demand for zinc micronutrient fertilizer apparently rises and falls every 4 or 5 years. U.S. imports of zinc sulfate also rise and fall in the same pattern but are offset by 1 year.[49] This pattern is especially clear with imports from China, as illustrated in Figure 2-3. One possibility is that, as demand rises again from a low point, zinc sulfate production cannot meet demand, and zinc sulfate imports rise to absorb this excess demand until zinc sulfate producers are able to raise their production levels. For example, 1993 was a low point for domestic ZSM production, but 1992 was a low point for Chinese zinc sulfate imports; by 1993 the Chinese imports were increasing.[50]

[49] Ibid.

[50] Ibid.

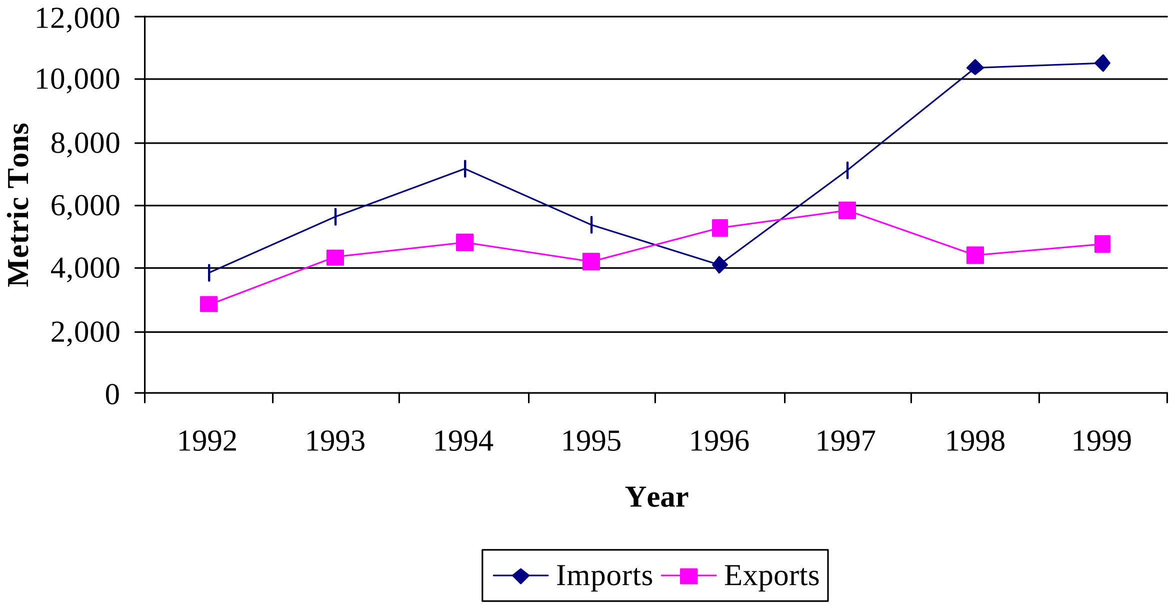

Figure 2-2. Zinc Sulfate Imports and Exports, 1992-1999 (Metric Tons)

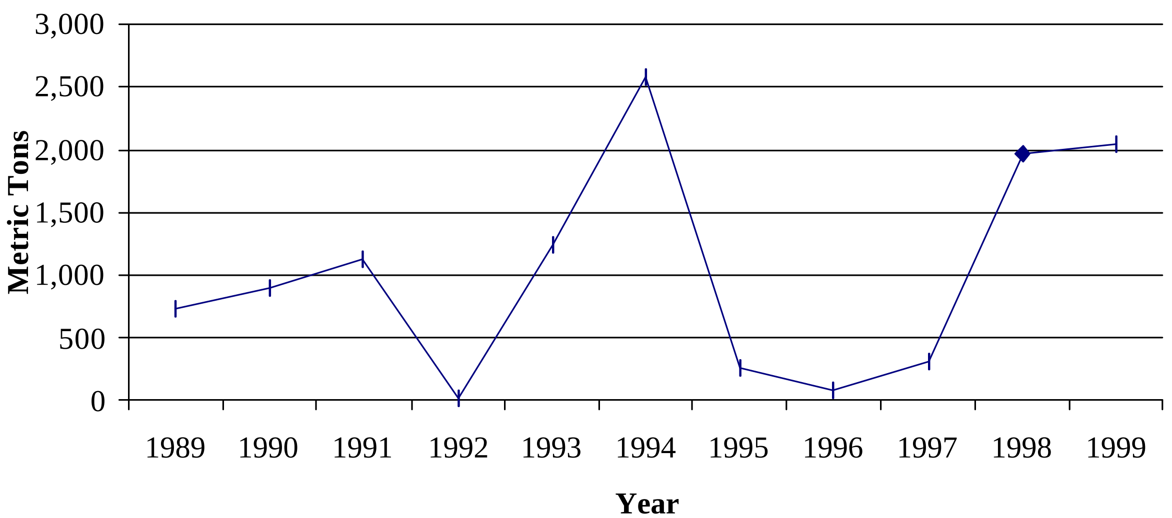

Figure 2-3. Chinese Imports of Zinc Sulfate, 1989-1999 (Metric Tons)

2.4.2 Market Prices

Prices for zinc micronutrient fertilizer products, per pound of zinc, vary depending on the type of product and the type of feedstock used to produce it. Thus, ZSM is uniformly priced higher than Oxy-sul, and Oxy-sul made from nonhazardous feedstocks is uniformly priced higher than Oxy-sul made from hazardous feedstocks. This pattern confirms information received from Richard Green, a fertilizer distributor. Mr. Green says zinc micronutrient's price varies primarily because of zinc content, but that somewhat lower prices would be paid for micronutrients with higher (nonnutritive) heavy metal content. According to a chemical industry database, 1997 ZSM prices range from $480 to $520 per ton.[51, 52]

Plant- and product-specific output prices per pound of zinc are shown in Table 2-8 (1997 data). Although the data in the table indicate a price of $0.59 per pound of zinc for Frit's Oxy-sul product, Frit president Carl Schauble indicates that their product sells for approximately $0.475 per pound of zinc.[53] This decrease in price may be due to a decline in market demand for zinc oxysulfates because of their heavy metal content.[54] Throughout this analysis, EPA uses the prices listed in Table 2-8.

Prices of zinc feedstocks also vary. Hazardous feedstocks are considerably cheaper than nonhazardous ones. Frit pays $10 per ton on average for the EAF dust from Nucor. Assuming the K061 has 20 percent zinc content, Frit pays approximately $0.025 per pound of zinc.[55] Bay Zinc pays $32/ton of tire ash. If tire ash has 31 percent zinc, this is approximately $0.052 per

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51 ChemExpo. "Chemical Profile: Zinc Sulfate." <http://www.chemexpo.com/news/PROFILE970811.cfm>. As obtained on March 17, 1999. Page 2.

52 Prices are on a per-ton basis, powder, bulk, f.o.b. works.

53 Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

54 ChemExpo. "Chemical Profile: Zinc Sulfate 7/3/2000." <http://www.chemexpo.com/news/PROFILE970811.cfm>. As obtained on August 11, 2000 Page 2

55 Ibid.

Table 2-8. 1997 Plant- and Product-Specific Output Prices of Zinc

Manufacturer	Location	Raw material	Product	% Zinc in product	Finished product annual tons	Zinc tons	Annual capacity tons	Sales price per ton of product	Sales price per pound zinc	Comments
Frit	Norfolk, NE	K061	Oxy-sul	20	15,000[a]	3,000[a]	Excess	$235	$0.59	
Frit	Walnut Ridge, AK	ZnO	Oxy-sul	35.5	9,000	3,240	Excess	$455	$0.63	
Madison Industries	Old Bridge, NJ	Zn fines and brass dust	ZSM	35	2,000	700	uk	$620	$0.69	Product used for animal feed
Madison Industries		Zn fines and brass dust	L. $ZnSO_4$	12	8,000	960	uk	$180	$0.75	Product used for animal feed
Big River	Sauget, Il	Brass dust	ZSM	31	6,500	2,015	6,500	$475	$0.77	
Bay Zinc	Moxee, WA	Tire ash	Oxy-sul	20	3,990[a]	798[a]	12,000	$235	$0.59	
		Zn fines	L. $ZnSO_4$	10.5	3,000	315	5,000	$155	$0.74	
Tetra Tech. (AMT)	Fairbury, NE	Zn fines and brass dust	ZSM	35.5	7,000	2,495	25,000	$620	$0.87	Product used for animal feed (½ total volume)
		Zn fines and brass dust	L. $ZnSO_4$	12	3,000	360	5,000	$180	$0.75	Product used for animal feed (½ total volume)
Tetra Tech. (WyZinCo)	Cheyenne, WY	Zn fines	ZSM	35.5	4,000	1,420	20,000	$590	$0.83	
Tetra Tech. (WyZinCo)		Zn fines	L. $ZnSO_4$	12	1,150	138	uk	$180	$0.75	
Chem & Pigment	Pittsburgh, CA	Zn fines	ZSM	35.5	2,000	710	8,000	$620	$0.87	
Chem & Pigment		Zn fines	L. $ZnSO_4$	12	2,500	300	3,000	$180	$0.75	
Mineral King	Hanford, CA	Zn fines	L. $ZnSO_4$	12	7,000	840	10,000	$165	$0.69	
Sims	Mt. Gilead, OH	ZnOH/Var	Oxy-sul	20	500	100	uk	$300	$0.75	
Sims		ZnOH/Var	Oxy-sul	31	2,000	620	uk	$440	$0.71	
Sims		ZnOH/Var	Oxy-sul	36	4,000	1,440	uk	$500	$0.69	
Agrium	Reise, MI	ZnOH/Var	Oxy-sul	40	1,500	600	uk	$465	$0.58	
Agrium		ZnOH/Var	Oxy-sul	27	1,500	405	uk	$375	$0.69	

Note: Big River is no longer using brass dust for the production of zinc micronutrient fertilizer.

uk = unknown.

[a] The finished product and zinc volumes have been estimated based on industry sources and production process requirements.

Source: Handout entitled “Zinc Micronutrient Fertilizer/Estimated Market Share Analysis” given to EPA during a meeting between representatives of the zinc micronutrient fertilizer industry and U.S. Environmental Protection Agency, April, 14, 1998.

pound of zinc.[56] Nonhazardous zinc feedstocks are more expensive and are estimated to cost about $0.30 and $0.42 per pound of zinc.[57, 58]

56 *Seattle Times*. November 23, 1997. "Toxic Sludge as Fertilizer." <http://www.purefood.com/Toxic/toxicSludge.html>. As obtained on March 10, 1999. Page 7.

57 Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

58 Queneau, Paul. Personal communication with Paul Borst, U.S. Environmental Protection Agency. March 9, 1999. Page 1.

CHAPTER 3

METHODOLOGY AND DATA LIMITATIONS

This chapter discusses the methodologies incorporated for the costs and economic impact analysis, as well as the data limitations and the assumptions that were used. This chapter begins with a description of the baseline conditions and behaviors of the zinc micronutrient fertilizer producers and zinc raw material suppliers. The analytical methodology used for calculating the costs and economic impacts is covered later in the chapter. The data sources, data limitations, and assumptions of the analysis are discussed in this chapter as well.

3.1 Baseline Conditions

To calculate the costs and economic impacts of the proposed rulemaking, the Agency must have an understanding of the costs that the affected entities are incurring prior to the rulemaking. This set of costs and behaviors occurring in the industry prior to the rulemaking is called the baseline.

This section characterizes the baseline conditions that are incorporated into the cost and economic impact analysis described in Chapter 5. These baseline conditions assume that all affected companies are handling their hazardous waste according to current applicable RCRA regulations.

3.1.1 Zinc Fertilizer Manufacturers

Under the baseline conditions, the Agency assumes that the zinc fertilizer producers that are using hazardous waste are all RCRA-compliant. This means that every facility, with the exception of Frit, which does not require one, has a RCRA permit and handles the raw material in such a manner that it does not touch the soil and cannot be wind dispersed. A description of compliance behavior for each facility is given below.

Table 3-1 shows the two zinc fertilizer producers currently using hazardous waste as a feedstock. Frit Industries' plant in Norfolk, NE, uses EAF dust (K061) from Nucor Steel as a feedstock for the production of Oxy-sul. Frit operates its facility on-site with Nucor; therefore, it

Table 3-1. Directly Affected Zinc Fertilizer Producers and Feedstocks

Manufacturer	Location	Zinc feedstock	Volume of feedstock processed (tons)	Source of zinc feedstock	Price paid per ton of raw material
Frit	Norfolk, NE	K061 (EAF dust)	10,000	Nucor Steel, NE	$10
Bay Zinc	Mozee, WA	Tire ash	3,120	Exeter Energy, CT	$32

incurs no hazardous waste transportation costs and does not require a RCRA storage permit.[1] The K061 dust is directly piped from Nucor to a Frit-operated storage silo.[2] In 1999, Frit produced 12,000 tons of Oxy-sul.[3]

Bay Zinc produces Oxy-sul from tire ash and has recently begun producing ZSM from nonhazardous feedstocks. Bay Zinc currently holds a RCRA permit for the storage of hazardous waste. Bay Zinc typically receives the tire ash in bulk shipments. The raw material is unloaded from the bottom of the rail car into a neoprene boot, through a grizzly into a screw conveyor. The screw conveyor carries the raw material to a covered silo. If the tire ash arrives in Supersacks, then Bay Zinc unloads them onto a concrete loading area in a covered building. The sacks are then hoisted and unloaded by a "bag-unloading machine." Recently, Bay Zinc has modified its handling process and is loading raw materials into a slurry tank and spraying the material with water. This method turns the dust into pumpable material that is easy to manage.[4] In 1998, Bay Zinc produced approximately 5,000 tons of Oxy-sul from tire ash.[5] Bay Zinc also has a recently installed ZSM line that currently uses nonhazardous, nonwaste-derived zinc feedstock.[6]

3.1.2 Zinc Raw Material Suppliers

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[1] Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

[2] Borst, Paul, U.S. Environmental Protection Agency, e-mail message to Katherine Heller, Research Triangle Institute. March 16, 1999. Revised Frit meeting notes and handling requirements for fertilizer. Page 1.

[3] Queneau, Paul et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

[4] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999. Page 1-2.

[5] Volume estimated based on Richard Camp (Bay Zinc) Teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999. Page 1.

[6] Ibid.

Under these baseline conditions, this analysis assumes the two raw material suppliers are RCRA-compliant. Every facility must handle the hazardous waste in a manner compliant with RCRA, including shipping the waste in a manifest fashion. The compliance behaviors for the two types of facilities are described below.

Nucor Steel does not store the K061 for more than 90 days; therefore, this facility does not require a RCRA storage permit. In 1999, Nucor sent at least 10,000 tons of EAF dust through the pipeline to Frit;[7] in 1999, Nucor may have transported as much as 12,500 tons of EAF dust to Frit.[8]

Exeter Energy is currently shipping the waste from its tire-burning operation to Bay Zinc. Exeter Energy's behavior in the baseline assumes the company is shipping its tire ash in a manner compliant with RCRA. In this baseline, the costs of storing the hazardous waste in a manner compliant with RCRA are calculated and used in the economic analysis. Additional costs are associated with loading the material onto a truck. Finally, the compliance baseline includes the costs of preparing records and transporting the raw material using a hazardous waste transport firm and a hazardous waste manifest.

3.2 Analytical Methodology

Under the assumption that the affected entities are currently in compliance with RCRA regulations, the Agency characterized the baseline operations of each entity. The Agency then compared the facility operations in the baseline conditions to the facility operations under the conditions of the proposed rulemaking and identified any changes that might be expected. Based on these expected changes, the Agency then estimated the costs or cost savings for zinc micronutrient fertilizer producers and their raw material suppliers. The Agency considered the effects the changes in costs will have on the markets and derived the economic impacts.

3.3 Data Sources, Data Limitations, and Assumptions

The zinc micronutrient fertilizer industry is a small industry, with fewer than 20 manufacturers. Because of its size, publicly available information on the zinc micronutrient fertilizer industry is scarce. The main sources of information used for this analysis were Paul Queneau's short course documents and telephone conversations with industry representatives, such as fertilizer dealers, company leaders, and representatives from trade associations.

Data limitations were present throughout this analysis. The exact amount of K061 incorporated into Frit's production of Oxy-sul was unknown and had to be estimated. Likewise, the amount of ZSM that could be produced by a new facility at Frit had to be estimated. The sales and employment data for each facility were difficult to obtain, and the Agency restricted the

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[7] K061 volume estimated based on Queneau, Paul et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

[8] Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

acquisition of this information to those entities that may be directly affected by the proposed rulemaking. The risk information that the Agency possessed was limited; therefore, the benefits assessment had to be qualitative rather then quantitative.

The Agency made several assumptions throughout the analysis. First of all, the baseline incorporated into the cost analysis assumed that all affected entities were currently in full compliance with RCRA regulations. Throughout the economic analysis, the Agency had to project post-rule behaviors for the directly and indirectly affected entities, and this projection required several basic economic assumptions. For example, the Agency assumed a company would choose the least-cost alternative when making a company decision.

EPA acknowledges that the prediction of significant cost savings for one of the directly affected firms is a controversial topic and an unusual situation. To achieve this financial improvement requires the firm to make an estimated capital investment of $5.68 million. This substantial investment may have discouraged the company from taking this step in the absence of the proposed conditional exclusion, in spite of the fact that the investment may be profitable. Under the conditional exclusion, however, the firm is faced with the need to incur costs to make changes in its production process in order to comply. Faced with this necessity, EPA projects that the firm will choose to incur substantial capital cost, because overall it will be more profitable than the firm's other compliance option. EPA solicits comment with regard to the cost savings predicted in this economic analysis.

Throughout this analysis, EPA uses volume and price data from 1997, from a handout entitled "Zinc Micronutrient Fertilizer/Estimated Market Share Analysis," which was given to EPA during a meeting between representatives of the zinc micronutrient fertilizer industry and EPA on April 14, 1998. Because of the cyclical nature of zinc micronutrient fertilizer demand, choosing a single year as a baseline may seem risky. However, EPA has examined zinc micronutrient fertilizer volume data for several years (1993, 1995, 1996, 1997, 1998, and 1999), and has chosen 1997 as a comparison year to use for this analysis.. (EPA chose to use the abovementioned handout as a primary source because this source provides both price and volume data. EPA relied on Paul Queneau's "Recycling Heavy Metals in Solid Waste" data for examining production trends, since this data source provides a time series.) When comparing 1997 volumes to the average volume from these 6 years, the 1997 volumes fall within one standard deviation of the average. For ZSM volumes, liquid zinc sulfate volumes, and volumes of contained zinc, the 1997 volumes are two-fifths or less of one standard deviation from the average, indicating that 1997 is a representative year for zinc micronutrient fertilizer production. Figures 3-1 through 3-4 present these trends.

EPA solicits comment on the methodology and data used in this analysis.

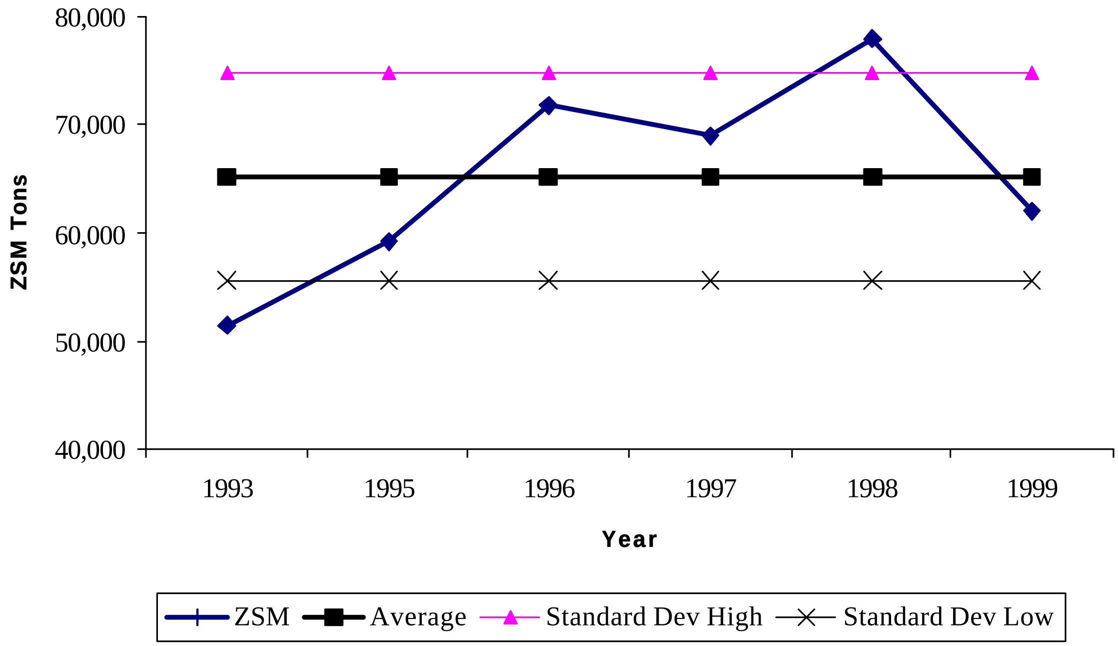

Figure 3-1. Annual Domestic ZSM Production, 1993–1999 (standard tons)

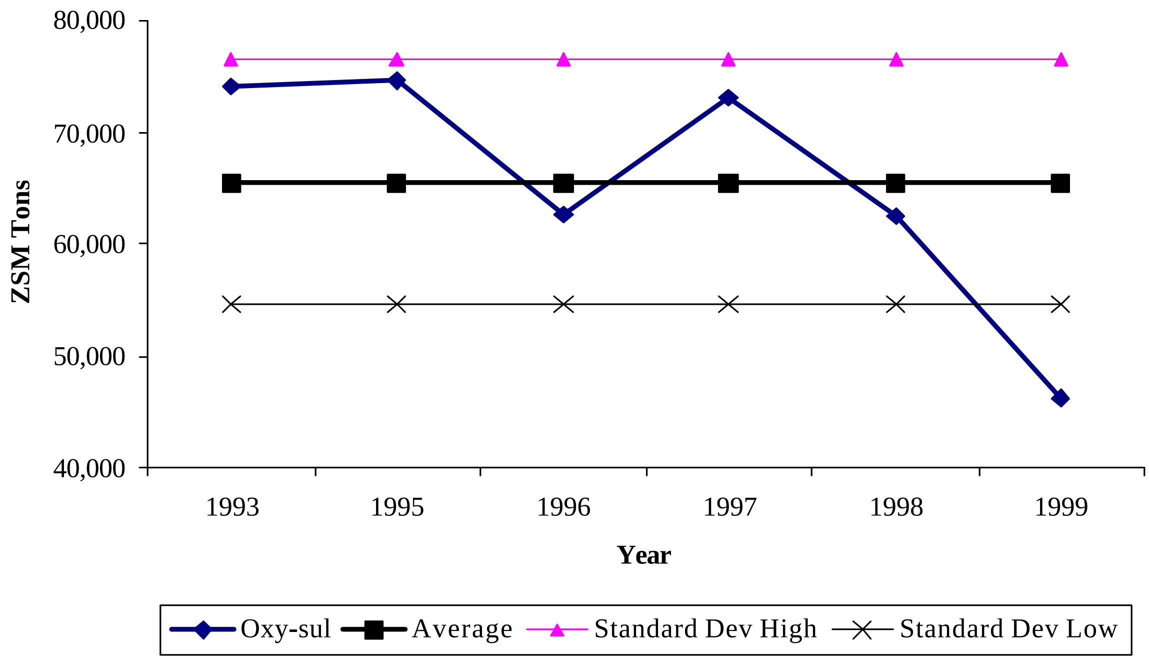

Figure 3-2. Annual Domestic Oxy-sul Production, 1993–1999 (standard tons)

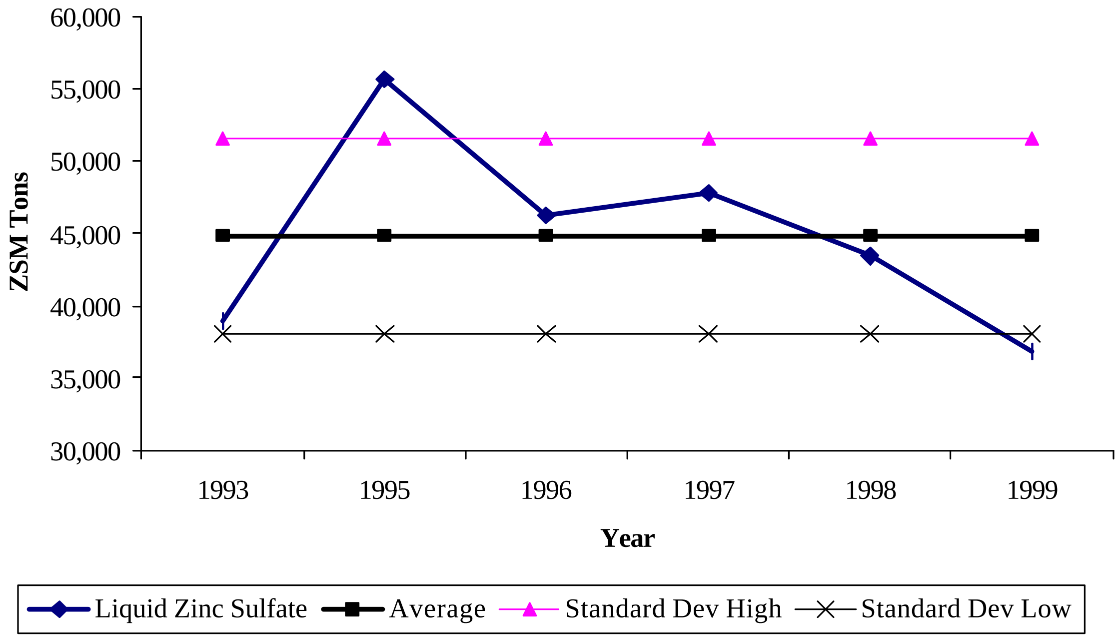

Figure 3-3. Annual Domestic Liquid Zinc Sulfate Production, 1993–1999 (standard tons)

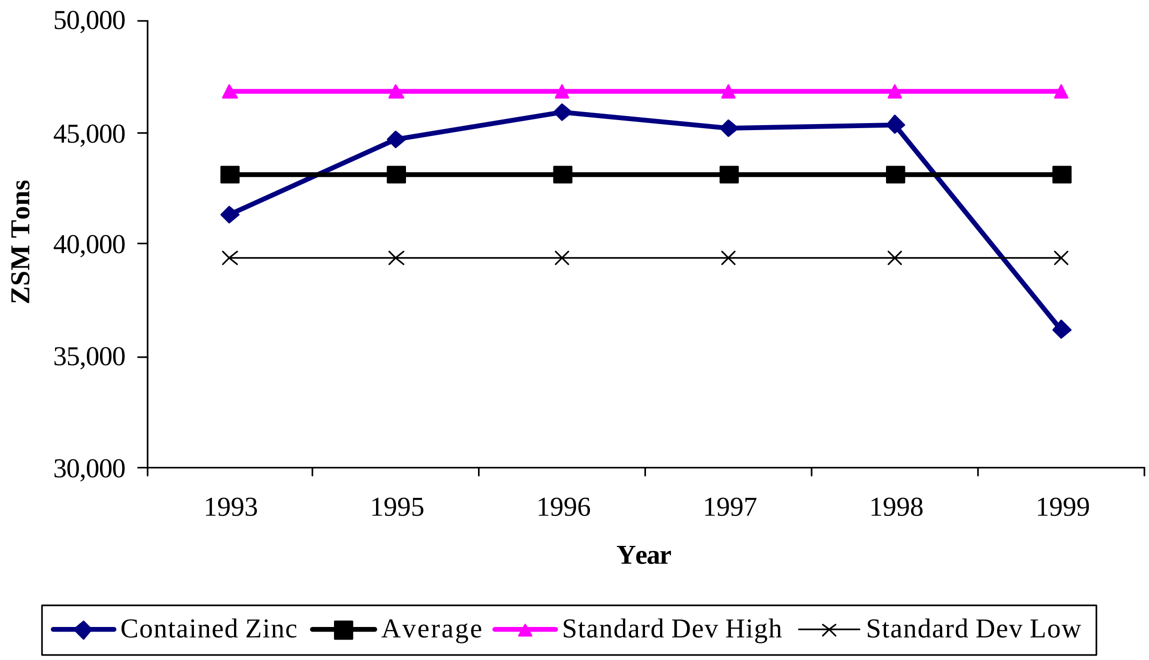

Figure 3-4. Annual Domestic Zinc Micronutrient Fertilizer Production in Zinc Tons, 1993–1999 (standard tons)

CHAPTER 4

PROPOSED RULEMAKING

EPA's proposed rulemaking would

- remove the K061 fertilizer exemption from RCRA regulation,
- provide a conditional exclusion from the definition of solid waste for hazardous secondary feedstocks (e.g., brass fume dust, EAF dust from steel mills) used to produce zinc-containing fertilizers, and
- provide product specifications based on ZSM for excluding hazardous waste-derived zinc-containing fertilizers.

The conditions for the exclusion of the hazardous secondary feedstocks would include handling requirements for storage and transport (e.g., no outdoor storage), reporting requirements, and labeling requirements. The current regulation and the proposed rulemaking are described in more detail below.

4.1 Current Regulation

Under current RCRA regulation, the following feedstocks used in zinc fertilizer manufacturing are typically characterized as solid wastes and hazardous wastes because they are used in a manner constituting disposal: EAF dust (K061) and brass fume dust (D006, D008) (40 CFR §261.2[c][1]). All of these hazardous wastes are currently fully regulated until the product is made. This means that hazardous waste generator requirements, transporter requirements, and storage requirements (i.e., must have a permit at the recycling facility) are all applicable (see 40 CFR Part 266 Subpart B). The current handling requirements proscribe land storage and require the prevention of wind dispersal.

Hazardous waste-derived fertilizers, except for K061-derived fertilizers, are conditionally exempt from regulation. There are two conditions: the fertilizer must be produced for the public's use, and the fertilizer must meet the applicable treatment standard listed under Subpart D of Part 268. K061-derived fertilizers are currently unconditionally exempt from regulation (40 CFR §266.20[b]).

In May 1998, the Phase IV LDR final rule changed the treatment standard for hazardous waste fertilizers from the Third Third treatment standard to the more stringent UTS levels. The Agency stayed the effect of the rule in August 1998, however, effectively placing hazardous waste-derived fertilizers back under the Third Third standard.

4.2 Proposed Rulemaking

The primary regulatory difference in the proposed rulemaking is a change in the status of EAF dust and brass fume dust used to produce fertilizers. Secondary feedstocks currently classified as solid wastes that are also hazardous wastes when used to produce fertilizer will no longer be classified as solid wastes or hazardous wastes, provided that they meet the following conditions:

- prior to recycling, such secondary materials are stored in tanks, containers, or buildings so that the materials are not placed on soils and that wind dispersal of the material is prevented;
- records of all shipments of hazardous secondary materials to the fertilizer manufacturer are maintained by the manufacturer for no less than 3 years, and these records identify at a minimum the volume, source, and type of material shipped; and
- for zinc micronutrient fertilizer made from hazardous secondary materials, the fertilizer meets the following standards for Maximum Allowable Concentrations of Hazardous Constituents (milligrams per kilogram of zinc):
  - Lead: based on ZSM levels
  - Cadmium: based on ZSM levels

The last provision of the conditional exemption will require that all zinc fertilizers have levels of cadmium and lead that are as low as the levels in ZSM. Oxy-sul produced from hazardous materials will most likely not be able to meet these treatment standards. Because the Agency is setting treatment standards, the proposed rulemaking includes a deletion of the provision that stayed the effectiveness of Phase IV LDR for zinc fertilizers.

The proposed rulemaking also considers commercial fertilizers (beyond zinc fertilizers) that contain recyclable materials and are produced for the general public's use. These fertilizers would not be subject to regulation provided that they meet the same treatment standards.

CHAPTER 5

COSTS AND ECONOMIC IMPACTS

In this section, EPA examines possible responses to the proposed conditional exclusion; estimates the costs or cost savings associated with those responses; and analyzes the impacts of these costs or cost savings on affected facilities, companies, and markets.

5.1 Cost Analysis

EPA analyzed the cost of compliance by first assessing baseline regulatory requirements and baseline performance, then determining what changes would be required or would be likely in response to the rulemaking. The baseline conditions are described in Section 2. This section describes EPA's analysis of possible facility choices in response to the conditional exclusion. EPA then compares performance that will comply with the conditional RCRA exclusion being considered to the baseline and computes the incremental cost (or cost savings) associated with the conditional RCRA exclusion. In this section, EPA presents the models used to estimate the costs of the rulemaking relative to each baseline and discusses the estimated costs and/or cost savings.

5.1.1 Costing Model and Assumptions

EPA estimates that the proposed rulemaking will directly affect two zinc micronutrient fertilizer manufacturers and one raw material supplier. EPA assumed that all facilities are complying with all applicable RCRA requirements at baseline, and that they will choose to respond to the conditional RCRA exclusion in the manner that is most profitable to them. Other facilities may be indirectly affected by the proposed rulemaking. These facilities are discussed in Section 5.1.3.

Two facilities, owned by Frit Industries and Bay Zinc, are currently producing Oxy-sul fertilizer from hazardous feedstocks. These products are not believed to meet the conditional exclusion's treatment standards, so these facilities must change their feedstocks or their production processes, or both. The three facilities projected to be directly affected by the proposed conditional exclusion include

- Frit Industries' Norfolk, NE, plant, which manufactures Oxy-sul from EAF dust it receives from the Nucor Industries steel plant with which it is co-located;
- Bay Zinc, which currently has a RCRA part B permit, and manufactures both ZSM from nonhazardous, nonwaste feedstocks and Oxy-sul from tire ash; and
- Exeter Energy, which supplies the tire ash used by Bay Zinc.

5.1.2 Estimated Costs and Cost Savings

Frit Industries' Norfolk, NE, plant is located on property owned by Nucor Steel and receives EAF dust that is piped directly from Nucor's air pollution control device to a silo at

Frit's plant. Frit is assumed to accept 10,000 tons of EAF dust in 1999.[1] EPA examined two possible responses for Frit:

- invest in a ZSM line and continue to accept K061, or
- substitute a nonhazardous zinc feedstock for K061 and continue to make Oxy-sul.

To evaluate which of the two responses Frit would select, EPA examined the cost and revenue implications of each. Both options are estimated to increase both Frit's costs and its revenues. The least costly option is shown in Table 5-1 for the first response. If Frit chooses to invest in a ZSM line, Frit is estimated to incur capital costs of $5.68 million to install new equipment. Annualized over 20 years, this is an annualized cost of $536,000. In addition, ZSM production involves filtering out the heavy metals from the zinc raw materials. This waste material (estimated to be 2,100 tons) is then assumed to be treated and disposed of off-site in a hazardous waste landfill. Finally, Frit will incur some costs for recordkeeping and reporting. These costs are estimated to be somewhat higher in the first year as systems are set up. On the other hand, the ZSM that would be produced (an estimated output of 6,700 tons) has a higher zinc content and commands a higher price per pound of zinc. Thus, EPA estimates that Frit's revenues would increase significantly if they chose to install a ZSM line. In this scenario, Frit is assumed to accept a higher quantity of K061,[2] so Nucor will not incur additional costs as a result of the conditional exclusion.

Table 5-1 shows the estimated changes in Frit's costs and revenues associated with complying by installing a ZSM line. Frit's costs are estimated to increase by approximately $900,000 per year (slightly more the first year, slightly less for subsequent years). Because ZSM is 35.5 percent zinc (compared to Oxy-sul's 20 percent zinc), and because ZSM sells for $0.87 per pound of zinc (compared to Oxy-sul's $0.59 per pound of zinc), Frit's revenues are estimated to increase from approximately $2.8 million per year to approximately $4.2 million per year, an increase of $1.3 million per year. Nucor's revenues would increase by $20,000 (because of selling additional K061 to Frit) if Frit chooses to process K061 into ZSM.

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1 K061 volume estimated based on 12,000 ton Oxy-sul production volume given in Queneau, Paul et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

2 Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Mr. Schauble estimated that 1999 K061 quantity might increase to 12,500 tons. Based on this indication of increased K061 levels, EPA has modeled a ZSM line with the capacity to accept 12,000 tons of raw material.

Table 5-1. Estimated Costs of Complying with the Conditional Exclusion for Frit Industries, Scenario 1: Install ZSM Line

	Cost or cost savings?	First year of compliance	Each subsequent year
Annualized capital costs for ZSM line[a]	Cost	$536,000	$536,000
Transportation, treatment, and disposal of 2,100 tons of waste	Cost	$344,830	$344,830
Recordkeeping and reporting	Cost	$21,596	$13,400
Increased cost for additional K061	Cost	$20,000	$20,000
Estimated incremental costs		$922,426	$914,230
Estimated change in Frit's revenue[b]	Cost savings	–$1,344,270	–$1,344,270
Total net costs (including increased revenues)	Cost savings	–$421,844	–$430,040

[a] Estimated based on 12,000 tons of K061, 6,761 tons of ZSM. There may be some additional operating costs associated with operating a ZSM line relative to an Oxy-sul line, which are omitted from this calculation.
[b] Estimated revenue changes based on following assumptions: Volume of zinc in ZSM: 2,400 tons, price of zinc in ZSM: $0.87/lb. Volume of zinc in Oxy-sul: 2,400 tons, price of zinc in Oxy-sul: $0.59/lb.

If Frit chooses to substitute a nonhazardous feedstock and continue to make Oxy-sul, it will incur the increased cost of purchasing the nonhazardous feedstock, and it will receive higher revenues from the sale of its product, for two reasons:

- The zinc content of the nonhazardous feedstock is higher. Nonhazardous feedstock is 60 percent zinc,[3] while K061 is 20 percent zinc.[4]
- The Oxy-sul made from nonhazardous feedstocks can be sold for a higher price: $0.69 per pound of zinc in the nonhazardous-derived Oxy-sul, compared to $0.59 per pound of zinc in the K061-derived Oxy-sul.

If Frit chooses to substitute a nonhazardous feedstock, Nucor would incur the costs of treating and disposing of the K061 in a hazardous waste landfill.

Table 5-2 shows the estimated changes to Frit's costs and revenues and to Nucor's costs if Frit chooses to substitute a nonhazardous feedstock and continue making Oxy-sul. As Table 5-2 shows, both Frit's costs and revenues are estimated to increase significantly if it substitutes

3 Queneau, Paul, personal communication with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999. Page 1.

4 Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999.

Table 5-2. Estimated Costs of Complying with the Conditional Exclusion for Frit Industries, Scenario 2: Substitute Nonhazardous Feedstock

Frit's costs and revenues [a]	Oxy-sul derived from K061	Oxy-sul derived from nonhazardous feedstock	Change resulting from substitution of nonhazardous feedstock
Estimated revenues from sale of Oxy-sul	$2,832,000	$6,226,560	$3,394,560
Estimated feedstock costs	$460,180	$4,055,400	$3,595,220
Estimated profit	$2,371,820	$2,171,160	–$200,660
Nucor's cost to dispose of K061	–$100,000	$1,624,200	$1,724,200

[a] There may be some additional capital equipment required to use nonhazardous feedstock, for managing feedstock received from offsite. The cost of this equipment, if any, has been omitted from this calculation, as well as the possible costs of relocation.

nonhazardous zinc feedstock in its Oxy-sul operation. Overall, EPA estimates that Frit's profits may decrease slightly if it makes this substitution. This analysis does not include the capital costs that would be incurred if Frit can no longer colocate with Nucor after closing their K061-derived Oxy-sul production line. In this likely scenario, Frit would incur significant costs if it substitutes nonhazardous zinc. These potential costs associated with relocation are not shown in Table 5-2. Nucor, which had received $100,000 per year for its K061 when Frit used it as a feedstock, would now be required to spend an estimated $1.62 million to transport, treat, and dispose of it in a hazardous waste landfill.

Based on the analysis described in Tables 5-1 and 5-2, EPA believes that Frit would choose to install a ZSM line.

Bay Zinc, the other zinc micronutrient fertilizer producer using hazardous waste as a feedstock, is also assumed to have two alternative means of complying with the conditional exclusion:

- It may choose to abandon Oxy-sul production entirely, which would reduce both its costs and its revenues.
- It could choose to substitute a nonhazardous feedstock for the tire ash it is currently using and continue to produce Oxy-sul

If Bay Zinc chooses the latter alternative, both its costs and its revenues would increase. Bay Zinc currently has a RCRA Part B permit. Whichever compliance alternative Bay Zinc selects, its RCRA permit would no longer need to be renewed under the conditional exclusion (a cost savings). In addition, the recordkeeping and reporting requirements under the conditional exclusion are less burdensome than those required under RCRA, which would also result in a cost savings.

Table 5-3 shows the cost and revenue implications of Bay Zinc's two compliance alternatives. Under the first scenario, where Bay Zinc stops producing Oxy-sul, EPA's analysis indicates that costs will exceed cost savings by more than $350,000 per year. If, however, Bay Zinc chooses to substitute a nonhazardous feedstock, EPA's analysis indicates that it will incur less costs (taking into account changes in revenues and cost savings), of approximately $140,000.

Table 5-3. Estimated Costs of Complying with the Conditional Exclusion for Bay Zinc

	Cost or cost savings?	Amount
Scenario 1: Bay Zinc Ceases Oyx-sul Production		
Current cost of production (labor and feedstock)	Cost savings	–$718,400
Current revenues from sale of Oxy-sul	Cost	$1,141,296
No renewal of RCRA permit	Cost savings	–$21,341
Change in recordkeeping and reporting	Cost savings	–$7,941
Salvage value of equipment	Cost savings	–$38,414
Total cost, Scenario 1		$355,200
Scenario 2: Substitute Nonhazardous Feedstock		
Current cost of production (labor and feedstock)	Cost savings	–$718,400
Current revenues from sale of Oxy-sul	Cost	$1,141,296
New cost of production (labor and feedstock)	Cost	$2,254,760
New revenues	Cost savings	–$2,509,304
No renewal of RCRA permit	Cost savings	–$21,341
Change in recordkeeping and reporting	Cost savings	–$7,941
Total cost, Scenario 2		$139,070

EPA believes the costs potentially incurred by Bay Zinc (associated with switching to a nonhazardous feedstock for Oxy-sul production) would be significantly offset by the potential cost savings of substituting brass fume dust into their ZSM production. EPA has not quantified these potential cost savings, but believes the scope of these savings to be between one and two million dollars annually. Bay Zinc currently operates a ZSM production line, which incorporates nonhazardous secondary zinc inputs as feedstock.[5] Bay Zinc is evaluating other hazardous and

[5] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999.

nonhazardous feedstocks, including brass fume dust.[6] Under the conditional exclusion, brass fume dust would provide a less expensive source of zinc for ZSM fertilizer production, and EPA predicts that Bay Zinc will change their behavior as a result of this post-rule cost advantage.

Even though EPA is examining this scenario qualitatively, the Agency has calculated the scope of potential cost savings by analyzing the price difference between nonhazardous secondary zinc and brass fume dust. Crude secondary zinc oxide from Zinc Nacional costs $0.415 per pound of zinc,[7] while brass fume dust costs $0.141 per pound of zinc;[8] these prices indicate a cost differential of $0.274 per pound zinc. Bay Zinc produced 5,000 tons of ZSM in 1999,[9] and is reportedly planning to increase their production of ZSM to 8,000 tons.[10] At 35.5 percent zinc (the average zinc content for ZSM), Bay Zinc may be processing roughly 1,800 to 2,800 tons of zinc per year. Under these circumstances, Bay Zinc could save between $986,000 and $1,534,000 by incorporating brass fume dust into their ZSM production. (The cost savings increase as ZSM production volume increases.) These potential cost savings more than offset the predicted costs described in Table 5-3.

EPA also notes that there is currently a market trend away from zinc oxysulfate in favor of zinc sulfate monohydrate due to the former's higher heavy metal content.[11] Therefore, it is likely that even in the absence of this proposed rulemaking, the marketability of zinc oxysulfate is declining in favor of zinc sulfate monohydrate production.

Whichever alternative Bay Zinc selects, it will probably not continue to accept tire ash from Exeter Energy. Thus, under either alternative, EPA anticipates that Exeter will incur the costs of disposing of its tire ash in an alternative manner. One viable option is for Exeter Energy to send its tire ash to Zinc Nacional in Monterrey, Mexico, for zinc reclamation. Exeter Energy will most likely experience increased costs post-rule as shown in Table 5-4.

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6 Ibid.

7 Zinc Nacional selling price from Paul Queneau, personal communication with Paul Borst, U.S. Environmental Protection Agency, April 16, 1999.

8 Arnett, John E. June 2, 2000. Copper and Brass Fabricators Council, Inc. Brass fume dust averages 46 percent zinc, and the average price paid by ZSM manufacturers in $0.07 per pound dust.

9 Queneau, Paul et al. June 27-29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

10 Queneau, Paul et al. June 22-24, 1999. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

11 See <<http://www.chemexpo.com/news/newsframe.cfm?framebody=/news/profile.cfm>> as obtained August 27, 2000 for zinc sulfate.

Table 5-4. Estimated Costs of Conditional Exclusion for Exeter Energy

Cost element	Cost
Current net cost to recycle at Bay Zinc	$227,760
Cost of reclamation at Zinc Nacional	$436,800
Incremental cost	$209,040

Please see Appendices B and C for an in-depth description of EPA's methodology for deriving costs.

5.1.3 Use of Brass Baghouse Dust in ZSM Production

Based on available information, Madison Industries and Tetra Micronutrients are the two zinc micronutrient manufacturers who are currently using brass fume dust as a feedstock.[12] Big River Zinc, a zinc producer which had used the dust in 1997, is not currently using this material. The number and type of brass dust supplier (either an ingot maker or large foundry) to each firm are unknown. Tetra Micronutrients in 1998 produced 10,000 tons of ZSM containing 2,845 tons of zinc. However, Tetra produces some of its zinc micronutrients from nonhazardous galvanizing fines as well as brass dust. Since the proportion of zinc made from hazardous feedstocks is limited to the feed market,[13] this analysis assumes that a small proportion of 20 to 40 percent of the throughput at Tetra's Fairbury, NE, facility is derived from hazardous brass dust sources. This analysis uses a value of 854 tons. Madison Industries, in 1997, produced 10,000 tons of ZSM containing 1,660 tons of zinc. Again, EPA estimates that 20 to 40 percent of the feedstock is derived from brass dust resulting in a value of 489 tons of zinc from brass dust. In addition, Big River Zinc produces ZSM using nonhazardous feedstock at present. Producing their current volume of ZSM requires 2,015 tons of zinc. Thus, if Big River switches to brass dust as a feedstock, the total volume of brass dust-derived zinc used for ZSM production is estimated to be 3,366 tons.

EPA used the following assumptions to develop model facilities for brass dust generators.

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[12] Madison Industries' and Tetra Micronutrient's use of brass dust comes from a handout entitled "Zinc Micronutrient Fertilizer/ Estimated Market Share Analysis" given to EPA during a meeting between representatives of the zinc micronutrient fertilizer industry and EPA, April, 14,1998 Bay Zinc's interest in brass dust was identified in a personal communication between Paul Borst of EPA and Richard Camp of Bay Zinc, April 16, 1999. Planned zinc micronutrient production from the Bay Zinc was obtained from Paul Queneau, et al., "Recycling Heavy Metals in Solid Waste," Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines, June 22-24, 1999.

[13] Tetra indicates that all zinc derived from hazardous feedstocks (brass dust) is used in the feed industry and is not used to produce fertilizer currently. Personal communication between Paul Borst, USEPA, and Mike Deiker, Tetra Micronutrients, July 16, 1999.

- There are approximately 12 brass ingot makers in the United States.[14]
- A typical ingot maker may generate between 100 and 2,500 tons of baghouse dust annually.[15]
- Brass ingot maker baghouse dust averages 60 to 70 percent zinc.[16]
- A typical ingot maker may ship one to two railroad cars of baghouse dust per month with between 75 and 90 tons of dust per car.[17]
- This analysis assumes an average generation rate of 450 tons of ingot maker baghouse dust per year, with a concentration of 65 percent zinc. Because the zinc content in the ingot maker baghouse dust is relatively high and there is a comparatively larger volume of dust per facility than a foundry, this analysis assumes that ingot makers are the principal suppliers of this type of material to zinc micronutrient manufacturers.
- There are approximately 791 brass and bronze or brass, bronze, and aluminum foundries in the United States that generate TC metal hazardous waste.[18] Typically nonferrous foundries generated 32 tons of baghouse dust per year.[19] However, empirically, larger brass foundries generate more dust and are therefore better able to afford the freight costs associated with shipping baghouse dust longer distances. Therefore, this analysis assumes a value of 100 tons per nonferrous foundry rather than the 32 ton average that characterizes the industry and assumes that three foundries supply baghouse dust to the fertilizer producers.
- There are 12 brass mills in the country. They are assumed to generate, on average, 125 tons of baghouse dust per year. EPA assumes that 10 of the 12 supply baghouse dust to fertilizer producers.

The conditional exclusion will mean the brass fume dust, if recycled into ZSM fertilizer or animal feed, is not solid waste. To analyze the impact of the conditional exclusion on brass fume

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14 Personal communication between Paul A. Borst, USEPA, and Mike Oberlin, I Schumann Inc. (a brass ingot maker), July 14, 1999.

15 Personal communication between Paul Borst, USEPA, and George Obeldobel, Big River Zinc, July 12, 1999.

16 Borst and Oberlin, July 14, 1999.

17 Personal communication between Paul Borst, USEPA, and Allan Silber, Recyclers of Copper Alloy Products. (RE-CAP), July 14, 1999.

18 Letter from Collier, Shannon, Rill, and Scott on behalf of the American Foundrymen's Society to the EPA RCRA Information Center commenting on the Phase IV LDR proposed rulemaking, November 27, 1995.

19 Personal communication between Paul Borst, USEPA, and Gary Mosher, American Foundrymen's Society, November 19, 1998.

dust generators, EPA assumes that ten ingot makers, ten brass mills, and the three largest brass foundries generating brass fume dust sell their brass fume dust to ZSM manufacturers. Because EPA does not know the characteristics of the specific generators, a model facility approach is used to characterize the generators. Table 5-5 depicts the characteristics of each typical brass fume generator.

Table 5-5. Typical Brass Mill, Brass Foundry, and Brass Ingot Maker

	Brass mill	Brass foundry	Brass ingot maker
Size (tons/yr)	125	100	450
Zinc content	35%	35%	65%
Baseline management	Send for reclamation, cost: $0.17/lb, sold to ZSM producer, $0.058/lb	Send for reclamation, cost: $0.17/lb, sold to ZSM producer, $0.058/lb	Send for animal feed, cost: $0.12/lb, sold to ZSM producer, $0.077/lb
Post-rule management	Sell to ZSM manufacturer, $0.058/lb	Sell to ZSM manufacturer, $0.058/lb	Sell to ZSM manufacturer, $0.077/lb
Number of generators	10	3	10

Overall, the Agency expects brass baghouse dust generators to benefit from the regulation. In the absence of the conditional exclusion, the brass generators are assumed to sell only about 1,350 tons of baghouse dust to ZSM producers at an average price of $0.065 per pound; the rest is assumed to be sent to Zinc Nacional, Horsehead Resource Development, or another zinc reclaimer for reclamation, at an average cost of $0.15 per pound.[20] Post-rule, the generators are assumed to sell approximately 3,500 tons of their brass baghouse dust to ZSM manufacturers, at an average price of $0.065 per pound. The actual cost for reclamation and price received from the ZSM manufacturers is assumed to reflect the variation in zinc content from the different types of brass baghouse dust generators. Brass mills and brass foundries are assumed to generate brass baghouse dust with an average zinc concentration of 35 percent, while brass ingot makers are assumed to generate dust with an average zinc concentration of 65 percent. Ingot makers are thus assumed to pay less for reclamation and earn more from ZSM makers for their brass baghouse dust. For all types of generators, the rulemaking is expected to result in reduced cost and increased revenues, averaging an increase in revenues of $0.22 per pound of brass dust sold to ZSM producers. Table 5-6 shows estimated impacts on typical brass dust generators.

[20] Arnett, John E. June 2, 2000. Copper and Brass Fabricators Council, Inc. Brass Mill Baghouse Dust. Brass fume dust averages 46 percent zinc; the average cost for reclamation is $0.15/lb, and the average price for paid by ZSM manufacturers is $0.07.

Table 5-7. ZSM Producers Using or Projected to Use Brass Baghouse Dust

	Big River Zinc	Madison Industries	Tetra, Fairbury, NE
Quantity of ZSM tons/yr	6,500	2,000 granular, 8,000 liquid	7,000 granular, 3,000 liquid
Baseline feedstock	ZnO	Zinc fines, brass dust	Zinc fines, brass dust
Post-rule feedstock	Brass dust	Zinc fines, brass dust	Zinc fines, brass dust
Baseline product	fertilizer	½ feed, ½ fertilizer	½ feed, ½ fertilizer
Post-rule product	fertilizer	fertilizer	fertilizer

Table 5-6. Financial Impacts on Brass Baghouse Dust Generators

	Brass mill	Brass foundry	Brass ingot maker
Dust volume	125	100	450
Baseline cost of reclamation	$19,800	$15,800	$44,900
Post-rule revenue from sales to ZSM	$14,500	$11,600	$66,700
Net revenue	$34,200	$27,000	$111,500
Number of generators	10	3	10
National net revenue	$342,000	$82,100	$1,115,000

Note: Values are rounded.

The Agency also expects several ZSM manufacturers to benefit from the rule's change in the treatment of brass baghouse dust. As noted above, EPA expects three ZSM manufacturers to use brass baghouse dust to manufacture ZSM for fertilizer post-rule. Of the three, two currently use brass baghouse dust as an input to ZSM manufacturing but sell their ZSM made from brass dust exclusively for animal feed. The third is not currently using brass baghouse dust; EPA expects that, post-rule, the company will substitute brass dust for the more costly nonhazardous ZnO it is currently using as a feedstock. In addition to these firms, Bay Zinc is reportedly planning an 8,000 ton ZSM production, which would contain 2,800 tons of zinc (assuming 35 percent zinc content). This zinc demand is not considered in EPA's analysis.

EPA expects differing impacts on these three ZSM manufacturers. Big River Zinc, which currently uses nonhazardous ZnO as a feedstock, is expected to switch to using brass dust. This switch is predicted to reduce their costs of production but leave their revenues unchanged. Madison Industries and Tetra currently use at least some brass dust as feedstock but produce only animal feed from the brass dust. These two producers are projected to switch from selling animal feed to selling fertilizer, because fertilizer commands a higher price, due to its seasonal nature.[21]

Table 5-7 shows the characteristics of the three ZSM manufacturers that EPA expects will use brass baghouse dust as an input for fertilizer manufacturing, as a result of the rulemaking.

To assess the potential impact of the rulemaking on these ZSM manufacturers, let us first focus on Big River Zinc. At baseline, this company is estimated to produce 6,500 tons per year of

[21] Queneau, Paul. Personal communication with Paul Borst, U.S. EPA. March 9, 1999.

ZSM, using nonhazardous ZnO as a feedstock. EPA assumes Big River Zinc purchases ZnO, which has a 65 percent zinc content, at $540 per ton. Post-rule, the company will be able to purchase brass dust, with an average zinc content of 46 percent, at $143 per ton. Big River Zinc will incur some additional costs as a result of using brass dust. Specifically, the Agency assumes the company will incur the costs of treating and transporting the sludge created as a by-product from ZSM production. Table 5-8 shows projected cost savings for Big River Zinc as a result of the rulemaking.

Table 5-8. Estimated Cost Savings due to the Rulemaking for Big River Zinc

Cost element	Value
Quantity of ZSM produced	6,500 tons
Baseline cost of ZnO	2,015 tons Zn × $540/0.6 = $1,813,500
Post-rule cost of brass dust	2,015 tons Zn × $0.065 × (2000/0.46) = $569,500
Post-rule cost of treatment	1,100 tons sludge × ($23.20/ton transportation + $139.22/ton treatment) = $180,200
Cost savings due to the rule	$1,063,800

Madison Industries and Tetra’s Fairbury, NE, plant are not projected to change their operations, only the market in which they sell their ZSM as a result of the rulemaking. EPA thus projects no changes in their costs as a result of the rulemaking, only an increase in their revenues because ZSM for fertilizer commands a higher price than ZSM for feed. In fact, Madison Industries and Tetra may choose to substitute brass dust for the zinc fines they are currently using as part of their feedstock; if they did so, they might realize additional cost savings. But to avoid overstating the benefits of the rulemaking for these firms, EPA estimates only changes in revenues for them. Table 5-9 shows these estimated changes in revenues.

Table 5-9. Estimated Revenue Increases for Madison Industries and Tetra, Fairbury, NE

Revenue Element	Value
Madison Industries	**All ZSM used for animal feed at baseline**
Current revenues	8,000 tons $ZnSO_4$ × \$180 + 2,000 tons ZSM × 620 = \$2,680,000
Estimated post-rule revenues	8,000 tons $ZnSO_4$ × \$230 + 2,000 tons ZSM × 670 = \$3,180,000
Estimated increased revenues	\$3,180,000 – \$2,680,000 = \$500,000
Tetra, Fairbury, NE	**Half ZSM used for animal feed at baseline**
Current revenues	3,000 tons $ZnSO_4$ × \$180 + 7,000 tons ZSM × \$620 = \$4,880,000
Estimated post-rule revenues	0.5 × \$4,880,000 + 0.5 × (3,000 × \$230 + 7,000 × \$670) = \$5,130,000
Estimated increased revenues	\$5,130,000 – \$4,880,000 = \$250,000

Overall, EPA projects that the conditional exclusion will benefit both brass baghouse dust generators and ZSM manufacturers. Brass baghouse dust generators will find an improved market for their baghouse dust, enabling them to sell it rather than paying to have it reclaimed.[22] Nationwide, ten brass mills, ten ingot makers, and three foundries are projected to sell their baghouse dust to ZSM producers, at a net savings of approximately $1.5 million. Big River Zinc is projected to substitute brass dust for the nonhazardous feedstock currently used, at a cost savings of $1,064,000. Madison Industries and Tetra are projected to be able to sell all their ZSM, regardless of feedstock, for fertilizer, increasing their revenues by $750,000.

5.2 Economic Impact Analysis

As described above, EPA estimates that the conditional exclusion will result in changes in the operations of at least three facilities, which in turn is estimated to change their costs and revenues. This section describes the projected impacts on affected markets, facilities, and companies.

[22] For example, Big River Zinc has indicated its capacity and interest in obtaining brass fume dust as an alternative feed material for zinc metal. The company produces a ZSM from its process that has been and could be marketed for fertilizer use. Personal communication between Paul Borst, USEPA and George Obeldobel, Big River Zinc, July 2000.

5.2.1 Expected Market Effects of the Conditional Exclusion

The conditional exclusion is expected to reduce the cost of using hazardous materials as feedstocks in zinc fertilizer manufacturing, because materials managed in compliance with the exclusion will no longer be subject to RCRA regulatory requirements. The change in regulatory status of the waste-derived zinc feedstocks will reduce the cost of using them relative to the cost of using nonhazardous zinc feedstocks. Zinc micronutrient producers may choose to substitute some waste-derived zinc feedstocks for nonwaste-derived feedstocks, thus increasing the demand (and price) for the waste-derived zinc feedstocks and decreasing the demand (and price) for the nonwaste-derived zinc feedstocks. Overall, the costs of production for zinc micronutrients are expected to decrease somewhat, resulting in an increased supply of zinc micronutrients and a decrease in the market price.

Because only a subset of the suppliers of zinc micronutrients are currently using hazardous waste feedstocks, and because the cost changes for these facilities are estimated to be fairly small, EPA expects the market impacts to be correspondingly small. The Agency has therefore not attempted to quantify the change in the market price of zinc micronutrients or zinc feedstocks; the economic impact analysis is conducted using a "full cost absorption" approach, based on market prices that do not change from their baseline levels.

5.2.2 Estimated Impacts on Companies Owning Zinc Micronutrient Facilities

EPA measures the impacts of the conditional exclusion by comparing the net costs of complying with the conditional exclusion (taking into account any estimated changes in revenues or cost savings) with the companies' baseline revenues. Table 5-10 shows the estimated net costs to comply with the conditional exclusion as a share of baseline company revenues for Frit Industries, Nucor, Bay Zinc, and Exeter Energy. The estimated costs for these four companies range from a cost savings of $420,000 for Frit to a cost of $209,000 for Exeter Energy. Nucor Steel is estimated to incur no costs due to the conditional exclusion, because Frit Industries is modeled as choosing to install a ZSM line and continuing to accept Nucor's EAF dust as a feedstock. Frit's estimated cost savings are approximately 0.6 percent of their baseline revenues, and Bay Zinc's estimated costs are approximately 1.42 percent of their baseline revenues. However, these costs for Bay Zinc will most likely be offset by cost savings realized from substituting brass fume dust as an input for ZSM production. The Agency believes, based on this analysis, that none of the firms directly affected by the conditional exclusion will incur significant impacts.

In addition to the specific companies listed above, several generators of brass baghouse dust are estimated to incur cost savings as a result of the conditional exclusions. Currently, they are able to sell only an estimated 1,350 tons of baghouse dust to ZSM manufacturers. Under the conditional exclusion, they are projected to increase those sales by more than 2,000 tons. As a result, they will experience cost savings because they will not have to pay a zinc reclamation facility to accept their baghouse dust and will experience increased revenues because they will be able to sell the dust to ZSM manufacturers. However, EPA does not have sufficient information about brass baghouse dust generators to identify individual generators that may experience these cost savings and increased revenues.

Table 5-10. Estimated Company Impacts of the Conditional Exclusion

Company	Baseline revenues	Net costs of compliance	Costs as a percentage of sales
Zinc Micronutrient Manufacturers			
Frit Inc.	$67,571,019[a]	–$421,844	–0.62%
Bay Zinc	$9,799,593[b]	$139,070	1.42%
Madison Industries	$50,000,000[c]	–$500,000	–1.0%
Tetra Technologies	$238,468,000	–$250,000	–0.1%
Big River Zinc	$110,000,000	–$1,064,000	–1.0%
Feedstock Suppliers			
Nucor Steel	$3,647,030,387	0	0.00%
Exeter Energy	$18,100,000[d]	$209,040	1.15%

Note: Negative net costs reflect EPA's estimate that a company's revenues will increase by more than their costs.

[a] Lycos Companies Online. 2000. "Frit Inc." Lycos Small Biz. <http://companies.lycos.com>. As obtained on August 14, 2000.

[b] Volume estimated, based on Richard Comp (Bay Zinc), teleconference with Paul Borst, U.S. EPA. April 16, 1999. Page 1.

[c] Lycos Companies Online. 2000. "Madison Industries." Lycos Small Biz. <http://companies.lycos.com>. As obtained on August 28, 2000.

[d] Wurdock, Jim, Exeter Energy, teleconference with Lindsay James, Research Triangle Institute. June 26, 2000. Page 1.

5.2.3 Impacts on Small Businesses

The Small Business Regulatory Enforcement Fairness Act (SBREFA) requires EPA to analyze and attempt to minimize economic impacts on small entities, including small businesses, small nonprofit organizations, and small governments. SBREFA amended the Regulatory Flexibility Act (RFA), which requires that a regulatory flexibility analysis be performed for any rule that imposes a significant economic impact on a substantial number of small entities.

EPA has determined that three small businesses will be directly affected by the proposed standards. Two of the small businesses are zinc micronutrient manufacturers, and one is a feedstock supplier. EPA conducted a screening analysis, comparing the estimated costs of the standards with these companies' baseline sales. For one zinc micronutrient manufacturer, the proposed standards are projected to result in cost savings or in revenue increases that entirely offset the increased costs. The other zinc micronutrient fertilizer producer and the feedstock supplier are projected to experience net costs as a result of the proposed standards. The estimated incremental costs of the standards for the supplier represent only 1.2 percent of their baseline sales. The estimated incremental costs incurred by the other zinc micronutrient fertilizer producer are only 1.42 percent of their company sales; these costs will most likely be recovered by this company in a post-rule environment.

One of the three small businesses is estimated to experience cost savings; one small business will experience cost-to-sales of 1.15 percent and one small business will experience cost-to-sales of 1.42 percent. EPA therefore certifies that the conditional exclusion will not have a significant economic impact on a substantial number of small entities, because

- only three small entities are directly affected,
- the overall financial impacts of the conditional exclusion on these small entities are expected to be affordable, and
- one small business may be able to recover its costs in a post-rule environment.

5.3 Conclusions

The conditional exclusion is expected to require two zinc micronutrient manufacturers to modify their operations. One, Frit Industries, is estimated to have to incur the cost of installing a ZSM line. This represents a substantial capital cost but is estimated to yield an even more substantial increase in revenues from the sale of the higher-priced ZSM. The other firm, Bay Zinc, is estimated to substitute nonhazardous feedstocks in place of tire ash in its Oxy-sul operation. Again, the firm will incur fairly large annual costs to comply, but the increased revenues estimated will help offset their costs. Also, Bay Zinc may realize cost savings between $1 million and $1.5 million post-rule by substituting brass fume dust in their ZSM production. Exeter Energy, the tire ash supplier, is estimated to incur incremental costs of more than $200,000, because instead of being paid for the tire ash, they must now pay to dispose of the tire ash in a hazardous waste landfill. This cost, while large, represents a small share of their baseline revenues and is therefore not estimated to cause a significant economic impact on the company.

Three additional zinc micronutrient producers, Big River Zinc, Madison Industries, and Tetra Technologies, are projected to experience either cost savings or increased revenues because of the effect of the conditional exclusion on the regulatory status of brass baghouse dust. The brass mills, brass foundries, and brass ingot producers that generate brass baghouse dust are also projected to experience cost savings.

Overall, therefore, EPA estimates that few companies will be directly affected by the conditional exclusion, and for those that are, most will incur relatively small impacts, when estimated costs, cost savings, and changes in revenue are accounted for.

CHAPTER 6

BENEFITS OF THE PROPOSED RULEMAKING

The benefits of the proposed conditional exclusion are described qualitatively for both hazardous secondary materials (e.g., brass fume dust, tire ash, electric arc furnace dust) used to make zinc micronutrient fertilizer and the fertilizer itself. These benefits include reduced loadings of heavy metals and dioxins to the environment for both hazardous secondary materials used to make fertilizer and the fertilizer itself. These benefits also include reduction of potential exposures that could result from the mismanagement of hazardous secondary materials used to make fertilizer. Because the Agency has not completed a quantitative risk assessment for this proposed rule, EPA cannot make any quantitative conclusions about the risk reduction from today's proposal.

To describe the benefits resulting from today's rule, EPA looked at available literature and records regarding both hazardous secondary material feedstocks used to make zinc micronutrient fertilizers as well as the fertilizer themselves. For both the feedstocks and the fertilizer, the data suggest that today's rule will reduce loading of toxic non-nutritive constituents to the soil.

6.1 Hazardous Secondary Materials Used to Produce Zinc Micronutrient Fertilizers

As described earlier in this analysis, hazardous secondary material feedstocks used to make zinc micronutrient fertilizer include brass fume dust, tire ash and electric arc furnace dust from steel production. Brass fume dust, tire ash and EAF dust contain substantial amounts of lead and cadmium . Lead content for these materials is estimated at 6 percent, 0.13 percent (1300 ppm) and 5.3 percent for brass fume dust, tire ash and EAF dust respectively.[1] The cadmium content of these materials is typically 1000 to 2000 ppm for brass fume dust, negligible amounts for tire ash and 2000 ppm for EAF dust.

If mismanaged, the lead and cadmium in these materials may be released to the environment where both humans and ecosystems may be exposed. EPA is aware of at least three damage incidents caused by land placement of hazardous secondary feedstocks to zinc micronutrient fertilizer production that resulted in contamination of either groundwater or surrounding surface water bodies adjacent to the site. For example, materials handling at one zinc

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[1] March 6, 2000 letter from George M. Obeldobel, President of Big River Zinc to David Fagan, U.S.E.P.A.

fertilizer manufacturer resulted in contaminated storm water running off into a wetland area and creek, contaminating them with heavy metals including lead and cadmium.[2] Another zinc micronutrient fertilizer manufacturer was recently fined $35,000 for spilling and improperly disposing of waste containing lead and cadmium.[3] The plant was also ordered to immediately prevent any further releases of hazardous waste to the environment and to develop a plan for cleaning up the site, which has both soil and groundwater contamination resulting from its fertilizer manufacturing activities. .. In the Tifton Georgia case, trace quantities of lead and cadmium from an outdoor pile of EAF dust were discovered in the groundwater supply below a residential neighborhood.[4] Compliance with the terms of the conditional exclusion would reduce releases of heavy metals to the environment

6.2 Zinc Micronutrient Fertilizers

The standards for both metals and dioxins on zinc micronutrient fertilizers produced from hazardous secondary materials proposed in this rulemaking will reduce loadings of these constituents to the environment. Two zinc oxysulfate samples produced from hazardous waste and analyzed by the State of Washington had dioxin concentrations between 17 and 42 times background level ("Final Report Screening Survey for Metals and Dioxins in Fertilizer Products and Soils in Washington State," Washington State Department of Ecology, April 1999, Figures 1-1 and 1-2). In addition, the zinc oxysulfate manufacturing process does not remove any of the lead or cadmium from the feedstock material. If promulgated, today's proposal would reduce annual loadings of these metals to the soil.

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2 U.S. EPA Report of RCRA Compliance Evaluation Inspection at American MicroTrace Corporation, Fairbury, NE. September 19, 1996 and October 3-4, 1996.

3 Washington Department of Ecology. September 23, 1999. *Fertilizer company fined for improper handling of hazardous waste*. News Release. <http://www.wa.gov:80/ecology/pie/1999news/99-186.html>.

4 Editorial, The Atlanta Journal/Constitution, April 11, 1993

CHAPTER 7

OTHER ADMINISTRATIVE REQUIREMENTS

This chapter describes the Agency's response to other rulemaking requirements established by statute and executive order, within the context of the notice of proposed rulemaking for zinc-containing hazardous waste-derived fertilizers.

7.1 Environmental Justice

EPA is committed to addressing environmental justice concerns and is assuming a leadership role in environmental justice initiatives to enhance environmental quality for all residents of the United States. The Agency's goals are to ensure that no segment of the population, regardless of race, color, national origin, or income, bears disproportionately high and adverse human health and environmental impacts as a result of EPA's policies, programs, and activities, and that all people live in clean and sustainable communities. In response to Executive Order 12898 and to concerns voiced by many groups outside the Agency, EPA's Office of Solid Waste and Emergency Response formed an Environmental Justice Task Force to analyze the array of environmental justice issues specific to waste programs and to develop an overall strategy to identify and address these issues (OSWER Directive No. 9200.3-17).

It is not certain whether the environmental problems addressed by the proposed conditional exclusion from hazardous waste regulation for zinc-containing hazardous waste-derived fertilizers could disproportionately affect minority or low income communities, due to the widespread distribution of fertilizers throughout the United States. As mentioned in Chapter 2, the West North Central region—which includes Kansas, Iowa, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota—are the largest consumers of zinc fertilizer, principally used in corn production. The Pacific and Mountain regions are second to the North West Central region in zinc fertilizer consumption. Because the proposed rule removes the exclusion for K061-derived fertilizers, retains protective management standards for hazardous secondary fertilizer feedstocks, and establishes technology-based protective product standards for zinc micronutrient fertilizers derived from hazardous feedstocks, the Agency does not believe that this rule will increase risks or result in any disproportionately negative impacts on minority or low income communities relative to affluent or nonminority communities. As stated in Chapter 6, EPA believes that this rule will reduce lead and cadmium loadings from zinc micronutrient fertilizers to the environment including groundwater and food supply.

7.2 Unfunded Mandates Reform Act

Under Section 202 of the Unfunded Mandates Reform Act of 1995, signed into law on March 22, 1995, EPA must prepare a statement to accompany any rule for which the estimated costs to state, local, or tribal governments in the aggregate, or to the private sector, will be $100 million or more in any one year. Under Section 205, EPA must select the most cost-effective and least burdensome alternative that achieves the objective of the rule and is consistent with statutory requirements. Section 203 requires EPA to establish a plan for informing and advising any small governments that may be significantly affected by the rule.

An analysis of the costs and benefits of the proposed rule was conducted and it was determined that this rule does not include a Federal mandate that may result in estimated costs of $100 million or more to either state, local, or tribal governments in the aggregate. The private sector also is not expected to incur costs exceeding $100 million per year in this RIA.

7.3 Protection of Children from Environmental Health Risks and Safety Risks

On April 21, 1997, the President signed Executive Order 13045 entitled, "Protection of Children from Environmental Health Risks and Safety Risks." The executive order requires all economically significant rules[1] that concern an environmental health risk or safety risk that may disproportionately affect children to comply with requirements of the executive order. Because EPA does not consider today's proposed rule to be economically significant, it is not subject to Executive Order 13045. Because this rulemaking removes the exclusion for K061-derived fertilizers, retains protective management standards for hazardous secondary fertilizer feedstocks, and establishes technology-based protective product standards for zinc micronutrient fertilizers derived from hazardous feedstocks, EPA believes that this proposed rulemaking will not result in increased exposures to children. EPA believes that removing the exemption for K061-derived fertilizers and establishing the technology-based performance standard for excluded fertilizers will reduce lead and cadmium loading to the environment, including the food supply and groundwater over current management practices. Moreover, the prohibition on outdoor storage of the hazardous secondary feedstocks used to produce the fertilizer assures proper management of these materials. For these reasons, the environmental health risks or safety risks addressed by this action do not have a disproportionate effect on children.

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[1] An economically significant rule is defined by Executive Order 12866 as any rulemaking that has an annual effect on the economy of $100 million or more, or would adversely affect in a material way the economy; a sector of the economy; productivity; competition; jobs; the environment; public health; or safety; or state, local, or tribal governments or communities.

CHAPTER 8

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APPENDIX A

COSTS OF COMPLIANCE

Frit is assumed to respond to the new rulemaking by building a ZSM line to replace its current equipment. Line size is estimated at 12,000 tpy of feed with product of about 6,760 tpy and waste of about 2,100 tpy. The estimated capital and annual capital recovery costs are $5.68 million and $536,000/yr, respectively. These costs include storage of hazardous raw materials and wastes. Additional costs include treatment and disposal to a Subtitle C landfill of the 2,100 tpy waste and recordkeeping and reporting for tracking purposes of the K061 waste entering the plant and being processed.

Treatment and disposal costs are estimated for off-site processing. Unit costs of $23.20/ton for transportation and $139.22/ton for treatment and disposal are updated to 1999 from LDR costing functions.[2] Annual costs are $344,830, with a unit cost of $162.43/ton.

Recordkeeping and reporting costs are estimated based on hours assigned for planning, implementing, and operating a system in the first year and revising and operating the system in ensuing years. As shown in Table 4-1, total costs in the first year are $21,596, and in the second and later years, $13,400. Bay Zinc will experience a cost savings of $7,940 for recordkeeping and reporting costs.

A.1 Estimates of Frit and Bay Zinc Quantities for Baseline Scenario

Quantity estimates are based on reported 1997 data from Frit[3] and an assumed 60 percent zinc content for zinc oxide used as supplementary feed.[4] The Frit data include a K061 feed quantity of 6,000 tpy having a zinc content of 20 percent and production of 7,200 tons of Oxy-sul containing 20 percent zinc.

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[2] U.S EPA, Development of Costing Functions, Appendix F, Economic Assessment for Land Disposal Restrictions, p. F-18, 1998.

[3] Queneau, Paul. Facsimile to Paul Borst, U.S. Environmental Protection Agency. Table dated November 16, 1998.

[4] Queneau, Paul. Personal communication with Paul Borst, U.S. Envrionmental Protection Agency. March 9, 1999. Page 1.

Table A-1. Recordkeeping and Reporting Costs

Operation	Personnel	First-year hours	Subsequent annual hours	First-year cost ($)	Subsequent annual cost ($/yr)
Planning and implementation					
	Management	30	4	$2,775	$370
	Technical	120	40	$7,476	$2,492
	Clerical	10	10	$283	$283
Daily operation					
Recordkeeping/reporting	Management	13	13	$1,203	$1,203
	Technical	52	52	$3,240	$3,240
	Operator	78	78	$3,015	$2,209
	Clerical	104	104	$2,945	$2,945
Training	Management	1	1	$93	$93
	Technical	4	4	$249	$249
	Operator	6	6	$232	$232
	Clerical	3	3	$85	$85
Annual cost to Frit				$21,596	$13,400
Annual cost to Bay Zinc					–$7,940

Supplemental feed quantity is estimated from the following analysis of 1997 volumes:

Zinc in K061 feed = 6,000 tpy × 20% zinc = 1,200 tpy zinc.

Zinc in Oxy-sul = 7,200 × 20% = 1,440 tpy zinc

Zinc from supplemental feed = 1,440 tpy zinc in Oxy-sul – 1,200 tpy zinc from K061 feed

= 240 tpy zinc required from supplemental feed.

Quantity of supplemental feed = 240 tpy zinc/60 percent zinc content

= 400 tpy crude zinc oxide

If Frit's production rate rises to 12,000 tpy of Oxy-sul at 20 percent zinc,[5] the feed rates of K061 and supplemental feed can be estimated from the ratio of feeds to production rate derived from the 19997 data for Frit. The K061 feed rate becomes (6,000 tpy K061/7,200 tpy Oxy-sul) × 12,000 tpy Oxy-sul = 10,000 tpy K061. The zinc oxide feed rate becomes (400 tpy zinc oxide/7,200 tpy Oxy-sul) × 12,000 Oxy-sul = 667 tpy zinc oxide.

[5] Queneau, Paul et al. June 27–29, 2000. "Recycling Heavy Metals in Solid Waste." Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

For Bay Zinc, only the feed rate of 3,120 tpy tire ash at 31 percent zinc is known.[6] Zinc feed rate is

3,120 tire ash × 31% zinc content = 967 tpy zinc.

For Oxy-sul at 20 percent zinc content,[7] the production rate, based on zinc tons in feed, = 967 tpy zinc/20 percent zinc content = 4,836 tpy Oxy-sul.

A.2 Estimates of Frit and Bay Zinc Quantities for Zinc Oxide Substitution Scenario

For the substitution scenario, EPA assumes that the raw production quantities (i.e. tons of Oxy-sul) will remain constant. If currently used feed materials are replaced by zinc oxide (assumed 60 percent zinc) to produce Oxy-sul at 37.6 percent zinc, the quantity of zinc oxide feed can be derived from the following equations.

For Frit, producing 12,000 tpy of Oxy-sul, 12,000 tpy × 37.6% zinc content (rounded) = 4,506 tpy of zinc. The required feed rate is 4,506 tpy of zinc/60 percent zinc in zinc oxide feed = 7,510 tpy (rounded) of zinc oxide feed.

For Bay Zinc, producing 4,836 tpy of Oxy-sul, 4,836 tpy × 37.6% zinc content (rounded) = 1,818 tpy of zinc. The required feed rate is 1,818 tpy of zinc/60 percent zinc in zinc oxide feed = 3,030 tpy (rounded) of zinc oxide feed.

A.3 Estimates of Frit Quantities for ZSM Production

For this scenario, EPA modeled a ZSM production line with the capacity for 12,000 tpy K061 feed, since in 1999 Nucor may have sold as much as 12,500 tons of K061 to Frit.[8] For ZSM production using a feed rate of 12,000 tpy K061 with 20 percent zinc, the quantity of zinc in the feed is 12,000 tpy K061 × 20% zinc content = 2,400 tpy of zinc. The production rate of ZSM at 35.5 percent zinc = 2,400 tpy zinc/35.5 percent zinc content = 6,761 tpy ZSM.

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[6] Camp, Richard, Bay Zinc, teleconference with Paul Borst, U.S. Environmental Protection Agency. April 16, 1999.

[7] Queneau, Paul et al. June 22–24, 2000. “Recycling Heavy Metals in Solid Waste.” Sponsored by Office of Special Programs and Continuing Education, Colorado School of Mines.

[8] Schauble, Carl, Frit Industries, teleconference with Paul Borst, David Fagan, Mitch Kidwell, Matt Hale, Caroline Ahearn, and Steve Silverman, U.S. Environmental Protection Agency. February 24, 1999. Page 1.

APPENDIX B

K061 ECONOMIC ANALYSIS DESCRIPTION

EPA's proposed rulemaking on the status of K061 would potentially affect two facilities, Nucor Steel and Frit. EPA has estimated the potential economic impacts to these facilities by examining two scenarios. In the first scenario, EPA assumes that Frit will no longer incorporate K061 into its production process, substituting a nonhazardous feedstock. The second scenario involves a capital investment from Frit to install a ZSM production line; in this scenario Frit would continue to use the EAF dust as a feedstock. The second scenario proves to have a lower cost impact on these facilities; therefore, EPA assumed the actions of the facilities will match this scenario and incorporated this scenario's costs into the economic analysis.

In the first scenario, Nucor will incur two sets of costs. First, Nucor will have the cost of lost revenue from K061 sales to Frit. Currently, Nucor sells 10,000 tons of EAF dust to Frit for $10/ton, amounting to $100,000 per year in revenues. Additionally, Nucor will have to pay for the transport and disposal of the EAF dust. Transport costs are $23.20/ton and disposal costs are $139.22/ton (please refer to Appendix A for the source of these numbers). Nucor would pay an annual cost of $1,624,200 (10,000 tons × [$23.20/ton + $139.22/ton]) to dispose of the EAF dust. For scenario one, EPA estimates the total costs to Nucor to be $1,724,200. The cost-to-sales ratio (calculated by dividing the costs by the company sales) for Nucor under this scenario is 0.05 percent.

The costs to Frit for the first scenario were calculated by estimating the cost of the nonhazardous feedstock as well as the change in revenues from selling a product with higher zinc content. Assuming Frit uses zinc oxide as a substitute, the cost of the nonhazardous feedstock would be $4,055,400 per year. EPA derives this cost by multiplying the amount required (10,000 tons, based on Frit's current production volume), the price per pound of crude zinc oxide ($0.27 per pound), and the conversion factor of pounds to tons.[1] Frit's current costs for feedstock includes the cost of the EAF dust (10,000 tons × $10/ton) and the cost of the zinc oxide to supplement the EAF dust. To calculate the cost of the supplemental zinc oxide, EPA estimated the amount of zinc oxide required, based on the amount of K061, sulfuric acid, and the ultimate product volume. EPA multiplied the zinc oxide volume (667 tons) by the price per pound ($0.27, Zinc Nacional's price), and the conversion factor for pounds to tons. Frit's current feedstock costs combined equal $460,180 annually ([10,000 tons EAF dust × $10/ton] + [667 tons ZnO × $0.27/lb ZnO × 2,000 lbs/ton]). Frit will be able to sell zinc oxide-derived Oxy-sul for a higher price, since the Oxy-sul will have a higher zinc content. EPA estimated the zinc oxide-derived Oxy-sul revenues by multiplying the product volume (12,000 tons), the zinc content percentage (37.6 percent), the price per pound zinc ($0.69/lb), and the conversion factor from pounds to tons. EPA

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[1] Zinc Nacional's selling price was described by Paul Queneau. Personal communication with Paul Borst, U.S. EPA, April 16, 1999.

estimated the current revenues from EAF dust-derived Oxy-sul in the same manner (12,000 tons × 20 percent zinc × $0.59/lb zinc × 2,000 lbs/ton). Based on this estimate, Frit's feedstock costs will increase from $460,180 to $4,055,400 per year, and their revenues will increase from $2,832,000 to $6,226,560 per year. The net change will be a decreased profit margin for Frit of $200,660. This cost analysis may be incomplete, however, because no capital costs have been captured. Capital costs may be minimal under this scenario, unless Nucor demands that Frit move their production line to a new location.

In the second scenario, Nucor will incur no costs because Frit will continue to accept the K061 and recycle the dust into fertilizer. Therefore, the cost-to-sales ratio for Nucor under Scenario 2 is 0 percent.

EPA estimates that Frit will again increase their profits under Scenario 2. There are several components to this cost estimation. First, Frit will have to install a ZSM production line. EPA estimates this equipment to cost $5.68 million, costing $536,000 per year (assuming a capital recovery factor of 0.2439). The ZSM production process generates a heavy metal sludge that Frit will have to transport and dispose of. Transport and disposal will cost $344,830 (based on 2,100 tons of sludge, transport costs of $23.20/ton, and disposal costs of $139.22/ton). Frit will incur recordkeeping and reporting costs in a post-rule scenario, which are estimated to cost $21,596 in the first year and $13,400 in subsequent years. (Please refer to Appendix A for an explanation of the derivation of the capital equipment costs, treatment and disposal costs, and recordkeeping and reporting costs.) Frit will also incur costs of increasing their feedstock from a volume of 10,000 tons to 12,000 tons. Since Frit pay $10 per ton for K061, Frit's costs will increase by $20,000. By selling ZSM, EPA expects Frit to increase its revenues substantially. Under Scenario 2, Frit's revenues would be $4,176,270 (6,761 tons ZSM × 35.5 percent zinc × $0.87/lb zinc × 2,000 lbs/ton), as opposed to their current revenues of $2,832,000 (10,000 tons Oxy-sul × 20 percent zinc × $0.59/pound zinc × 2,000 pounds/ton). By summing these costs and the expected increase in revenues, EPA estimates that Frit will experience $922,426 in first-year costs and a net cost savings of $421,844. In subsequent years, Frit will experience $914,230 in increased annual costs and $430,040 in savings. Under this scenario, Frit's cost-to-sales ratio is 1.37 percent in the first year and 1.35 percent in subsequent years; with the increased revenues, Frit's cost-to-sales ratio is –0.62 percent in the first year and –0.64 percent in subsequent years.

APPENDIX C

TIRE ASH ECONOMIC ANALYSIS DESCRIPTION

EPA's proposed rulemaking on the status of tire ash would potentially affect two companies, Exeter Energy and Bay Zinc. EPA estimated the potential economic impacts to these companies' facilities by examining two scenarios. In the first scenario, Bay Zinc completely abandons their Oxy-sul production line, resulting in lower costs as well as lower revenues. In the second scenario, EPA assumes that Bay Zinc will continue to produce Oxy-sul but will substitute a nonhazardous feedstock instead of recycling tire ash, resulting in higher costs and higher revenues. Exeter Energy will experience the same economic impacts in either scenario. EPA has found that the economic impacts affecting Bay Zinc will be less costly in the substitution scenario. The costs generated from modeling this substitution scenario are the costs incorporated in the economic analysis.

In both scenarios, Exeter Energy will no longer ship its tire ash to Bay Zinc for recycling. Exeter will be responsible for disposing of this ash; EPA has modeled the option of shipping the ash to Zinc Nacional in Mexico for zinc reclamation. Exeter Energy will pay $140/ton waste to reclaim the zinc at Zinc Nacional; this figure includes shipping costs.[1] Exeter sells 3,120 tons of tire ash to Bay Zinc per year.[2] The estimated cost for Exeter to dispose of its waste through Zinc Nacional is $436,800 (3,120 tons waste × $140/ton waste). Exeter currently pays $73/ton to recycle its waste, totaling $227,760 annually (3,120 tons waste × [$105 for shipping ! $32 paid by Bay Zinc]).[3] For both scenarios one and two, EPA estimates the net cost impact to Exeter Energy to be $209,040 ($436,800 ! $227,760). The cost-to-sales ratio (calculated by dividing the costs by the company sales) for Exeter Energy under either scenario is 1.15 percent.

Bay Zinc will experience cost savings in both scenarios for permit renewal and recordkeeping and reporting costs; since Bay Zinc will no longer be accepting hazardous waste, this company will no longer have to pay these costs. EPA calculated the cost savings from the permit renewal by estimating 25 percent of the original RCRA permit cost, spread over a 5-year period using a capital recovery factor of 0.2439. The permit renewal cost savings is calculated to be $21,341. Bay Zinc is also estimated to experience $7,940 cost savings annually from recordkeeping and reporting costs. (Please refer to Appendix A for an explanation of this cost.)

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[1] Wittenborn, John and William Guerry, Jr., Counsel to the Steel Manufacturers Association. Memorandum to Paul Borst, U.S. EPA, entitled *Economic Impact of EAF Dust Processing Costs on the U.S. Steel Industry*. May 11, 1994.

[2] Volume estimated based on Richard Camp, Bay Zinc. Personal communication with Paul Borst, U.S. EPA. April 16, 1999.

[3] Seattle Times. November 23, 1997. "Toxic Sludge as Fertilizer." <http://www.purefood.com/toxic/toxicsludge.html>. As obtained March 10, 1999.

In both scenarios, EPA estimates Bay Zinc will experience a cost savings of $29,282 attributable to permit renewal and recordkeeping and reporting cost savings.

In the first scenario, EPA models Bay Zinc's regulatory response as abandoning their Oxy-sul production completely. EPA estimates both lower revenues and lower costs in this scenario. Bay Zinc's revenue is estimated to decrease by $1,141,296—their current Oxy-sul revenue (967 zinc tons × $0.59/pound zinc × 2,000 pounds/ton).[4] Bay Zinc's current costs of production are treated as a cost savings in this scenario, since Bay Zinc would no longer pay these costs. Bay Zinc's current costs of production were estimated by adding the tire ash feedstock cost, zinc oxide feedstock cost, and the estimated cost for labor. The total feedstock cost is estimated to be $99,840 ([3,120 tons tire ash × $32/ton tire ash]). The costs of production attributable to labor were calculated to be $618,560 ($38.66/hour × 8 employees × 2,000 hours/year).[5] Bay Zinc's total costs of production are estimated to be $718,400 ($99,840 feedstock costs + $618,560 labor costs). Under scenario one, Bay Zinc is also expected to salvage their Oxy-sul production equipment and experience a cost savings of $38,414 ($4,500,000 equipment cost × 50 percent depreciation × 7 percent interest rate × 0.2439 capital recovery factor). The sum of costs and cost savings for scenario one, including the permit renewal and recordkeeping and reporting cost savings, equals –$355,200, a substantial cost. The cost-to-sales ratio is 3.62 percent for Bay Zinc under Scenario 1.

In the second scenario, EPA models Bay Zinc's costs and cost savings under the assumption that Bay Zinc decides to substitute a nonhazardous feedstock for tire ash. In this scenario, Bay Zinc will experience higher costs of production, as well as higher revenues. Bay Zinc's current costs of production are estimated to be $718,400 (see preceding paragraph). Bay Zinc's costs of production under a substitution scenario are estimated to be $2,254,760. This estimate includes labor ($618,560, see preceding paragraph) and feedstock costs of $1,636,200 (3,030 tons zinc oxide × $0.27/lb zinc oxide × 2,000 lbs/ton). Bay Zinc's revenues are estimated to increase to $2,509,304 (3,030 tons Oxy-sul × 37.6 percent zinc × $0.69/lb zinc × 2,000 lbs/ton). As described in the previous paragraph, Bay Zinc's current revenues from the sale of Oxy-sul are estimated to be $1,141,296. EPA assumes the current costs of production will be a cost savings, the current revenues will be a cost, the costs of production under Scenario 2 will be a cost, and the revenues under Scenario 2 will be a cost savings. When all costs and cost savings are added, including the cost savings from permit renewal and recordkeeping and reporting, EPA estimates that Bay Zinc will incur net costs of $139,070. This cost is a low percentage of company sales. The cost-to-sales ratio for Bay Zinc is 1.42 percent under Scenario 2.

Again, EPA believes Bay Zinc will capitalize on the conditional exclusion and incorporate brass fume dust into their ZSM production line. By substituting the affordable brass fume dust for the much more costly nonhazardous zinc, Bay Zinc should realize cost savings in the range of $1 million to $1.5 million annually.

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[4] Zinc tons are estimated based the volume of Oxy-sul (3,990 tons) and the zinc content (20 percent).

[5] Wages are estimated based on SIC code.

APPENDIX D

SENSITIVITY ANALYSIS

Farmers do not apply zinc micronutrient fertilizer to their fields every year; instead, farmers apply zinc micronutrient fertilizer to their crops when the zinc levels in the soil indicate a need for more zinc. The application of zinc fertilizer is variable, even though the agricultural production itself does not necessarily vary. Climatic conditions may also affect the timing and rate of zinc micronutrient fertilizer application. The effects of weather may create a scenario where individual farmers' zinc needs align and create a market force. For example, after an especially rainy season, many farmers may need to reapply zinc micronutrient fertilizer, thus boosting demand. After examining domestic production data for zinc micronutrient fertilizer, EPA determined the demand for zinc micronutrient fertilizer is cyclical. One possible explanation for the cyclical demand could be the fluctuating nature of zinc micronutrient fertilizer application in the United States. Zinc micronutrient fertilizer manufacturers increase or decrease their production, in response to the fluctuating demand. U.S. imports of zinc micronutrient fertilizer are also cyclical; the imports may provide extra supply if demand increases and the domestic generators have not yet increased their production enough to meet the excess demand. For example, 1993 was a low point for domestic ZSM production, but 1992 was a low point for Chinese ZSM imports; by 1993 the imports were increasing. The demand for zinc micronutrient fertilizer appears to cycle every 4 or 5 years.

In the interest of estimating a complete range of potential impacts to the fertilizer industry from the proposed rulemaking, EPA presents a sensitivity analysis as an appendix to the economic analysis. Throughout the economic analysis, EPA based the impact calculations on price and production data from 1997[1] (see the discussion in Chapter 3, Section 3 of this report for the basis of this choice). Since 1997 is an average year in terms of U.S. zinc micronutrient production, EPA examined the potential impacts of the proposed rule on the fertilizer industry during years of low production and years of high production. For the sensitivity analysis, the Agency estimated the impacts on fertilizer manufacturers and raw material producers for two scenarios: a 20 percent decrease in baseline fertilizer production, and a 20 percent increase in baseline fertilizer production.

D.1 Low Zinc Micronutrient Fertilizer Production and the Economic Impacts of the Proposed Rulemaking

[1] EPA uses 1997 production levels throughout the analysis, with the exception of Frit and Bay Zinc production volumes. These were derived or chosen based on additional industry information. In the case of Frit, the production volume is a 1999 estimate. Bay Zinc's volume is a 1998 estimate.

To provide a thorough analysis of the impacts of the proposed rulemaking on the zinc micronutrient fertilizer industry, EPA examined the impacts of the rule when the demand for zinc fertilizer has decreased dramatically. To do this, EPA measured the impacts for each generator and the raw material suppliers when fertilizer production has decreased by 20 percent from 1997 levels. The following sections describe the estimated impacts in detail.

D.1.1 Frit Industries

Under the baseline scenario, Frit produces 12,000 tons of Oxy-sul, and EPA predicts that Frit will switch to ZSM production post-rule, at a rate of 6,761 tons of ZSM annually. Under a 20 percent decline in production, Frit would produce 9,600 tons of Oxy-sul pre-rule and possibly switch to ZSM production post-rule, at a decreased rate of 5,409 tons of ZSM annually. EPA followed the same methods of analysis as used in the main analysis when modeling the costs and revenues for these decreased production levels in a post-rule (i.e., ZSM production) scenario. (Appendix B describes the methodology in detail.) Frit's estimated costs and revenues under the 20 percent decline in production scenario (post-rule) are presented in Table D-1.

Table D-1. Estimated Costs of Complying with the Conditional Exclusion for Frit Industries, 20 Percent Decline in Production Levels

	Cost or cost savings?	First year of compliance	Each subsequent year
Annualized capital costs for ZSM line	Cost	$536,000	$536,000
Transportation, treatment, and disposal of 1,680 tons of waste	Cost	$272,866	$272,866
Recordkeeping and reporting	Cost	$21,596	$13,400
Increased costs of additional K061	Cost	$20,000	$20,000
Estimated incremental costs		$850,462	$842,266
Estimated change in Frit's revenue[a]	Cost savings	–$1,075,416	–$1,075,416
Total net costs (including increased revenues)	Cost savings	–$244,954	–$233,150

[a] Estimated revenue changes based on the following assumptions: volume of zinc in ZSM: 1,920 tons; price of zinc in ZSM: $0.87/lb. Volume of zinc in Oxy-sul: 1,920 tons; price of zinc in Oxy-sul: $0.59/lb.

Under a 20 percent decline in production, Frit would still realize net cost savings post-rule by switching from Oxy-sul production to ZSM production. These cost savings are less than the cost savings predicted in Chapter 5, under baseline production levels.

The economic impacts to Nucor Steel, the K061 raw material supplier to Frit, would vary only slightly under the scenario of a 20 percent decline in Frit's production levels. In this case, Nucor would be responsible for disposing of approximately 2,400 tons of EAF dust (the difference between the amount of EAF dust Nucor supplies to Frit under normal production levels and the amount of EAF dust Nucor would supply to Frit under decreased production levels). Nucor would pay approximately $389,808 annually for transporting, treating, and disposing of 2,400 tons of waste, a minuscule fraction of Nucor's company sales ($3.6 billion).

D.1.2 Bay Zinc

Bay Zinc, under the baseline scenario, incorporates 3,120 tons of tire ash to produce 4,836 tons of Oxy-sul. EPA predicts that Bay Zinc will switch from tire ash to zinc oxide as a feedstock for Oxy-sul production post-rule, maintaining their production levels at 4,836 tons of Oxy-sul. Under a 20 percent decline in production levels, Bay Zinc would produce 3,869 tons of Oxy-sul. Again, EPA followed the same methods of analysis when modeling the costs and revenues for these decreased production levels in a post-rule (i.e., zinc oxide substitution) scenario. (See Appendix C for a detailed description of the methodology.) Bay Zinc's estimated costs and revenues under the 20 percent decline in production scenario (post-rule) are presented in Table D-2.

Table D-2. Estimated Costs of Complying with the Conditional Exclusion for Bay Zinc, 20 Percent Decline in Production Levels

	Cost or cost savings?	Amount
Current [a] cost of production	Cost savings	–$698,432
Current [a] revenues from Oxy-sul	Cost	$913,037
New cost of production	Cost	$1,927,520
New revenues	Cost savings	–$2,007,443
No renewal of RCRA permit	Cost savings	–$21,341
Change in recordkeeping and reporting	Cost savings	–$7,941
Total net costs (including increased revenues)	Cost	$105,400

[a] "Current" costs and revenues reflect a 20 percent decline in production levels.

Under a 20 percent decline in production levels, Bay Zinc would still incur costs in a post-rule scenario of switching from the hazardous tire ash feedstock to the nonhazardous zinc oxide feedstock. The costs incurred under the 20 percent decline in production scenario are less than those that would be incurred in a baseline production scenario.

Exeter Energy, Bay Zinc's tire ash supplier, would face the same economic impacts regardless of the 20 percent decline in production. In a post-rule setting, EPA predicts that Bay Zinc will switch to a nonhazardous feedstock. Therefore, a change in Bay Zinc's post-rule production levels will have no impact on the post-rule costs to Exeter Energy.

D.1.3 Big River Zinc, Madison Industries, and Tetra Technologies

Under the baseline (pre-rule) production scenario, Madison Industries and Tetra are the two zinc micronutrient producers that are currently incorporating brass fume dust as a feedstock. Both of these companies are assumed to be using brass fume dust as roughly 30 percent of their total feedstock. Big River Zinc is not currently using brass fume dust as a feedstock. In this pre-rule environment, Madison Industries sells its product in the animal feed market, and Tetra sells one-half of its product in the animal feed market and the other half to fertilizer distributors. Big River sells all of its product to fertilizer distributors. EPA predicts that all three companies (Madison Industries, Tetra, and Big River) will sell 100 percent of their product to fertilizer distributors in a post-rule scenario. Also, EPA predicts that Madison Industries and Tetra will maintain the same ratio of feedstock materials (30 percent brass fume dust, 70 percent zinc fines) in a post-rule environment, while Big River will substitute 100 percent of their nonhazardous feedstock with brass fume dust post-rule. EPA maintains these assumptions and predictions for the sensitivity analysis.

Under the baseline production levels, Madison Industries produces 8,000 tons of liquid ZSM and 2,000 tons of granular ZSM. With a 20 percent decrease of production levels, Madison Industries would produce 6,400 tons of liquid ZSM and 1,600 tons of granular ZSM. Under the baseline production levels, Tetra produces 3,000 tons of liquid ZSM and 7,000 tons of granular ZSM. Tetra's production levels would decline to 2,400 tons of liquid ZSM and 5,600 tons of granular ZSM under a 20 percent production downturn scenario. Big River, under 1997 production levels, produces 6,500 tons of ZSM. If production levels decreased by 20 percent, Big River would produce 5,200 tons of ZSM. The quantities and assumptions EPA used for the 20 percent production decrease scenario are presented in Table D-3.

Again, EPA followed the same methods of analysis when modeling the costs and revenues for these decreased production levels in a post-rule scenario for these three companies. (See Chapter 5 for a detailed description of the methodology.) Big River's estimated costs and revenues under the 20 percent decline in production scenario (post-rule) are presented in Table D-4, and Madison Industries's and Tetra's estimated costs and revenues are presented in Table D-5.

Table D-3. ZSM Producers Using or Projected to Use Brass Baghouse Dust, 20 Percent Decline in Production Levels

	Big River Zinc	Madison Industries	Tetra, Fairbury NE
Quantity of ZSM tons/yr	5,200	1,600 granular, 6,400 liquid	5,600 granular, 2,400 liquid
Baseline feedstock	ZnO	Zinc fines, brass dust	Zinc fines, brass dust
Post-rule feedstock	Brass dust	Zinc fines, brass dust	Zinc fines, brass dust
Baseline product	Fertilizer	½ feed, ½ fertilizer	Feed
Post-rule product	Fertilizer	Fertilizer	Fertilizer

Table D-4. Estimated Cost Savings due to the Rulemaking for Big River Zinc, 20 Percent Decline in Production Levels

Cost element	Value
Quantity of ZSM produced	5,200 tons
Baseline cost of ZnO	1,612 tons Zn × $540/0.6 = $1,450,800
Post-rule cost of brass dust	1,612 tons Zn × $0.065 × (2000/0.46) = $455,565
Post-rule cost of treatment	888 tons slag × ($23.20/ton transportation + $139.22/ton treatment) = $144,197
Cost savings due to the rule	$851,038

Although less than the cost savings realized under normal production levels, all three companies are still expected to realize cost savings when production levels have declined 20 percent in a post-rule environment.

A representative from Big River Zinc indicated to EPA that Big River Zinc would buy any excess brass fume dust on the market to use in their zinc metal production process, even in the event of a 20 percent decline in zinc micronutrient fertilizer production. Therefore, the brass fume dust generators will be subject to approximately the same level of impacts, with or without the 20 percent decline in production levels, since Big River Zinc will absorb any excess brass fume dust on the market. The impacts will vary slightly, based on EPA's estimation of the baseline costs of disposal to the brass fume dust generators, which depend on the pre-rule

Table D-5. Estimated Revenue Increases for Madison Industries and Tetra, Fairbury, NE, 20 Percent Decline in Production Levels

Revenue element	Value
Madison Industries	
Current revenues	6,400 tons L.ZSM × $180 + 1,600 tons ZSM × $620=$2,144,000
Estimated post-rule revenues	6,400 tons L.ZSM × $230 + 1,600 tons ZSM × $670=$2,544,000
Estimated increased revenues	$2,544,000 – $2,144,000 = $400,000
Tetra, Fairbury, NE	
Current revenues	2,400 tons L.ZSM × $180 + 5,600 tons ZSM × $620 = $3,904,000
Estimated post-rule revenues	0.5 × $3,904,000 + 0.5 × (2,400 × $230 + 5,600 × $670) = $4,104,000
Estimated increased revenues	$4,104,000 – $3,904,000 = $200,000

amounts of brass fume dust incorporated by Madison Industries and Tetra. Under the 20 percent decrease in production scenario, the amount of brass fume dust incorporated by Madison Industries and Tetra decreases; thus, the baseline disposal costs are increased for brass fume dust generators in a pre-rule, 20 percent production decrease scenario (which is equivalent to an increase in post-rule cost savings). The estimated financial impacts are presented in Table D-6.

Table D-6. Financial Impacts on Brass Baghouse Dust Generators, 20 Percent Decrease in Zinc Micronutrient Fertilizer Production Levels

	Brass mill	Brass foundry	Brass ingot maker
Dust volume	125	100	450
Baseline cost of reclamation	$24,272	$19,418	$59,547
Post-rule revenue from sales to ZSM	$14,463	$11,570	$66,690
Net revenue	$38,735	$30,988	$126,237
Number of generators	10	3	10
National net revenue	$387,347	$92,963	$1,262,371

D.2 High Zinc Micronutrient Fertilizer Production and the Economic Impacts of the Proposed Rulemaking

EPA has established that the demand for zinc micronutrients is cyclical. Therefore, to provide a thorough analysis of the impacts of the proposed rulemaking on the zinc micronutrient fertilizer industry, EPA is examining the impacts of the rule when the demand for zinc fertilizer has increased dramatically. To do this, EPA measured the impacts for each generator and the raw material suppliers when fertilizer production has increased by 20 percent from 1997 levels. The following sections describe the estimated impacts in detail.

D.2.1 Frit Industries

Under the baseline scenario, Frit produces 12,000 tons of Oxy-sul, and EPA predicts that Frit will switch to ZSM production post-rule, at a rate of 6,761 tons of ZSM annually. Under a 20 percent increase in production, Frit would produce 14,400 tons of Oxy-sul pre-rule and possibly switch to ZSM production post-rule, at an increased rate of 8,113 tons of ZSM annually. It should be noted that Frit may not be able to increase its production of ZSM by 20 percent for two reasons. First of all, Nucor may not be able to provide 14,400 tons of EAF dust. Also, the ZSM capital equipment may not have a throughput capacity of this volume, although Frit could add an additional shift to increase capacity. EPA followed the same methods of analysis when modeling the costs and revenues for these increased production levels in a post-rule (i.e., ZSM production) scenario. (Appendix B describes the methodology in detail.) Frit's estimated costs and revenues under the 20 percent increase in production scenario (post-rule) are presented in Table D-7.

Table D-7. Estimated Costs of Complying with the Conditional Exclusion for Frit Industries, 20 Percent Increase in Production Levels

	Cost or cost savings?	First year of compliance	Each subsequent year
Annualized capital costs for ZSM line	Cost	$536,000	$536,000
Transportation, treatment, and disposal of 2,520 tons of waste	Cost	$409,298	$409,298
Recordkeeping and reporting	Cost	$21,596	$13,400
Increased costs of additional K061	Cost	$20,000	$20,000
Estimated incremental costs		$986,894	$978,698
Estimated change in Frit's revenue[a]	Cost savings	–$1,613,124	–$1,613,124
Total net costs (including increased revenues)	Cost savings	–$626,229	–$634,425

[a] Estimated revenue changes based on following assumptions: Volume of zinc in ZSM: 2,880 tons; price of zinc in ZSM: $0.87/lb. Volume of zinc in Oxy-sul: 2,880 tons; price of zinc in Oxy-sul: $0.59/lb.

Under a 20 percent increase in production, Frit would again realize net cost savings post-rule by switching from Oxy-sul production to ZSM production. These cost savings are greater than the cost savings predicted in Chapter 5, under baseline production levels.

The economic impacts to Nucor Steel, the K061 raw material supplier to Frit, would not vary from the analysis presented in Chapter 5. No additional costs to Nucor are expected to be incurred as a result of the increase in Frit's zinc micronutrient fertilizer production levels.

D.2.2 Bay Zinc

Bay Zinc, under the baseline scenario, incorporates 3,120 tons of tire ash to produce 4,836 tons of Oxy-sul. EPA predicts that Bay Zinc will switch from tire ash to zinc oxide as a feedstock for Oxy-sul production post-rule, maintaining its production levels at 4,836 tons of Oxy-sul. Under a 20 percent increase in production levels, Bay Zinc would produce 5,803 tons of Oxy-sul. Again, EPA followed the same methods of analysis when modeling the costs and revenues for these increased production levels in a post-rule (i.e., zinc oxide substitution) scenario. (See Appendix C for a detailed description of the methodology.) Bay Zinc's estimated costs and revenues under the 20 percent increase in production scenario (post-rule) are presented in Table D-8.

Table D-8. Estimated Costs of Complying with the Conditional Exclusion for Bay Zinc, 20 Percent Increase in Production Levels

	Cost or cost savings?	Amount
Current [a] cost of production	Cost savings	–$738,368
Current [a] revenues from Oxy-sul	Cost	$1,369,555
New cost of production	Cost	$2,582,000
New revenues	Cost savings	–$3,011,164
No renewal of RCRA permit	Cost savings	–$21,341
Change in recordkeeping and reporting	Cost savings	–$7,941
Total net costs (including increased revenues)	Cost	$172,741

[a] "Current" costs and revenues reflect a 20 percent increase in production levels.

Under a 20 percent growth in production, Bay Zinc would incur costs in a post-rule scenario of switching from the hazardous tire ash feedstock to the nonhazardous zinc oxide feedstock. The costs incurred under the 20 percent increase in production scenario are greater than those that would be incurred in a baseline production scenario.

Again, Exeter Energy, Bay Zinc's tire ash supplier, would face the same economic impacts regardless of the 20 percent increase in production. In a post-rule setting, EPA predicts that Bay Zinc will switch to a nonhazardous feedstock. Therefore, a change in Bay Zinc's post-rule production levels will have no impact on the post-rule costs to Exeter Energy.

D.2.3 Big River Zinc, Madison Industries, and Tetra Technologies

Under the baseline (pre-rule) production scenario, Madison Industries and Tetra are the two zinc micronutrient producers that are currently incorporating brass fume dust as a feedstock. Both of these companies are assumed to be using brass fume dust as roughly 30 percent of their total feedstock. Big River Zinc is not currently using brass fume dust as a feedstock. In this pre-rule environment, Madison Industries sells its product in the animal feed market, and Tetra sells one-half of its product in the animal feed market and the other half to fertilizer distributors. Big River sells all of its product to fertilizer distributors. EPA predicts that all three companies (Madison Industries, Tetra, and Big River) will sell 100 percent of their product to fertilizer distributors in a post-rule scenario. Also, EPA predicts that Madison Industries and Tetra will maintain the same ratio of feedstock materials (30 percent brass fume dust, 70 percent zinc fines) in a post-rule environment, while Big River will substitute 100 percent of its nonhazardous feedstock with brass fume dust post-rule. EPA maintains these assumptions and predictions for the sensitivity analysis.

Under the baseline production levels, Madison Industries produces 8,000 tons of liquid ZSM and 2,000 tons of granular ZSM. With a 20 percent increase of production levels, Madison Industries would produce 9,600 tons of liquid ZSM and 2,400 tons of granular ZSM. Under the baseline production levels, Tetra produces 3,000 tons of liquid ZSM and 7,000 tons of granular ZSM. Tetra's production levels would increase to 3,600 tons of liquid ZSM and 8,400 tons of granular ZSM under a 20 percent growth in production scenario. Big River, under 1997 production levels, produces 6,500 tons of ZSM. If production levels increased by 20 percent, Big River would produce 7,800 tons of ZSM. The quantities and assumptions EPA used for the 20 percent production increase scenario are presented in Table D-9.

Table D-9. ZSM Producers Using or Projected to Use Brass Baghouse Dust, 20 Percent Increase in Production Levels

	Big River Zinc	**Madison Industries**	**Tetra, Fairbury, NE**
Quantity of ZSM tons/yr	7,800	2,400 granular, 9,600 liquid	8,400 granular, 3,600 liquid
Baseline feedstock	ZnO	Zinc fines, brass dust	Zinc fines, brass dust
Post-rule feedstock	Brass dust	Zinc fines, brass dust	Zinc fines, brass dust
Baseline product	Fertilizer	½ feed, ½ fertilizer	Feed
Post-rule product	Fertilizer	Fertilizer	Fertilizer

Again, EPA followed the same methods of analysis when modeling the costs and revenues for these increased production levels in a post-rule scenario for these three companies. (See Chapter 5 for a detailed description of the methodology.) Big River's estimated costs and revenues under the 20 percent growth in production scenario (post-rule) are presented in Table D-10, and Madison Industries's and Tetra's estimated costs and revenues are presented in Table D-11.

Table D-10. Estimated Cost Savings due to the Rulemaking for Big River Zinc, 20 Percent Increase in Production Levels

Cost Element	Value
Quantity of ZSM produced	7,800 tons
Baseline cost of ZnO	2,418 tons Zn × $540/0.6 = $2,176,200
Post-rule cost of brass dust	2,418 tons Zn × $0.065 × (2000/0.46) = $683,348
Post-rule cost of treatment	1,332 tons slag × ($23.20/ton transportation + $139.22/ton treatment) = $216,296
Cost savings due to the rule	$1,276,556

Table D-11. Estimated Revenue Increases for Madison Industries and Tetra, Fairbury, NE, 20 Percent Decline in Production Levels

Revenue Element	Value
Madison Industries	
Current revenues	9,600 tons L.ZSM × $180 + 2,400 tons ZSM × $620=$3,216,000
Estimated post-rule revenues	9,600 tons L.ZSM × $230 + 2,400 tons ZSM × $670=$3,816,000
Estimated increased revenues	$3,816,000 – $3,216,000 = $600,000
Tetra, Fairbury, NE	
Current revenues	3,600 tons L.ZSM × $180 + 8,400 tons ZSM × $620 = $5,856,000
Estimated post-rule revenues	0.5 × $3,904,000 + 0.5 × (3,600 × $230 + 8,400 × $670) = $6,156,000
Estimated increased revenues	$5,856,000 – $6,156,000 = $300,000

All three companies are still expected to realize cost savings when production levels have increased 20 percent in a post-rule environment. These cost savings are greater than the cost savings realized under normal production levels.

In the scenario of a 20 percent increase in domestic micronutrient zinc fertilizer production, the amount of brass fume dust demanded by Big River Zinc, Madison Industries, and Tetra will increase. EPA modeled the impacts of this increased demand on the brass fume dust generators. Based on EPA's knowledge of the brass fume dust generator industry, it seems most likely that the brass ingot makers will be able to supply the additional brass fume dust. EPA increased the number of ingot makers supplying brass fume dust from ten in the baseline level of production scenario to 12 in the increased production scenario. Because of this increase in the number of suppliers, EPA expects the financial benefits for ingot makers to increase as a result of the growth in demand for brass fume dust. However, the baseline disposal costs for the generators will change as the pre-rule levels of brass dust consumed are adjusted, slightly lowering the financial gains for brass mills and foundries. Table D-12 presents the estimated financial impacts to brass fume dust generators under a 20 percent growth in zinc micronutrient fertilizer production scenario.

Table D-12. Financial Impacts on Brass Baghouse Dust Generators, 20 Percent Increase in Zinc Micronutrient Fertilizer Production Levels

	Brass mill	Brass foundry	Brass ingot maker
Dust volume	125	100	450
Baseline cost of reclamation	$19,353	$15,483	$43,516
Post-rule revenue from sales to ZSM	$14,463	$11,570	$66,690
Net revenue	$33,816	$27,053	$110,206
Number of generators	10	3	12
National net revenue	$338,158	$81,158	$1,322,475

D.3 Conclusions

EPA concludes that despite the cyclical nature of demand for zinc micronutrient fertilizers in the United States, the economic impacts to the zinc micronutrient fertilizer manufacturers and raw material suppliers remain mostly as cost savings, with the exceptions of Nucor Steel and Exeter Energy. In the instance of Nucor Steel, the costs are minimal, especially as compared to Nucor's company sales. For Exeter Energy, the costs for the sensitivity analysis are the same as the costs estimated in Chapter 5.

The net costs of compliance for each of the three production level scenarios (20 percent decrease, baseline, and 20 percent increase) are shown in Tables D-13 through D-15 for each of the affected entities. Throughout these tables, negative values indicate expected cost savings.

Table D-13. Estimated Post-Rule Costs (or Cost Savings) to Frit Industries and Nucor Steel for Various Production Levels

	20 percent decrease	Baseline	20 percent increase
Frit Industries (annual costs for first year)	–$224,954	–$421,844	–$626,229
Frit Industries (annual costs for subsequent years)	–$233,150	–$430,040	–$634,425
Nucor Steel	$389,810	$0	$0

Table D-14. Estimated Post-Rule Costs (or Cost savings) to Bay Zinc and Exeter Energy for Various Production Levels

	20 percent decrease	Baseline	20 percent increase
Bay Zinc	$105,400	$139,070	$172,741
Exeter Energy	$209,040	$209,040	$209,040

Table D-15. Estimated Post-Rule Costs (or Cost savings) to Big River Zinc. Madison Industries, Tetra Micronutrients, and Brass Fume Dust Generators for Various Production Levels

	20 percent decrease	Baseline	20 percent increase
Big River Zinc	– $851,040	–$1,063,800	–$1,276,560
Madison Industries Industries	–$400,000	–$500,000	–$600,000
Tetra Technologies	–$200,000	–$250,000	–$300,000
Brass Mills (National)	–$387,350	–$342,270	–$338,160
Brass Foundries (National)	–$92,960	–$82,144	–$81,160
Brass Ingot Makers (National)	–$1,262,370	–$1,075,370	–$1,322,480